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Nephron-Specific Deletion of Circadian Clock Gene *Bmal1* Alters the Plasma and Renal Metabolome and Impairs Drug Disposition.

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ABSTRACT

The circadian clock controls a wide variety of metabolic and homeostatic processes in a number of tissues, including the kidney. However, the role of the renal circadian clocks remains largely unknown. To address this question we performed a combined functional, transcriptomic and metabolomic analysis in mice with inducible and conditional ablation of the circadian clock system in the renal tubular cells (*Bmal1*^{lox/lox}/*Pax8*-rtTA/LC1 mice). Deep sequencing of the renal transcriptome revealed significant changes in the expression of genes related to metabolic pathways and organic anion transport. In parallel, kidneys from *Bmal1*^{lox/lox}/*Pax8*-rtTA/LC1 mice exhibited a significant decrease in the NAD⁺/NADH ratio suggesting an increased anaerobic glycolysis and/or decreased mitochondrial function. Metabolome profiling showed significant changes in plasma levels of amino acids, biogenic amines, acylcarnitines and lipids. In-depth analysis of two selected pathways revealed (i) a significant increase in plasma urea levels correlating with increased renal arginase 2 (*Arg2*) activity, hyperargininemia and increase of the kidney arginine content; (ii) a significantly increased plasma creatinine concentration and reduced capacity of the kidney to secrete anionic drugs (furosemide), paralleled by a ~80% decrease in the expression levels of organic anion transporter OAT3 (*SLC22a8*). Collectively, these results indicate that the renal circadian clocks control a variety of metabolic/homeostatic processes at both the intra-renal and systemic levels and are involved in drug disposition.

INTRODUCTION

The circadian timing system is an essential physiological regulatory mechanism that provides to cells, tissues, organs and, finally, to the whole organism, with an important functional advantage of anticipation of circadian changes in the environment that are imposed by the Earth's rotation. The circadian timing system is organized in a hierarchical manner, in that the central oscillator located in the suprachiasmatic nucleus of hypothalamus coordinates subsidiary oscillators located in peripheral tissues. On the molecular level, both the central and peripheral oscillators share a common molecular clock mechanism based on cell-autonomous and self-sustained transcriptional/translational feedback loops. This core clock mechanism controls circadian expression of so-called "output genes" that, in turn, impose cell-specific functional rhythms (reviewed in^{1,2}).

Previous studies have shown that the circadian timing system plays a major role in renal function. In mice, whole-body inactivation of different elements of the molecular clock leads to abnormal circadian patterns of urinary sodium and potassium excretion, loss of the circadian rhythmicity of plasma aldosterone levels and significant changes in arterial blood pressure (BP) (reviewed in³⁻⁵). In humans, growing evidence suggests a possible link between dysregulation of renal circadian rhythms and, development of hypertension and accelerated progression of chronic kidney disease. The importance of the circadian clock system in the kidney has been recently demonstrated on the molecular level. Zuber et al. and Nikolaeva et al. have shown that hundreds of transcripts in microdissected distal convoluted tubule and the connecting tubule (DCT/CNT) and, the cortical collecting duct (CCD) exhibit significant circadian oscillations in their expression levels and, that the whole-body inactivation of circadian transcriptional factor *Clock* leads to dramatic changes in the transcriptomes of the DCT/CNT and the CCD^{6,7}. Gumz and colleagues have shown that the circadian clock protein PER1 exerts diverse effects on the renal handling of sodium⁸⁻¹⁰. Zhang et al. have

demonstrated that among twelve tested mouse tissues, the kidney exhibits the second greatest number of circadian transcripts (the greatest number was found in the liver)¹¹. However, the role of the renal circadian clocks in the generation of functional and molecular rhythms in the kidney, as well as in the development of kidney disease remains largely unknown. To our knowledge, the only study that addressed this question is a recent paper by Tokonami et al. who showed that ablation of the circadian clock in renin-secreting granular cells results in several abnormalities, including increased glomerular filtration rate (GFR), decreased plasma aldosterone levels and low BP¹². Here, we studied the role of circadian clocks in the nephron by using conditional and inducible inactivation of BMAL1 protein, an indispensable element of the molecular clock (*Bmal1*^{lox/lox}/Pax8-rtTA/LC1 mice).

The renal tubular cells are involved in a wide variety of essential functions including maintenance of homeostasis, disposition of xenobiotics and synthesis of molecules that are released into the bloodstream (e.g. bicarbonate and arginine). Since many of these processes exhibit circadian rhythmicity, the aim of this study was to identify the molecular pathways/mechanisms that are directly controlled in the nephron by the tubular circadian clock. Using an approach combining functional, metabolomic and deep sequencing analyses we show that the tubular circadian clock is not a prerequisite for the control of the GFR or of the water, sodium and potassium balance. However, we demonstrate that the tubular circadian clock is deeply involved in the control of both, intra-renal and systemic metabolism and in drug disposition.

RESULTS

Validation of the *Bmal1*^{lox/lox}/*Pax8-rtTA/LC1* (cKO) knockout model. The conditional inactivation of the *Arntl* gene encoding BMAL1 was induced by 2-weeks treatment with doxycycline (DOX, 2 mg/ml in drinking water) of 8-weeks old *Bmal1*^{lox/lox}/*Pax8-rtTA/LC1* mice (hereafter referred to as conditional knockout mice or cKO mice). In parallel the same DOX treatment was provided to their littermate controls (*Bmal1*^{lox/lox} mice, hereafter referred to as Control mice). **The qPCR analysis revealed that *Bmal1* mRNA expression was significantly reduced in kidneys of cKO mice (2 month after the end of DOX treatment, Supplemental Figure 1).** Immunohistochemical staining for BMAL1 and CRE expression was performed at day 5 of the 2-weeks DOX treatment period or 2 month after the end of DOX treatment. As shown in Supplemental Figure 2, at day 5 of DOX treatment the CRE was ubiquitously expressed along the renal tubule but not in glomeruli or blood vessels in cKO mice. The BMAL1 protein was ubiquitously expressed in all kidney cells in Control mice, but in cKO mice all tubular cells became negative for BMAL1 staining at day 5 of DOX treatment (Supplemental Figure 3). The specific tubular inactivation of BMAL1 was maintained in cKO mice 2 month after the end of DOX treatment (Supplemental Figure 3). **To assess the effect of BMAL1 deficiency on circadian mechanism *per se*, we performed qPCR analysis of expression levels of several genes involved in the core clock (*Cry1*, *Per2* and *Nr1d1*) and that of *Dbp*, an output gene that is directly controlled by the circadian clock. As shown in Supplemental Figure 1, the BMAL1 deficiency results in a significant attenuation in circadian oscillations of mRNA expression of *Cry1*, *Per2*, *Nr1d1* and *Dbp*. The expression level of *Bmal2*, a paralog of *Bmal1* which is thought to be able to rescue the BMAL1 deficiency in some tissues¹³, was increased in kidneys of cKO mice but the absolute levels of *Bmal2* expression remained significantly lower than those of other tested core clock**

components (Supplemental Figure 1). Collectively, these results suggested that the activity of the circadian clock in renal tubular cells is significantly impaired.

PAX8 is a paired-box transcriptional factor crucial to the organogenesis and development of the kidney, the thyroid gland and the Müllerian system. Traykova-Brauch et al. used a partial *Pax8* promoter to target the expression of a tetracycline-dependent transactivator (tTA) to the renal tubular cells¹⁴. The tissue-specificity of the promoter-driven expression was assessed in the kidney, liver, heart, lung, brain, spleen, thyroid and colon. Among the tissues tested, the Pax8-driven CRE expression was found all along the renal tubule and in a subset of periportal hepatocytes. Hence, we tested the BMAL1 expression in the liver. As shown in Supplemental Figure 4, indeed some proportion of liver cells located in the vicinity of large blood vessels appeared negative for BMAL staining in DOX-treated cKO mice.

Basic characteristics of cKO mice. To avoid the potential side effects related to DOX toxicity all further analyses were performed 2 month after the end of DOX treatment. For all experiments mice were adapted to a 12-hour light/12-hour dark cycle for 2 weeks.

The cKO mice were overtly normal, their body weight was not different from the Control mice but their kidney weight/body weight ratio was significantly decreased (Table 1). The basic morphological analysis did not reveal any obvious renal abnormalities in cKO mice (tested parameters: gross renal morphology, interstitial fibrosis, glomerular sclerosis, inflammation, vascular lesions; data not shown).

Blood collection was performed at ZT4 and ZT16 (ZT – Zeitgeber time units; ZT0 is the time of light on and ZT12 is the time of light off). Twenty-four hour or hourly urine was collected from freely moving mice housed in metabolic cages with free access to food and water. As shown in Table 1, the only difference found in 24-hour urine samples was a

significant reduction in urinary pH in cKO mice. Since the whole body knockout of *Clock* results in a significantly different circadian kinetics of urinary water, sodium and potassium excretion, we also analyzed the hourly urine excretion pattern in Control and cKO mice. **To exclude the influence of light on urine excretory rhythms, the hourly urine collection was also performed on animals placed in constant darkness 30 hours before urine collection (dark-dark conditions).** As shown in Supplemental Figures 5 and 6 the circadian patterns of urinary excretion of water, sodium and potassium were not different between Control and cKO mice **in both light/dark and dark/dark conditions, respectively.** Basic analysis of plasma samples revealed a significant increase in creatinine (ZT4 and ZT16), urea (ZT4 and ZT16) and magnesium (ZT16) levels and of osmolality (ZT16) in cKO mice (Table 1, *t*-test). **Differences between ZT4 and ZT16 for plasma parameters were analyzed by 2-way ANOVA. As shown is Supplemental Table 1, ANOVA revealed a significant effect of time on plasma osmolality and plasma concentration of sodium, potassium, calcium, creatinine, urea and aldosterone. This effect of time was similar between Control and cKO mice.** Importantly, there was no difference in the GFR between Control and cKO mice, as measured by inulin clearance (Table 1). The cKO mice showed a modest but statistically significant decrease in systolic BP (FDR<0.001), but not in diastolic BP; the inactive phase BP dipping was not different between Control and cKO mice (Supplemental Figure 7 and Supplemental Table 2).

Deep sequencing kidney transcriptome profiling and plasma metabolome analysis of

Control and cKO mice. The increased plasma creatinine and urea levels along with normal GFR suggested a tubular impairment in cKO mice. Since the circadian clock has been shown to control a variety of physiological processes, we performed unbiased kidney transcriptome and plasma metabolome analyses in Control and cKO mice in order to identify metabolic/homeostatic pathways and/or transporter systems that are controlled by the renal

circadian clock. Transcriptome profiling of RNAs extracted from the whole kidney (ZT4 and ZT16) was performed by deep sequencing and the partial metabolome profiling (180 plasma metabolites from five substance classes, i.e. hexose, amino acids, biogenic amines, acylcarnitines, and lipids; BIOCRATES Life Sciences AG, Innsbruck) was performed on plasma samples collected at ZT4 and ZT16.

For each sample, from 34 to 50 million sequencing reads were aligned to the mouse genome (Supplemental Table 3). As shown in Figure 1A, 721 and 765 transcripts exhibited differential expression levels between Control and cKO mice at ZT4 and ZT16, respectively (FDR<0.05, Supplemental Table 4). Among them, 552 transcripts were commonly changed at ZT4 and ZT16 (Figure 1A and Supplemental Table 4). Gene ontology (GO) analysis with these 552 genes followed by summarization in REVIGO¹⁵ revealed enrichment of processes related to the cellular metabolism (carboxylic acid metabolism cluster, blue box, Figure 1B and Supplemental Table 5) and organic anion transport (organic anion transport cluster, pink box, Figure 1B and Supplemental Table 5). Differential expression of six selected genes, namely nicotinamide phosphoribosyltransferase (Nampt), peroxisome proliferator-activated receptor delta (Ppard), mitochondrially encoded NADH dehydrogenase 1 (mt-Nd1), carnitine transporter Slc22a5, monocarboxylate transporter 1 (Slc16a1, or Mct1) and cyclin-dependent kinase inhibitor 1a (Cdkn1a, or p21) was validated by qPCR (Supplemental Figure 8). Analysis of transcripts encoding proteins located in mitochondria demonstrated that transcripts encoded by both mitochondrial and nuclear genomes are significantly overrepresented among the most down-regulated genes in cKO mice, at both ZT4 and ZT16 ($p < 0.001$, two-tailed Mann-Whitney U test, Supplemental Figure 9). Because the circadian clock has been shown to control mitochondrial biogenesis¹⁶ we performed a quantitative analysis of mitochondrial genomic DNA in kidneys of Control and cKO mice. As shown in Figure 2A, the mitochondrial DNA content was not different between Control and cKO mice.

The NAD⁺/NADH ratio, a marker reflecting oxidative phosphorylation/glycolysis ratio, was significantly decreased in the kidney of cKO mice but not in the liver (Figure 2B).

Metabolome analysis revealed significant difference in the plasma levels of amino acids (arginine (ZT16), glutamate (ZT4) and methionine (ZT 16)), biogenic amines (asymmetric dimethylarginine (ADMA, ZT16); creatinine (ZT4 and ZT16 (thereby confirming results of blood chemistry analysis, see Table 1)); carnosine (ZT16) and taurine (ZT16)), carnitine (C0, ZT4 and ZT16) and several acylcarnitines, and of different species of phosphatidylcholine, lysophosphatidylcholine and sphingomyeline (Supplemental Table 6).

Comparison of metabolome and transcriptome data allowed us to identify several potential mechanisms through which the tubular circadian clocks participate in the control of blood metabolome. Mechanisms involved in the control of plasma urea/arginine and creatinine levels were selected for validation and more in-depth analysis.

Urea and arginine The urea is the end product of ammonia detoxification in the liver, a process that depends on the activity of Arginase I, an enzyme that converts *L*-arginine formed in the liver urea cycle into urea and *L*-ornithine. The kidney expresses the second arginase isoform, namely Arginase II (ARGII), but its activity is significantly lower than the activity of ARG I in the liver. Hence, it is generally accepted that in the normal physiological state ARGII does not influence plasma urea levels¹⁷. Most of the circulating *L*-arginine is synthesized in the kidney proximal tubule from *L*-citrulline that is absorbed from the small intestine.

Analysis of transcriptomes revealed that ArgII transcript levels are significantly upregulated in kidneys of cKO mice (Supplemental Table 5 and Supplemental Figure 10A). Western blotting performed on microdissected renal tubules (Figure 3A and Supplemental Figure 10B) and immunohistochemical staining (Supplemental Figure 10C) demonstrated that

ARGII protein expression is dramatically increased specifically in the proximal straight tubule (PST). As shown in Figure 3B, the enzymatic arginase activity was significantly increased in kidneys of cKO mice and reached ~25% of arginase activity in the liver; the liver arginase activity was not different between Control and cKO mice. In parallel, arginine levels in kidney tissue of cKO mice were significantly increased (Figure 3C), thereby providing a potential link with hyperargininemia in cKO mice demonstrated in the metabolomic profiling (Supplemental Table 6). Interestingly, the activity of the nitric oxide synthase, the second major arginine consuming enzyme in the kidney¹⁸ was also significantly increased in cKO mice (Figure 3D).

Creatinine and furosemide Creatinine, a weak organic acid, is eliminated in the urine by glomerular filtration and, in part, by tubular secretion. Vallon et al. have shown that organic anion transporter 3 (OAT3 (Slc22a8)) significantly contributes to the creatinine secretion in the mouse kidney¹⁹. Analysis of transcriptome revealed that OAT3 expression is reduced in cKO mice at both ZT4 and ZT16 (Supplemental Table 4). These results were confirmed by qPCR (Figure 4A). Western blotting demonstrated ~ 80% reduction in OAT3 protein expression in cKO mice (Figure 4B, $p=0.004$). Since OAT3 is involved in the basolateral transport of a variety of organic acids, including several clinically important drugs, we tested the possibility that the tubular circadian clocks controls pharmacological properties of furosemide, a diuretic which is actively secreted in the kidney by OAT3. As shown in Figure 4C, the cKO mice exhibited rightward shift in the natriuretic dose-response curve for furosemide (Control mice: $IC_{50}=0.117\pm 0.048$ μg furosemide/g BW; cKO mice: $IC_{50}=0.263\pm 0.094$ μg furosemide/g BW, Mean \pm SD; $n=5$, $p=0.012$, t -test). In parallel, cKO mice showed lower urinary furosemide excretion following a single 0.3 μg /g BW furosemide bolus (Figure 4D).

DISCUSSION

An intriguing result of this study is that the renal phenotype of cKO mice differs significantly from that of *Clock*-null mice⁷. The major difference consists in the normal circadian dynamics of urinary water, sodium and potassium excretion, normal plasma aldosterone levels and normal GFR in cKO mice, whereas these functions were significantly impaired in *Clock*-null mice. This difference suggests that either the tubular circadian clocks are not involved in the generation of urinary excretory rhythms or, that the inactivation of tubular circadian clocks could be fully compensated by other mechanisms. These findings raise the question about the tissue/cellular origin of renal excretory rhythms. Okamura and colleagues²⁰ showed that mice lacking *Cry1* and *Cry2* exhibit hyperaldosteronism and blunted circadian oscillations in plasma aldosterone levels due to increased aldosterone synthesis in adrenal glands. We have recently shown that the deletion of *Arntl* in renal granular cells results in modified circadian rhythm of urinary sodium excretion, polyuria, increased GFR and low BP¹². Accumulating evidence from Titze, Luft and colleagues²¹ suggest that total body sodium content fluctuates independently of intake or body weight, thereby pointing to a possible role of extracellular sodium storage/release dynamics. Also, there is strong evidence that the circadian rhythms of urinary potassium excretion are determined, at least in part, by the net potassium fluxes between intracellular and extracellular compartments²². Collectively, these results suggest that circadian clocks in many different organs/cell types may participate to the generation/maintenance of circadian rhythms of urinary sodium, potassium and water excretion, but the role of the intrinsic renal tubular clocks in these processes remains yet unclear.

However, we found that the tubular circadian clock is deeply involved in several other essential physiological functions including control of both the intra-renal and systemic

metabolism, elimination of xenobiotics/drugs and maintenance of homeostasis of compounds secreted into the blood by the kidney. The critical role of the circadian clock system in the control of metabolism has been demonstrated in a number of tissues²³; however, the novelty of our study is that the suppression of the tubular circadian clock greatly impacts plasma metabolome, in a way that in turn may affect metabolic and homeostatic processes at the systemic level. Our partial metabolome analysis covered less than 5% of the total plasma metabolome estimates (180 vs ~ 4'000 metabolites, respectively), but even this restricted approach allowed us to identify more than 50 metabolites that are differentially represented in plasma of cKO mice.

Comparison of transcriptome and metabolome data allows establishing tubular mechanisms that are disturbed in cKO mice. For instance, carnitine deficiency in cKO mice correlates with significantly decreased expression of the *Slc22a5* carnitine transporter involved in the carnitine reabsorption in the proximal tubule. Of note, the loss-of-function of *Slc22a5* is a well-known cause of primary carnitine deficiency²⁴. Two of these mechanisms, namely, those that are involved in the renal control of plasma creatinine and urea levels were selected for in-depth analysis. These two mechanisms were chosen because (i) plasma creatinine and urea concentrations are commonly used as surrogate biomarkers of glomerular (dys)function in clinical settings, and (ii) because creatinine secretion in the kidney occurs through the same transporter systems as those used by many clinically important drugs (see below).

We found that the increase in plasma urea levels correlates with tubular and not with glomerular dysfunction. We show that cKO mice exhibit a parallel increase in the renal Arginase II (*ARG2*) activity and renal and plasma arginine levels. Arginine, a semi-essential amino acid, is synthesized in the proximal convoluted tubule and released into the blood stream where it can be, in part, recovered by the proximal straight tubule and converted to

urea and *L*-ornithine by ARG2, or oxidized to nitric oxide and *L*-citrulline by NO synthases in tubular and non-tubular renal cells¹⁸. Interestingly, the activity of the NO synthase was also significantly upregulated in kidneys of cKO mice. Collectively, these results suggest that the circadian clock in tubular cells controls both the intra-renal arginine metabolism and systemic arginine and urea levels.

Similarly, we found that the increase in plasma creatinine levels has tubular origin and results from the decreased expression levels of OAT3. This finding has a second important facet that supports the link between the circadian clock and the pharmacokinetics of drugs. The OAT3 transporter is involved in tubular secretion of a variety of clinically important drugs including diuretics (furosemide, bendroflumethiazide), antiherpetics (acyclovir), antiretrovirals (tenofovir), antineoplastics (methotrexate), antibiotics (benzylpenicillin) and many other (reviewed in²⁵). Here we show that the reduced expression of OAT3 in cKO mice correlates with less potent natriuretic effect and lower rate of urinary elimination of furosemide, a diuretic which is not filtered in glomeruli and must be secreted into tubular lumen to inhibit the Na/K/2Cl co-transporter. To our knowledge, this is the first demonstration that the renal circadian clocks are involved in drug pharmacokinetic. Hence, together with the well-documented effects of the circadian clock on drug metabolism in the liver²⁶, drug absorption in the intestine²⁷ and drug distribution²⁸ our study shows that the circadian timing system interferes with drug pharmacokinetics at very different levels and highlights the attention that must be given to chronopharmacology and chronotherapy.

CONCISE METHODS

Animals The procedures used to generate and the characterization of *Bmal1*^{lox/lox}, Pax8-rtTA and LC-1 Cre mice were described previously¹⁴. The three mouse lines used in this

study are inbred strains, bred on the genetic background of the C57BL/6J mouse. The animals were maintained *ad libitum* on the standard laboratory chow diet (KLIBA NAFAG diet 3800). Before all experiments, mice were adapted to a 12-hour light/ dark cycle. All experiments with animals were performed in accordance with the Swiss guidelines for animal care, which conform to the National Institutes of Health animal care guidelines.

Antibodies Anti-CRE recombinase antibody was from Novagen. Anti-BMAL1 antibody was described elsewhere¹². Anti-ARG2 antibody was from Santa Cruz Biotechnology. Anti-actin antibody was from Sigma-Aldrich. Anti-OAT3 (SLC22a8) antibody was from Abcam. Anti-OCTN2 (SLC22a5) antibody was from GeneTex. Immunohistochemistry and Western blotting protocols were identical to those described previously¹².

Metabolic cages Mice were housed in individual metabolic cages (Tecniplast). Urine collection was performed after a 3-day adaptation period. Urine and blood chemistry was analyzed as previously described⁷. Hourly urine collection was performed as previously described⁷.

Blood and urine chemistry Partial plasma metabolome profiling (180 plasma metabolites from five substance classes, i.e. hexose, amino acids, biogenic amines, acylcarnitines, and lipids) was performed by BIOCRATES Life Sciences AG (Innsbruck). Plasma aldosterone levels were measured by radioimmunoassay (DPC).

Measurements performed on kidney and/or liver tissue extracts The NAD⁺ and NADH levels in kidney and liver tissue were determined by PicoProbe colometric kit from BioVision. Kidney tissue spermine levels were determined by Ansynth Service B.V. (Netherlands). Kidney tissue *L*-arginine levels were determined by kit from MyBioSource. Arginase activity in the kidney and liver tissues was determined as arginase-specific urea

formation from ^{14}C -*L*-arginine as previously described^{29,30}. NOS activity was determined as NOS-specific *L*-citrulline formation from ^{14}C -*L*-arginine as described in Supplementary Methods.

BP The BP was measured in conscious unrestrained mice using telemetry (DSI system).

GFR The GFR was determined according to the method described by Qi et al.³¹.

Gene analysis by RNAseq (see Supplementary Methods)

Natriuretic effect of furosemide and furosemide dosage These experiments were performed according to the protocol established by Vallon et al.³².

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DISCLOSURES

None

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FIGURE LEGENDS

Figure 1. Deep sequencing transcriptome analysis of kidneys from Control and cKO mice.

A. Heat maps of normalized expression values of genes significantly affected in kidneys of cKO mice at ZT4, ZT16 or both time points (FDR < 5%). Expression values were mean centered, variance normalized and subjected to hierarchical clustering (complete linkage) using Pearson correlation as similarity metric. **B.** Gene ontology analysis showing significantly enriched biological processes (Bonferroni correction) among the 552 genes differentially expressed in kidneys of Control and cKO mice at ZT4 and ZT16. Significant biological processes were summarized and classified with REVIGO.

Figure 2. Altered renal metabolism in cKO mice. **A.** Quantification of mitochondrial DNA (mtDNA) in kidneys of Control and cKO mice (ZT8). Relative amounts of mtDNA and nuclear DNA were quantitated by qPCR of mitochondrial NADH dehydrogenase 1 (*mt-Nd1*) and nuclear *Ppia* (cyclophilin) genes¹⁶. Mean±SD, n=6, Student's t-test. **B.** NAD⁺/NADH

ratios in the kidney (ZT12) and the liver (ZT12) of Control and cKO mice. Mean±SD, n=6, Student's *t*-test.

Figure 3. Altered arginine production/degradation in cKO mice. **A.** Western blot analysis of ARG2 protein expression in the proximal straight tubules (PST) microdissected from kidneys of Control and cKO mice (ZT8). 3 mice/genotype were used for this analysis. **B.** Arginase activity in the kidney (ZT0) and the liver (ZT0) of Control and cKO mice. Mean±SD, n=3, Student's *t*-test. **C.** *L*-arginine levels in kidney tissue of Control and cKO mice (ZT8). Mean±SD, n=6, Student's *t*-test. **D.** NOS-specific *L*-citrulline formation in kidney tissue of Control and cKO mice (ZT8). Mean±SD, n=6, Student's *t*-test.

Figure 4. Lower OAT3 mRNA and protein expression correlates with impaired natriuretic response to furosemide and decreased urinary excretion of furosemide in cKO mice. **A.** qPCR analysis of *Oat3* (*Slc22a8*) mRNA expression in kidneys of Control (open circles) and cKO (filled circles) mice. Mean±SD, n=6. **B.** Western blotting with anti-OAT3 or anti-GAPDH antibodies on protein extracts prepared from kidneys of Control and cKO mice (n=5 mice in each group), ZT16. **C.** Rightward shift in the natriuretic response to furosemide in cKO mice. Mean±SEM, n=5. The IC₅₀ values were calculated using the GraphPad PRISM 6 software; v - vehicle. ZT16. **D.** Lower urinary excretion of furosemide in cKO mice. Furosemide was dosed in the urine collected during 10 min followed the 0.3 µg/g BW furosemide bolus. Mean±SEM, n=8. Student's *t*-test.

Table 1. 24h-urine and plasma chemistry in Control and cKO mice

	Control	cKO	p
Body weight (BW, g)	33.07±3.28 (20)	31.89±2.26 (21)	NS
Kidney weight (g)	0.19±0.02 (20)	0.15±0.02 (21)	<0.001
Kidney weight/BW (%)	0.58±0.06 (20)	0.46±0.06 (21)	<0.001
Urine			
Volume/BW (ml/g)	0.049±0.019 (12)	0.054±0.028 (12)	NS
Osmolality (mosm/kg H ₂ O)	2734±755 (12)	2636±575 (12)	NS
pH	6.53±0.27 (12)	6.13±0.15 (12)	<0.001
UV*Na ⁺ /g BW (μmol/g)	6.3±3.25 (12)	5.6±1.67 (12)	NS
UV*K ⁺ /g BW (μmol/g)	21.6±6.46 (12)	22.2±7.1 (12)	NS
UV*Ca ²⁺ /g BW (μmol/g)	0.088±0.061 (12)	0.114±0.057 (12)	NS
UV*Mg ²⁺ /g BW (μmol/g)	1.46±0.54 (12)	1.69±0.83 (12)	NS
UV*PO ₄ ³⁻ /g BW (μmol/g)	3.82±1.66 (12)	3.96±2.12 (12)	NS
UV*Creatinine/g BW (μmol/g)	0.31±0.12 (12)	0.31±0.13 (12)	NS
UV*Urea/g BW (μmol/g)	94.0±41.6 (12)	97.0±42.6 (12)	NS
UV*NOx/g BW (μmol/g)	0.107±0.030 (12)	0.118±0.046 (12)	NS
UV*Glucose/g BW (μmol/g)	0.19±0.11 (12)	0.15±0.08 (12)	NS
UV*Total protein/g BW (mg/g)	0.50±0.13 (12)	0.35±0.20 (12)	0.06
UV*Ammonium/g BW (μmol/g)	0.604±0.178 (11)	1.288±0.407 (12)	NS
UV*TA/g BW (μmol/g)	1.757±0.325 (12)	2.343±0.298 (12)	NS
Plasma			
Osmolality Zt4 (mosm/kg H ₂ O)	306.8±6.9 (6)	304.8±4.2 (6)	NS
Osmolality Zt16 (mosm/kg H ₂ O)	304.3±6.2 (6)	311.3±3.6 (6)	0.037
Na ⁺ (mM) Zt4	153.1±2.52 (6)	153.8±1.44 (6)	NS
Na ⁺ (mM) Zt16	147.3±2.23 (6)	146.8±3.46 (6)	NS
K ⁺ (mM) Zt4	3.93±0.63 (6)	3.78±0.44 (6)	NS
K ⁺ (mM) Zt16	3.35±0.33 (6)	3.25±0.29 (6)	NS
Ca ²⁺ (mM) Zt4	2.18±0.06 (6)	2.20±0.05 (6)	NS
Ca ²⁺ (mM) Zt16	2.04±0.06 (6)	2.02±0.07 (6)	NS
Mg ²⁺ (mM) Zt4	1.12±0.09 (6)	1.14±0.09 (6)	NS
Mg ²⁺ (mM) Zt16	1.12±0.04 (6)	1.23±0.07 (6)	0.008
Creatinine (μM) Zt4	21±2.1 (6)	28.5±2.5 (6)	<0.001
Creatinine (μM) Zt16	18.6±1.8 (5)	24.4±4.2 (5)	0.021
PO ₄ (mM) Zt4	2.15±0.26 (6)	2.22±0.34 (6)	NS
PO ₄ (mM) Zt16	2.24±0.31 (6)	2.45±0.35 (6)	NS
Urea (mM) Zt4	9.23±1.89 (6)	11.40±0.62 (6)	0.023
Urea (mM) Zt16	10.77±1.57 (6)	12.97±1.08 (6)	0.017
Aldosterone (pg/ml) Zt4	503.3±116.1 (6)	435.0±173.2 (6)	NS
Aldosterone (pg/ml) Zt16	312.9±131.4 (6)	216.7±88.2 (6)	NS
GFR			
GFR ZT6 (μl/min)	264.0±36.52 (7)	251.1±43.03 (7)	NS

Values are means ± SEM. Student's t-test.; BW - body weight

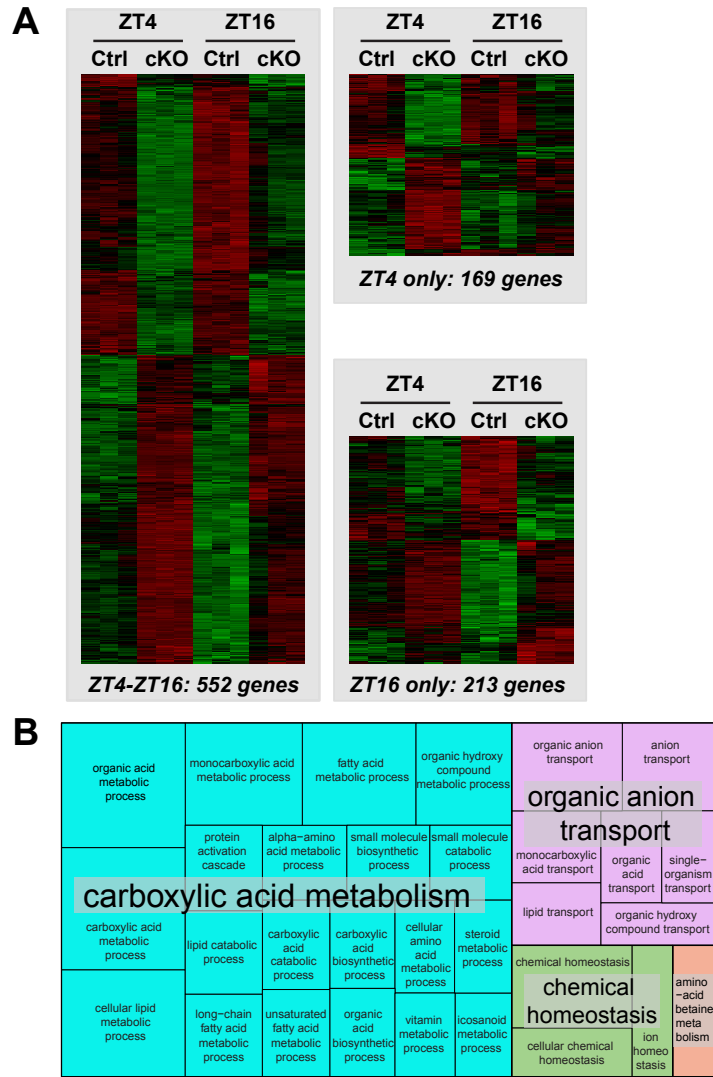


Figure 1, Nikolaeva et al.

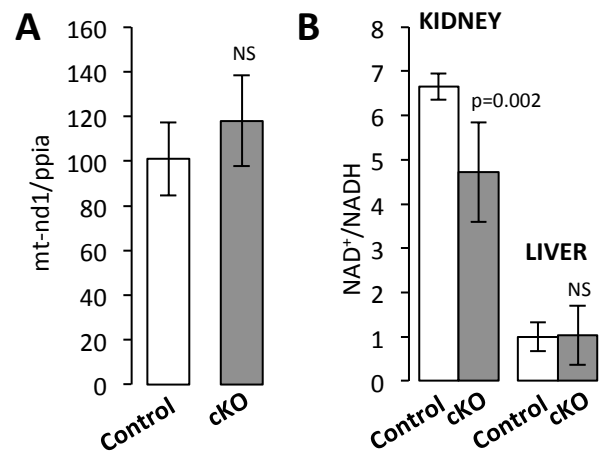


Figure 2, Nikolaeva et al.

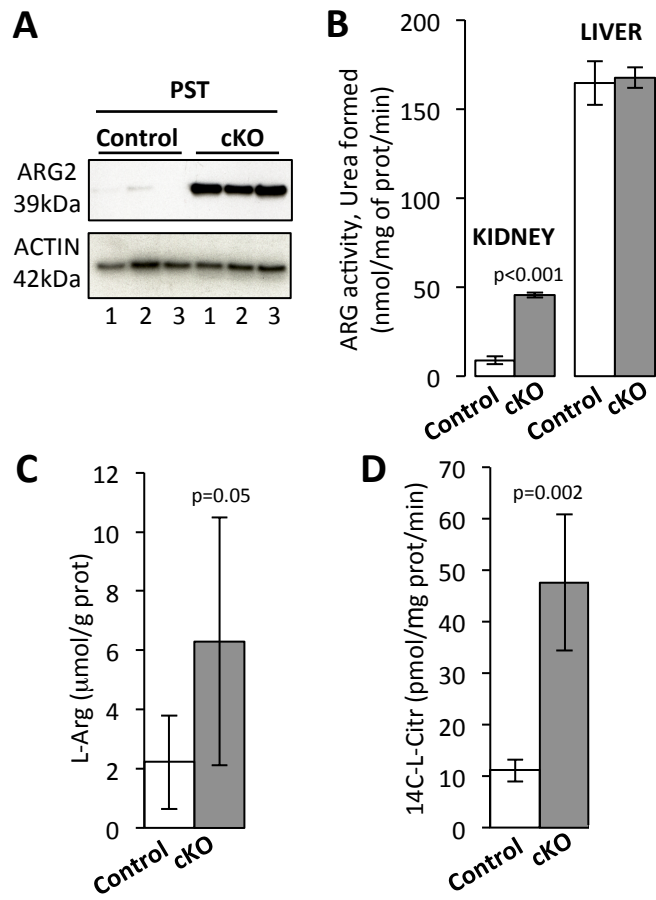
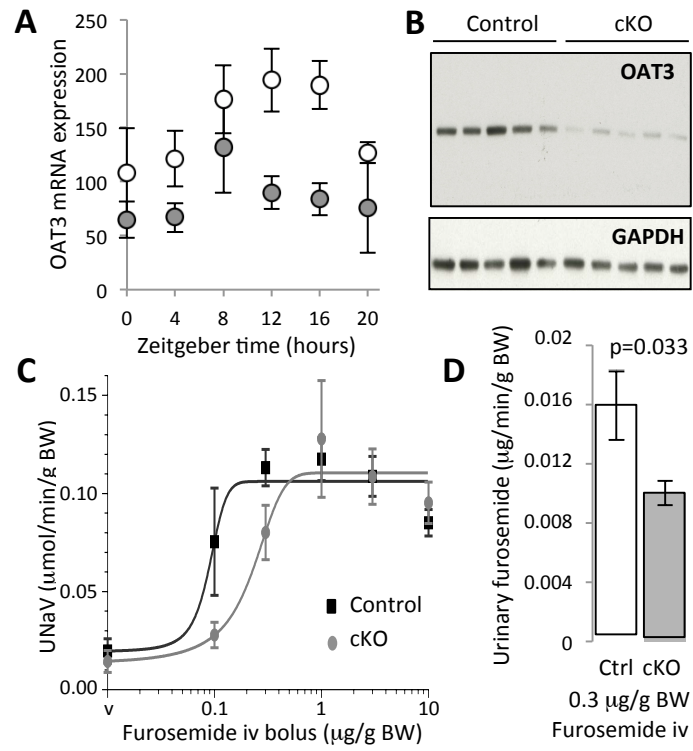
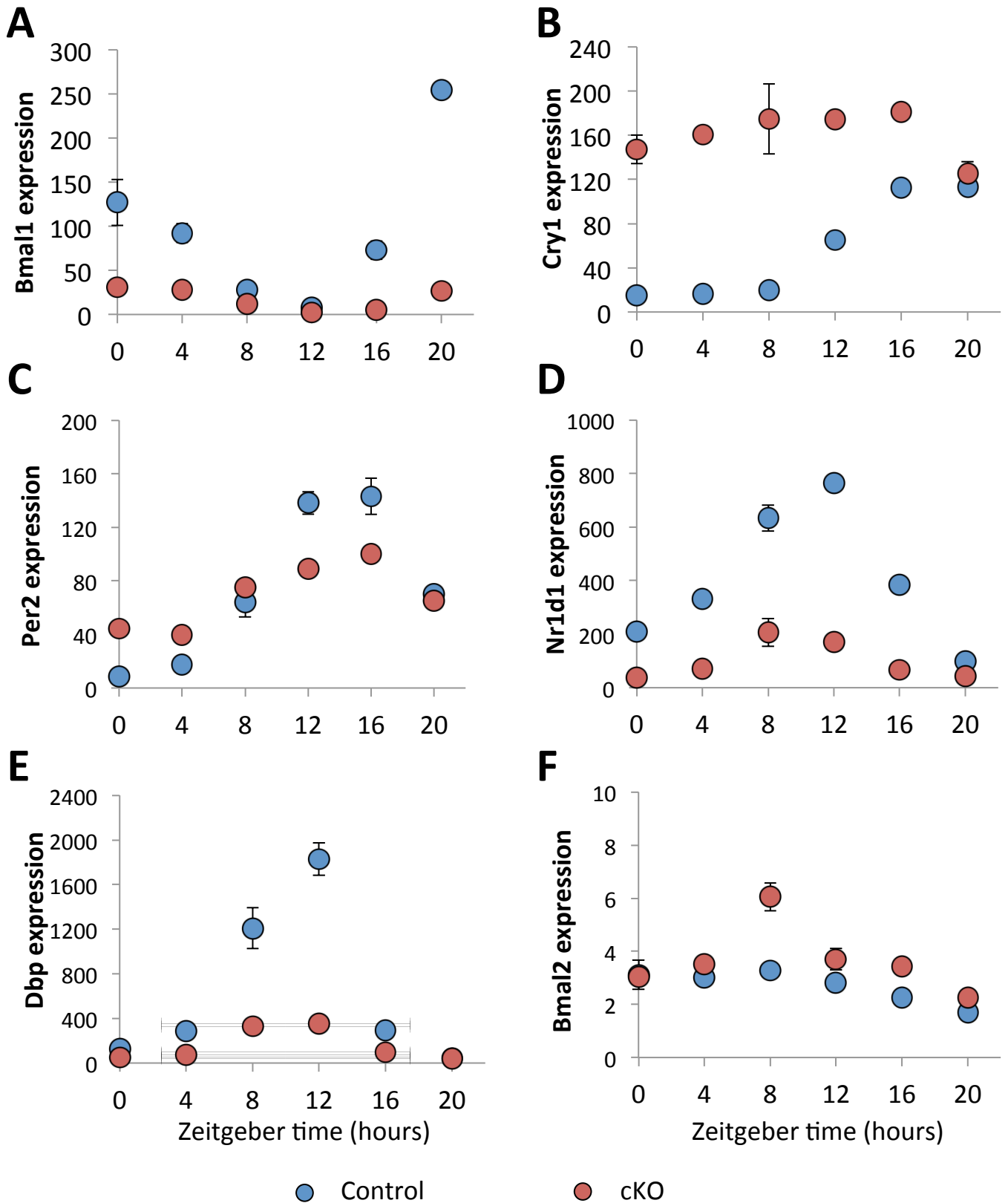
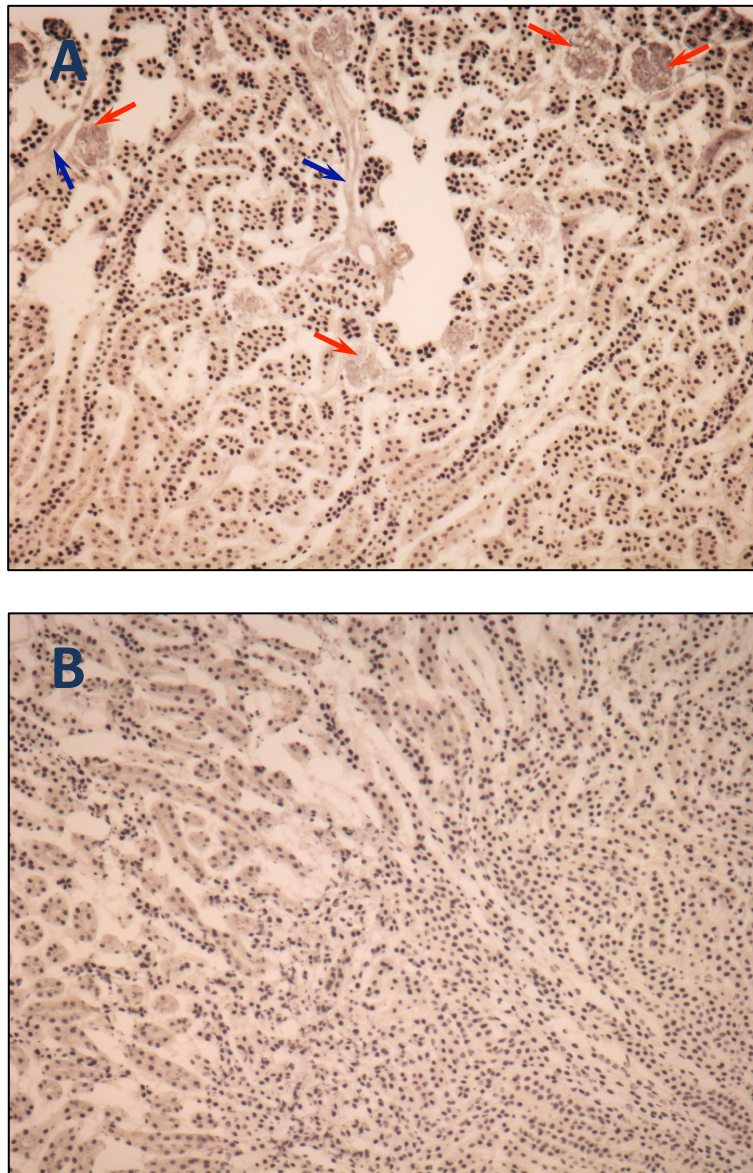


Figure 3, Nikolaeva et al.

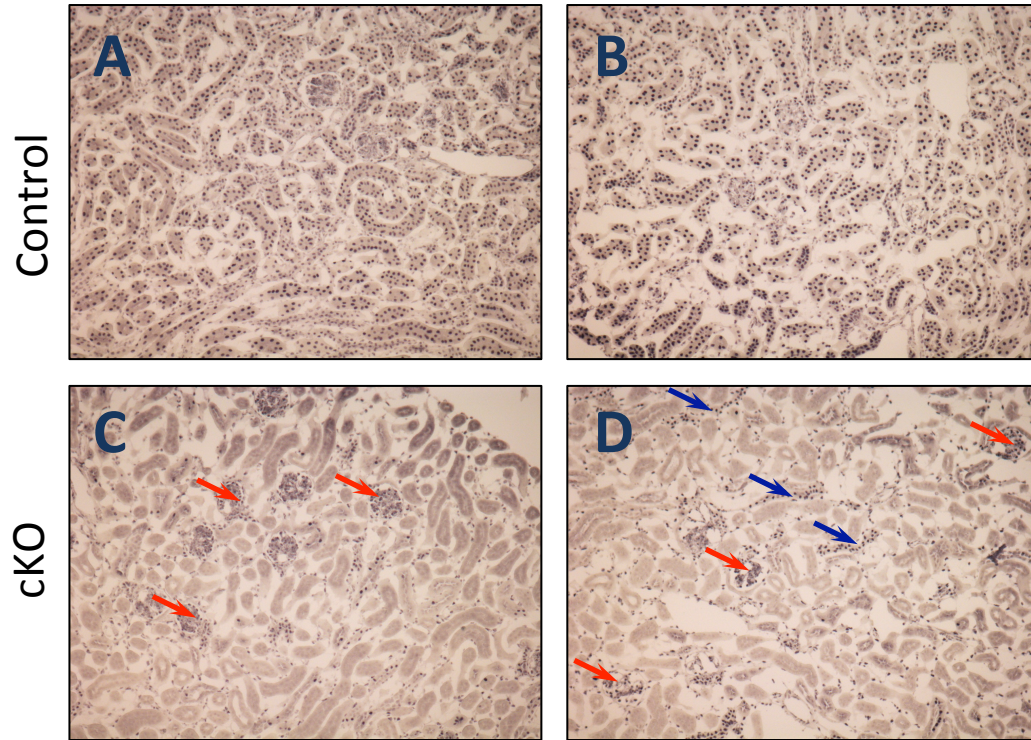




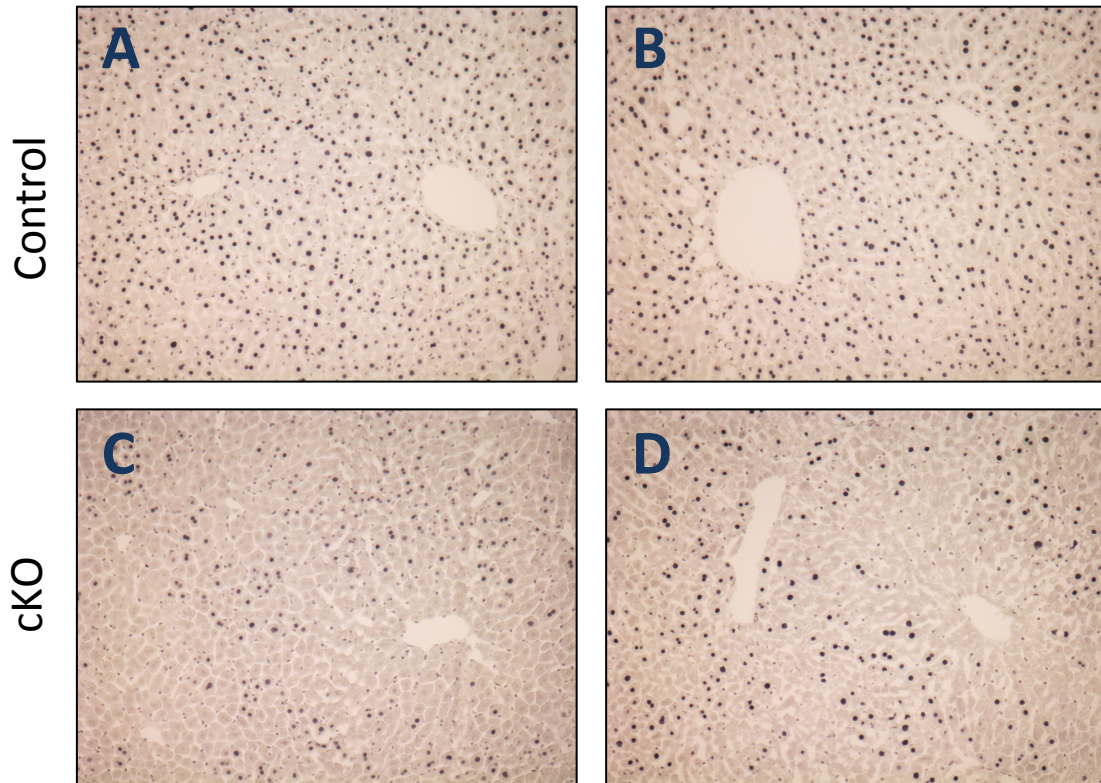
Supplemental Figure 1. qPCR analysis of Bmal1 (A), Cry1 (B), Per2 (C), Nr1d1 (D), Dbp (E) and Bmal2 (F) mRNA expression in kidneys of Control and cKO mice. n=6 for both genotypes. Error bars represent SEM. Data are expressed in arbitrary units and are standardized to Dbp expression levels in kidneys of Control animals at ZT0.



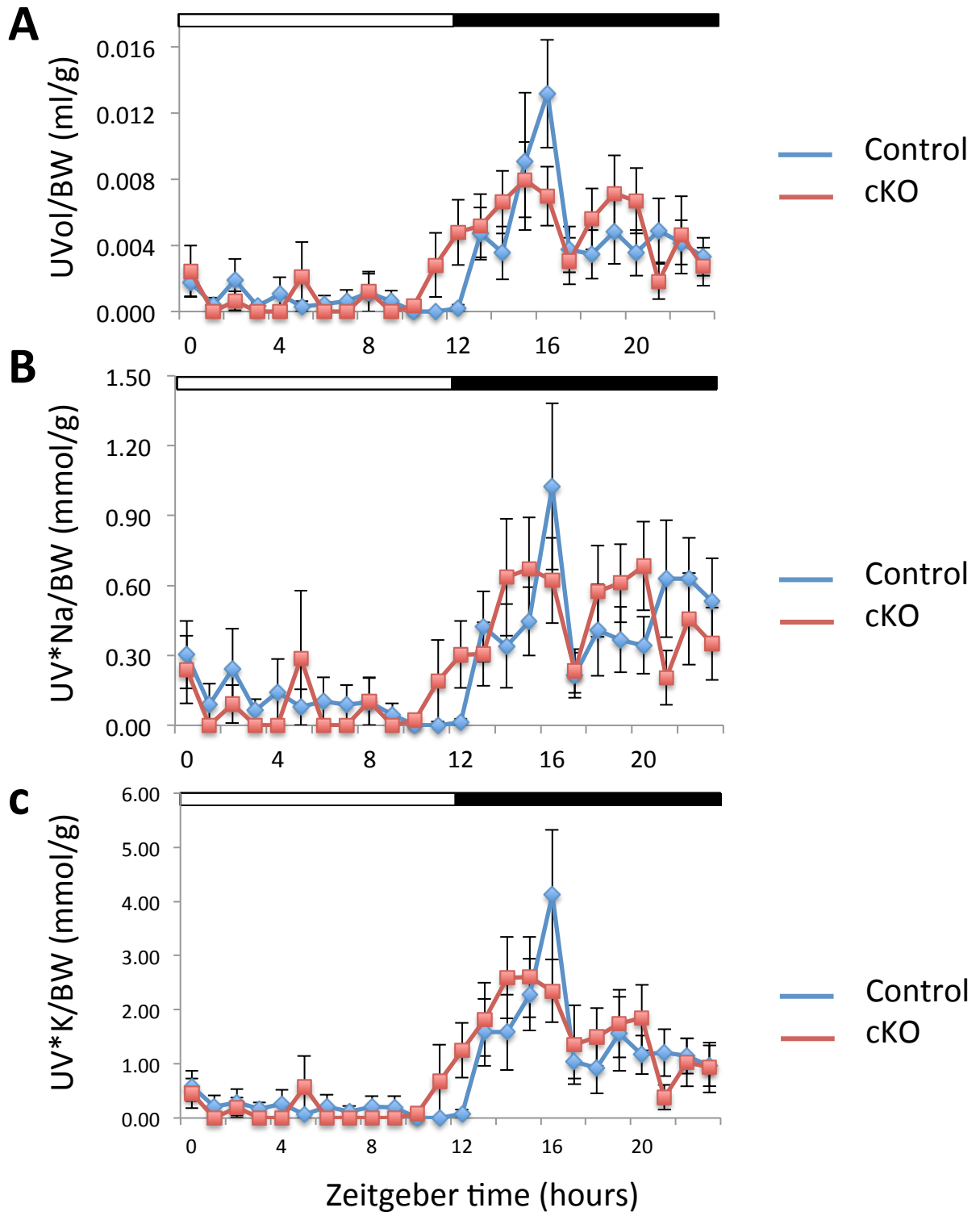
Supplemental Figure 2. Immunohistochemical localization of CRE recombinase in kidney cortex (**A**) and medulla (**B**) of cKO mice treated 5 days with DOX (2 mg/ml in drinking water). The anti-CRE recombinase antibody was from Novagen. These images show that the CRE is ubiquitously expressed in the nuclei of all renal tubular cells but not in glomeruli (red arrow) or blood vessels (blue arrow).



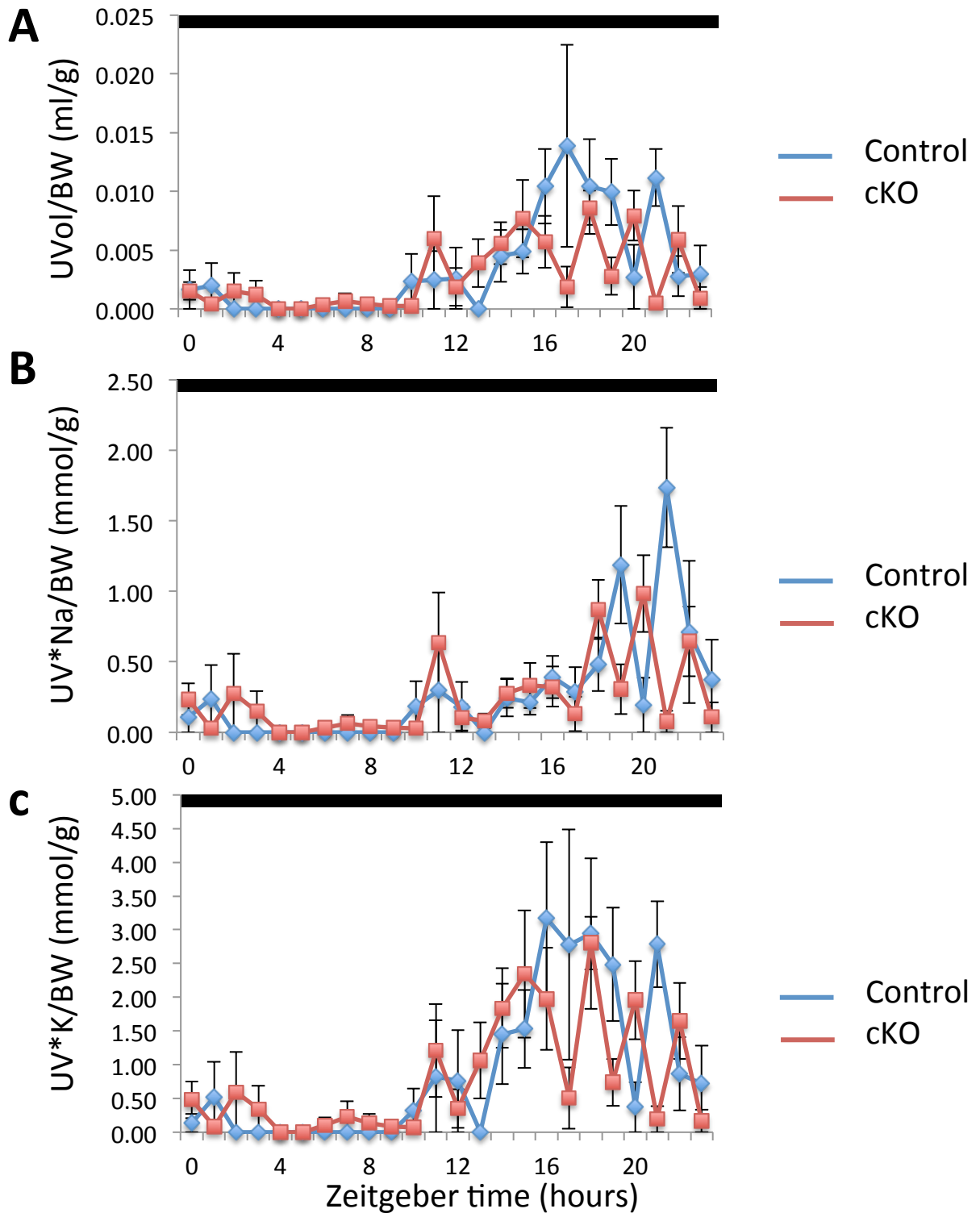
Supplemental Figure 3. Immunohistochemical localization of BMAL1 in kidney cortex of Control or cKO mice treated with DOX (2 mg/ml in drinking water). **(A)** Control mice treated 5 days with DOX. **(B)** Control mice 2 months after the end of DOX treatment. **(C)** cKO mice treated 5 days with DOX. **(D)** cKO mice 2 months after the end of DOX treatment. The anti-BMAL1 antibody was described elsewhere (12). These images show ubiquitous nuclear BMAL1 staining in kidneys of Control mice. In cKO mice, the BMAL1 expression disappeared all along the renal tubule but not in glomeruli (red arrow) or blood vessels (blue arrow).



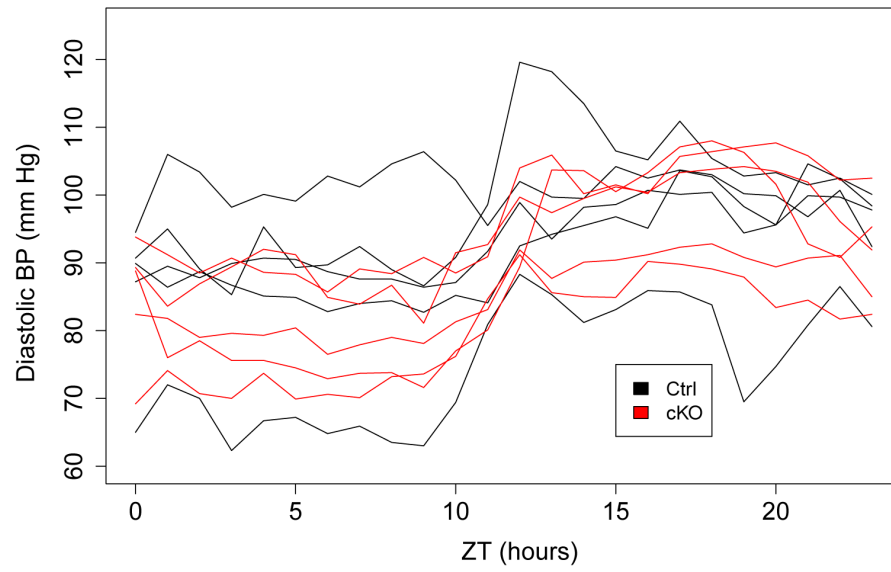
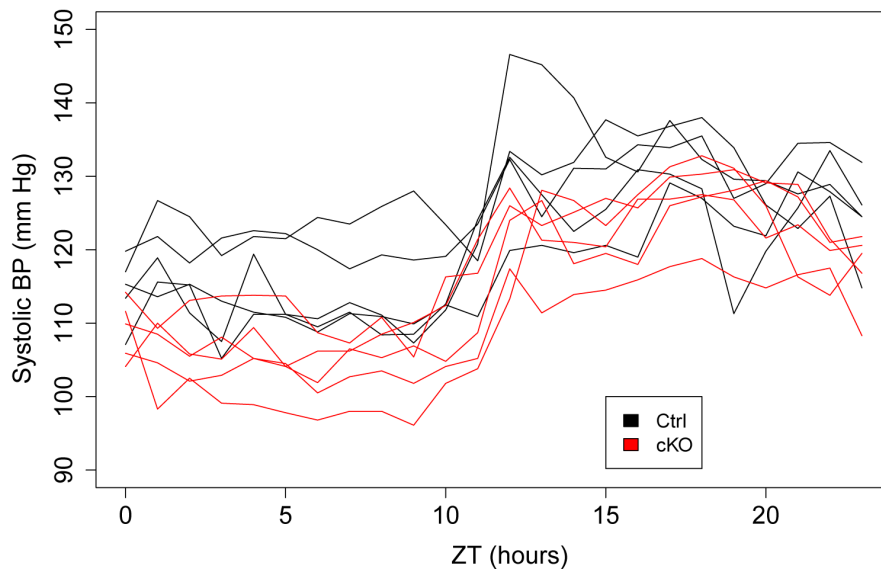
Supplemental Figure 4. Immunohistochemical localization of BMAL1 in the liver of Control or cKO mice treated with DOX (2 mg/ml in drinking water). **(A)** Control mice treated 5 days with DOX. **(B)** Control mice 2 months after the end of DOX treatment. **(C)** cKO mice treated 5 days with DOX. **(D)** cKO mice 2 months after the end of DOX treatment. The anti-BMAL1 antibody was described elsewhere (12). These images show that BMAL1 is inactivated in some proportion of liver cells located in the vicinity of the large blood vessels.



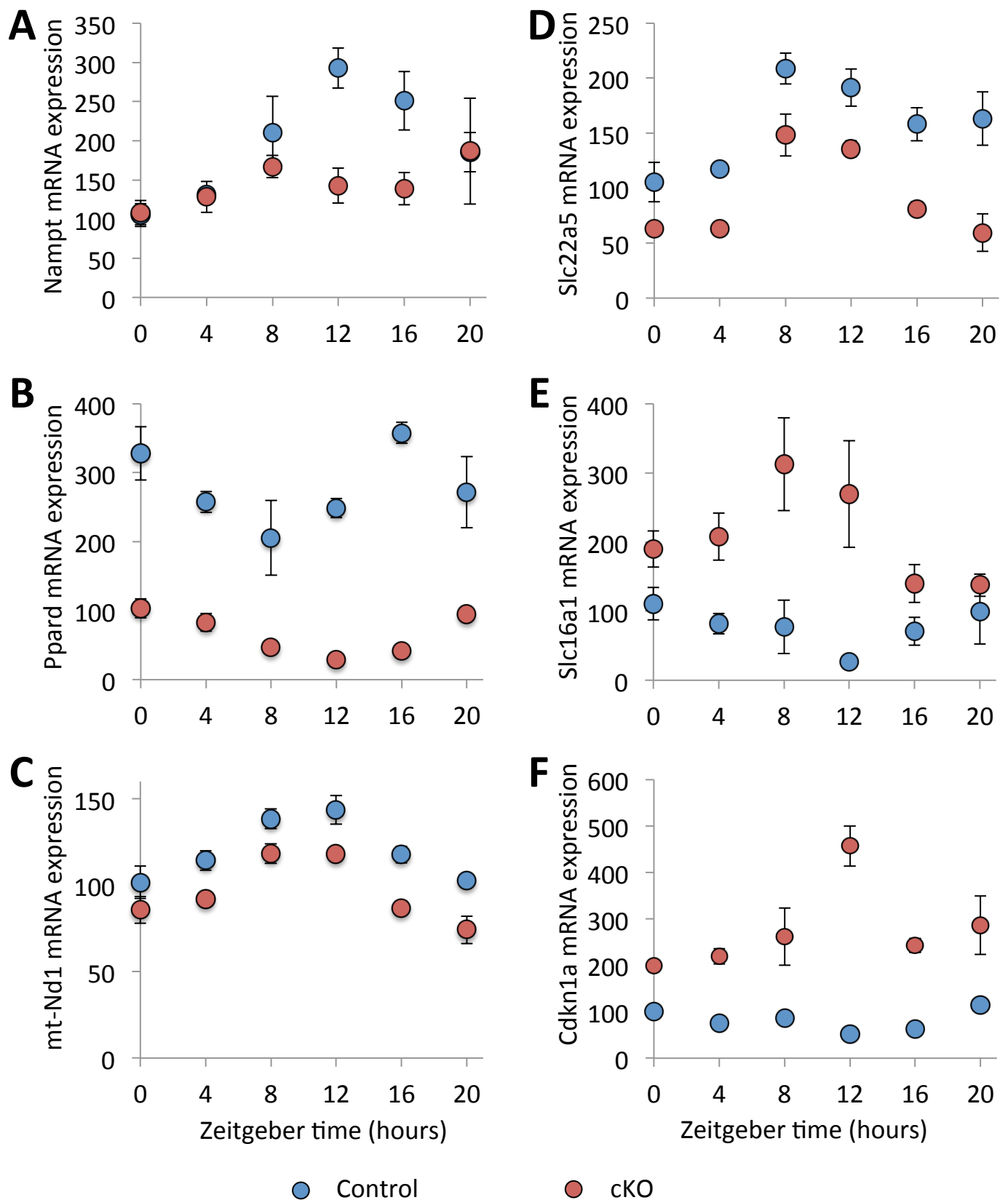
Supplemental Figure 5. Circadian patterns of renal water (A), sodium (B) and potassium (C) excretion in Control (blue line) and cKO mice (red line) in **light/dark** conditions. The hourly urine collection was performed in metabolic cages. The experiment was performed on Control and cKO mice 2 months after the end of DOX treatment. Two way ANOVA did not reveal the effect of genotype (Control vs. cKO: $P=0.63$ for water, $P=0.99$ for sodium and $P=0.57$ for potassium). $n=12$ for both genotypes. Error bars represent SEM.



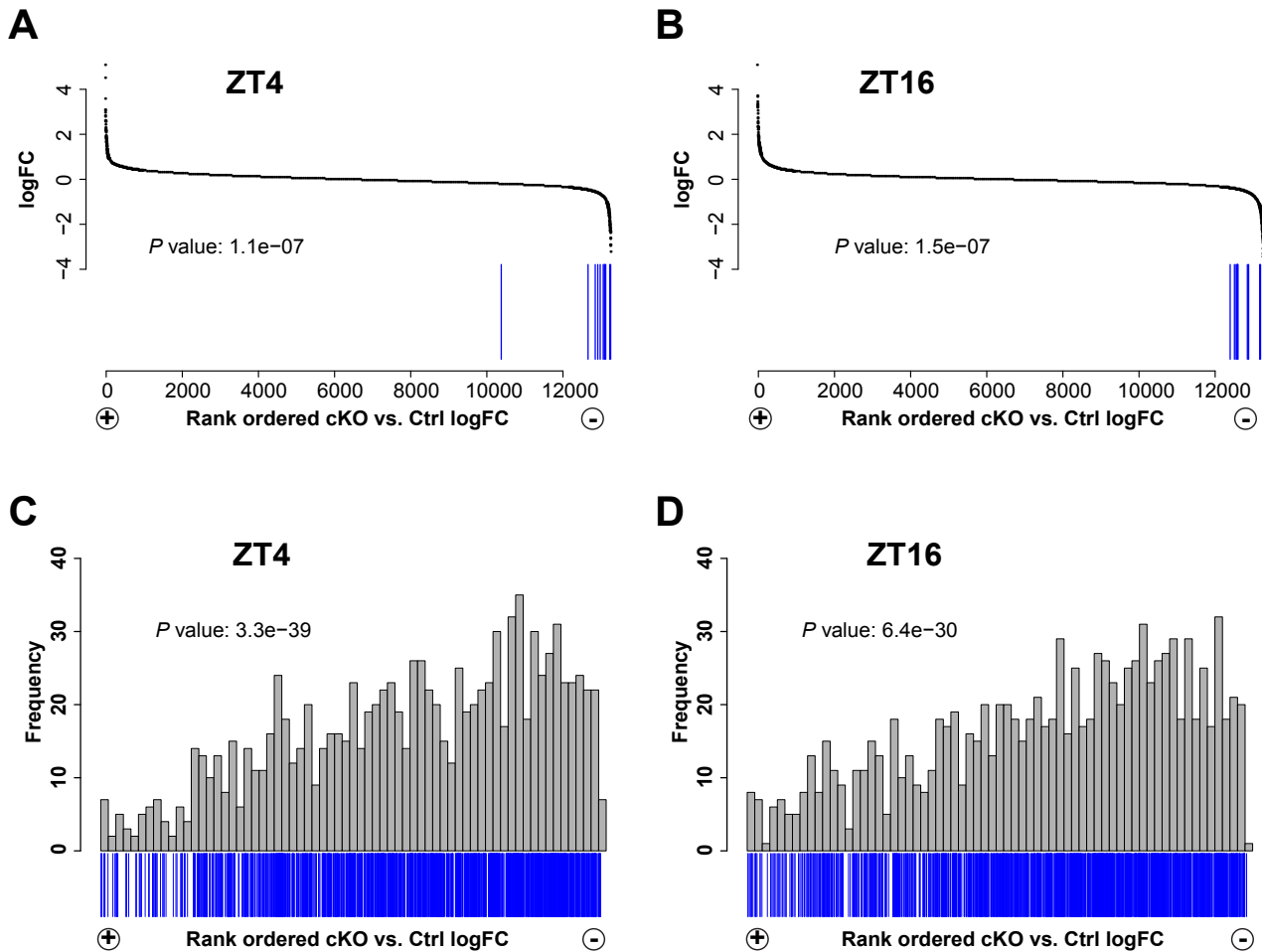
Supplemental Figure 6. Circadian patterns of renal water (A), sodium (B) and potassium (C) excretion in Control (blue line) and cKO mice (red line) in **dark/dark** conditions. The hourly urine collection was performed in metabolic cages. The experiment was performed on Control and cKO mice 2 months after the end of DOX treatment. Animals were placed in constant darkness 30 hours before urine collection. Two way ANOVA did not reveal the effect of genotype (Control vs. cKO: $P=0.23$ for water, $P=0.45$ for sodium and $P=0.50$ for potassium). $n=6$ for both genotypes. Error bars represent SEM.

A**B**

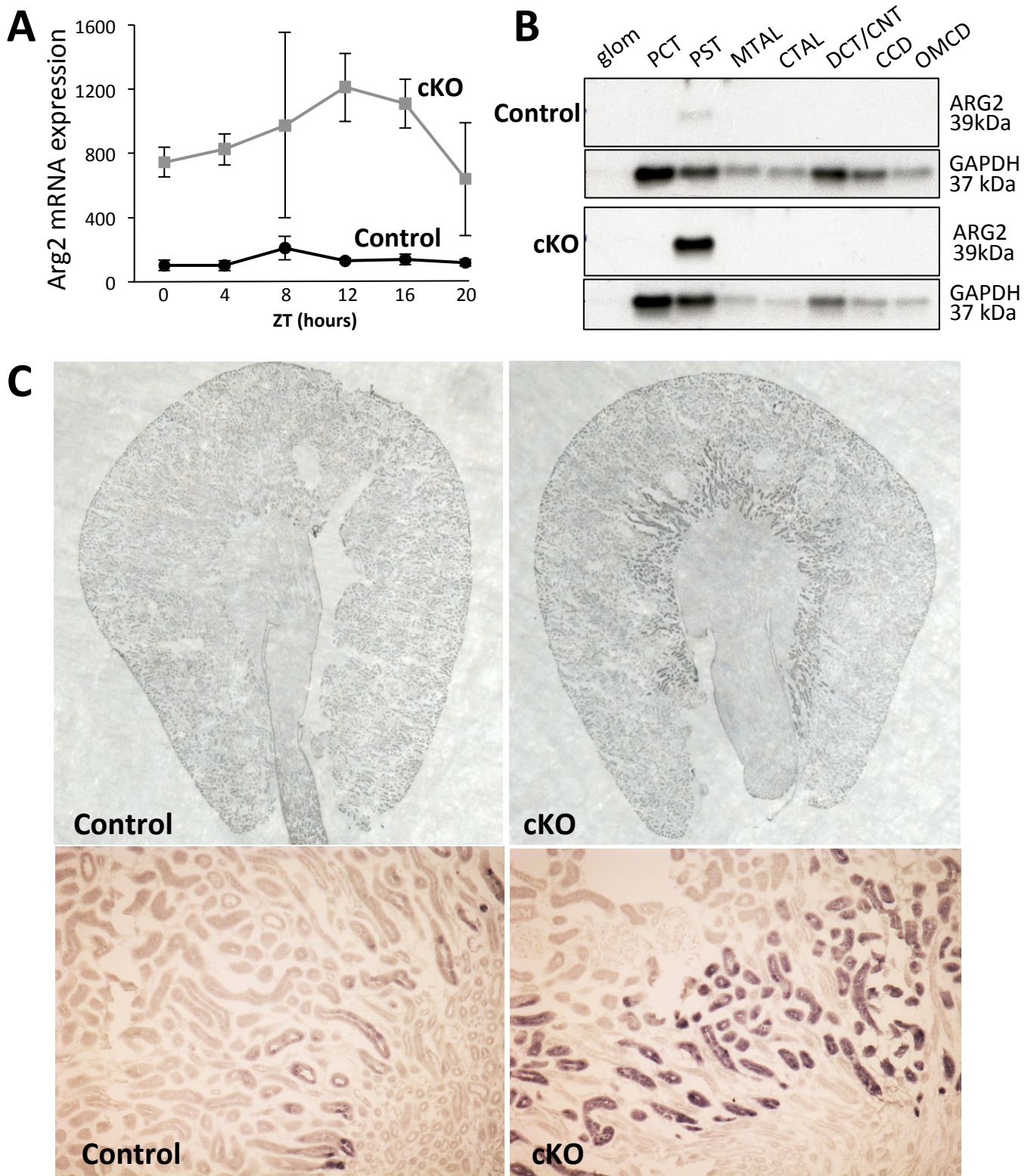
Supplemental Figure 7. Telemetry records of (A) Diastolic and (B) systolic BP from 5 Control and 5 cKO mice. For each mouse, each record represent a mean of 7-day recordings. See statistical treatment of the data in Table S2.



Supplemental Figure 8. qPCR analysis of Nampt (A), Ppard (B), mt-Nd1 (C), Slc22a5 (D), Slc16a1 (E) and Cdkn1a (F) mRNA expression in kidneys of Control and cKO mice. n=6 for both genotypes. Error bars represent SEM.



Supplemental Figure 9. Protein coding genes with at least 1 count per million in at least one sample were ordered by their log fold-change (logFC) of the difference between Control and cKO animals at ZT4 (A,C) or ZT16 (B,D) from the highest logFC on the left to the lowest logFC on the right. (A-B) Ordered logFC values (black dots) with positions of the mitochondrial DNA (mt-DNA) genes in the rank indicated by the blue tick marks. (C-D) The logFC ordered genes were binned into 50 bins. For each time point, the histogram displays the number of nuclear genes with mitochondrial localization (mt-localized) in each bin. The 1158 nuclear genes with mitochondrial localization were obtained from MitoCarta (<http://www.broadinstitute.org/scientific-community/science/programs/metabolic-disease-program/mitocarta/mitocarta-inv>). We tested the assumption that mt-DNA (A-B) or mt-localized (C-D) genes were uniformly distributed along the logFC ordered genes using a two-tailed Mann-Whitney U test. The assumption of uniform distribution was rejected, indicating an overrepresentation of mt-DNA and mt-localized genes among down-regulated genes in Bmal1 KO.



Supplemental Figure 10. Arginase 2 expression in kidneys of Control and cKO mice. **A.** Circadian pattern of Arg2 mRNA expression in kidneys of Control and cKO mice. Arbitrary units, Arg2 mRNA levels in kidneys of Control mice at ZT0 were considered as 100%. Mean \pm SD, n=6. **B.** ARG2 Western probing performed on microdissected tubular segments (10 mm/segment) or 10 glomeruli. **C.** Immunohistochemical ARG2 localization in kidneys of Control and cKO mice.

Supplemental Methods.

Gene expression analysis by RNASeq RNA-seq libraries were prepared using 500 ng of total RNA and the Illumina TruSeq Stranded mRNA reagents (Illumina; San Diego, California, USA) on a Caliper Sciclone liquid handling robot (PerkinElmer; Waltham, Massachusetts, USA) using a Caliper-developed automated script. Cluster generation was performed with the resulting libraries using the Illumina HiSeq PE Cluster Kit v3 reagents and sequenced on the Illumina HiSeq 2500 using HiSeq SBS Kit v3 reagents. Sequencing data were processed using the Illumina Pipeline Software version 1.82. Purity-filtered reads were adapters and quality trimmed with Cutadapt (v. 1.3.) and filtered for low complexity with PRINSEQ (v. 0.20.3.) (1). Reads were aligned against *Mus musculus GRCh38* genome using Tophat (v. 2.0.9) (2). Quality of the RNASeq data alignment was assessed using RSeQC (v. 2.3.7, RSeQC (v. 2.3.7, (3)). The number of read counts per gene locus was summarized with htseq-count (v. 0.6.1) using *Mus musculus GRCh38.75* gene annotation (4). Data was further processed in R (v. 3.1.2), using Bioconductor packages. The 13,279 protein coding genes with at least 1 count per million in at least one sample were normalized with scaling factors computed by the TMM method (Bioconductor package *edgeR*, (5)) and subsequently transformed to log₂-counts per million by voom, a method implemented in the R Bioconductor package *limma* (6). Differences in gene expression levels between KO and WT animals at ZT4 and ZT16 were combined into one F-test using the *limma* package (7). Statistically significant genes (False Discovery Rate < 5%) were classified for being affected at ZT4, ZT16 or at both time points using the nestedF method from *limma*. Gene Ontology (GO) analysis was performed using GOrilla using all protein coding genes from *Mus musculus GRCh38.75* as background list (8). Significant enriched biological processes GO terms were identified after Bonferroni correction (P value < 3.68e-06). GO terms that were not at least 4 levels above the root node were discarded (generic terms). Enriched GO terms

representation was generated using REVIGO (9). The complete data set is publicly available at GEO through the accession number GSE76838.

NOS activity Mouse kidneys were homogenized in 10 volumes (w/v) of solution containing 250 mM sucrose, 1 mM EDTA and protease inhibitors cocktail (Roche), pH 7.7. The homogenate was centrifuged at 14000 rpm, +4°C, 20 min. The supernatant was collected and 5 ml were incubated in 50 ml of reaction mixture containing 2 mM CaCl₂, 1 mM NADPH, 25 μM FAD, 1.25 μg/ml calmodulin, 10 μM BH₄, and 0.5 μl of [¹⁴C]-L-Arginine (100 μCi/ml), 20 mM HEPES, pH 7.2, 1h at 37°C (10). The reaction was stopped by adding of 200 μl acetone. The samples were incubated overnight at -20°C for protein precipitation. The proteins were removed by centrifugation at 14000 rpm, +4°C for 20 min. The supernatants were collected and dried in vacuum. The dried samples were dissolved in 25 μl methanol:water (2:1, v/v) (11). 5 μl of dissolved samples were applied to silica gel TLC plates (Sigma) along with *L*-citrulline and *L*-arginine standards, and TLC was performed in C₂H₅OH : 25% NH₄OH (2:3, v/v). The standards spots were visualized after treatment the silica gel with 0.25% ninhydrin prepared in acetone, the plate areas corresponding to *L*-citrulline were processed for the determination of radioactivity. NOS-specific *L*-citrulline formation was determined as the difference between samples containing 2 mM *L*-NAME and samples without *L*-NAME.

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Supplemental Table 1. Analysis of variance of plasma parameters in Control and cKO mice.

osmolality

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	37.5	37.5	1.2879	0.26985
Time	1	24	24	0.8243	0.37474
Genotype*Time	1	121.5	121.5	4.1729	0.05448

Na+

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.094	0.094	0.0148	0.9044
Time	1	250.26	250.26	39.4758	3.91E-06 ***
Genotype*Time	1	2.344	2.344	0.3697	0.55

K+

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.0938	0.09375	0.4817	0.495639
Time	1	1.815	1.815	9.3256	0.006267 **
Genotype*Time	1	0.0038	0.00375	0.0193	0.89099

Ca2+

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.000067	0.000067	0.0197	0.8898
Time	1	0.160067	0.160067	47.2638	1.12E-06 ***
Genotype*Time	1	0.001667	0.001667	0.4921	0.4911

Mg2+

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.026667	0.026667	4.4593	0.04749 *
Time	1	0.0096	0.0096	1.6054	0.2197
Genotype*Time	1	0.011267	0.011267	1.8841	0.18507

creatinine

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	248.909	248.909	3.30E+01	1.92E-05 ***
Time	1	57.614	57.614	7.63E+00	0.01283 *
Genotype*Time	1	3.941	3.941	0.522	0.47928

glucose

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.37	0.375	0.0165	0.8991
Time	1	1.4	1.4017	0.0617	0.8064
Genotype*Time	1	4.34	4.335	0.1908	0.6669

PO4

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	0.1176	0.1176	1.1822	0.2898
Time	1	0.16007	0.160067	1.6091	0.2192
Genotype*Time	1	0.0294	0.0294	0.2956	0.5927

urea

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	28.602	28.6017	15.1412	0.000907 ***
Time	1	14.415	14.415	7.631	0.012013 *
Genotype*Time	1	0.002	0.0017	0.0009	0.976598

aldosterone

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	40615	40615	2.3703	0.13934
Time	1	250656	250656	14.6282	0.00106 **
Genotype*Time	1	1166	1166	0.0681	0.79685

2-way ANOVA was performed with genotype (Control, *cKO*), time (ZT4 and ZT16) and interaction between time and genotype as factors.

P values are indicated in figure legends. A P value less than 0.05 was considered significant.

Supplemental Table 2. Diastolic (A) and Systolic (B) BP in Control and cKO mice n analysis of

variance **A. Diastolic Blood Pressure light phase vs. dark phase**

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	52.62	52.62	2.8803	0.1281067
Time	1	806.77	806.77	44.1576	0.0001616
Animal	8	1229.82	153.73	8.4141	0.0034175
Genotype*Time	1	23.93	23.93	1.3096	0.2855575
Residuals	8	146.16	18.27		

B. Systolic Blood Pressure light phase vs. dark phase

Factor	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	1	336	336	29.8249	6.01E-04
Time	1	1105.71	1105.71	98.1493	9.10E-06
Animal	8	242.27	30.28	2.6881	0.0917283
Genotype*Time	1	13.68	13.68	1.2144	0.3025017
Residuals	8	90.12	11.27		

ANOVA were performed with genotype (Control, cKO), time (light phase vs. dark phase), mouse (for mouse to mouse variability) and interaction between time and genotype as factors.

Supplemental Table 3: Quantity of RNA-seq reads generated and aligned against Mus musculus GRCh38 genome

RNA sample	CtrlZT16_1	CtrlZT16_3	CtrlZT16_5	CtrlZT4_1	CtrlZT4_3	CtrlZT4_5
NB PF READS [Million]	46.34	54.59	52.18	47.24	38.43	43.53
READS ALIGNED [Million]	44.21	52.77	50.38	45.39	37.02	42.15
NB READS UNIQUELY MAPPED INSIDE GENES [Million]	31.81	38.04	35.36	33.4	27.14	31.3
	cKOZT16_2	cKOZT16_4	cKOZT16_6	cKOZT4_2	cKOZT4_4	cKOZT4_6
NB PF READS [Million]	53.48	47.84	35.97	45.6	51.8	35.39
READS ALIGNED [Million]	51.36	46.03	34.52	44.04	49.63	33.92
NB READS UNIQUELY MAPPED INSIDE GENES [Million]	35.64	34.34	25.9	33.36	37.65	25.63

Supplemental Table 4. Genes differentially expressed in kidneys of cKO mice.

GeneID	Symbol	logFC ZT4	logFC ZT16	AveExp	AveExp	AveExp	AveExp	F	P.Value	adj.P.Val	Post-hoc
				Ctrl ZT4	cKO ZT4	Ctrl ZT16	cKO ZT16				classification
ENSMUSG00000074254	Cyp2a4	-2.30	-2.31	15.37	13.07	15.98	13.67	308.89	3.15E-10	1.91E-06	ZT16, ZT4
ENSMUSG00000033860	Fgg	3.07	3.25	9.99	13.06	10.15	13.39	277.92	5.51E-10	1.91E-06	ZT16, ZT4
ENSMUSG00000026077	Npas2	2.22	3.49	9.41	11.63	7.70	11.19	271.08	6.28E-10	1.91E-06	ZT16, ZT4
ENSMUSG00000023913	Pla2g7	1.36	1.60	10.72	12.08	10.70	12.31	270.40	6.37E-10	1.91E-06	ZT16, ZT4
ENSMUSG00000026205	Slc23a3	1.48	1.53	9.42	10.90	9.55	11.08	264.36	7.17E-10	1.91E-06	ZT16, ZT4
ENSMUSG00000025185	Loxl4	3.00	3.36	8.22	11.22	7.67	11.03	246.21	1.04E-09	1.99E-06	ZT16, ZT4
ENSMUSG00000028150	Rorc	2.19	0.59	11.60	13.80	13.14	13.73	244.47	1.08E-09	1.99E-06	ZT16, ZT4
ENSMUSG00000035910	Dcdc2a	1.36	1.77	10.15	11.51	9.35	11.12	239.79	1.20E-09	1.99E-06	ZT16, ZT4
ENSMUSG00000031373	Car5b	0.99	1.44	12.66	13.66	12.30	13.75	231.12	1.46E-09	2.15E-06	ZT16, ZT4
ENSMUSG00000043719	Col6a6	2.65	3.40	7.42	10.07	6.32	9.71	216.66	2.04E-09	2.71E-06	ZT16, ZT4
ENSMUSG00000020038	Cry1	2.81	0.76	8.00	10.82	10.19	10.95	207.77	2.54E-09	3.07E-06	ZT16, ZT4
ENSMUSG00000046352	Gjb2	-1.51	-1.06	12.83	11.32	12.27	11.20	199.86	3.12E-09	3.45E-06	ZT16, ZT4
ENSMUSG00000021125	Arg2	2.35	2.34	8.40	10.74	9.23	11.57	192.47	3.80E-09	3.64E-06	ZT16, ZT4
ENSMUSG00000058756	Thra	1.15	1.45	11.20	12.35	10.62	12.07	192.14	3.83E-09	3.64E-06	ZT16, ZT4
ENSMUSG00000030762	Aqp8	2.86	3.74	7.45	10.30	5.92	9.66	179.51	5.47E-09	4.84E-06	ZT16, ZT4
ENSMUSG00000028327	1300002K09Rik	0.32	1.58	11.15	11.47	10.06	11.64	172.92	6.65E-09	5.52E-06	ZT16, ZT4
ENSMUSG00000021775	Nr1d2	-1.99	-1.98	12.85	10.86	12.85	10.86	163.70	8.84E-09	6.91E-06	ZT16, ZT4
ENSMUSG00000057074	Ces1g	-2.62	-1.89	12.01	9.39	12.08	10.18	160.62	9.76E-09	7.20E-06	ZT16, ZT4
ENSMUSG00000030244	Gys2	-0.92	-1.24	11.05	10.13	10.96	9.72	150.98	1.35E-08	9.41E-06	ZT16, ZT4
ENSMUSG00000055745	Ldoc1l	1.14	1.64	9.16	10.31	8.43	10.07	144.96	1.66E-08	1.10E-05	ZT16, ZT4
ENSMUSG00000032374	Plod2	0.91	1.19	11.84	12.75	11.64	12.83	140.74	1.94E-08	1.23E-05	ZT16, ZT4
ENSMUSG00000027510	Rbm38	1.57	1.52	8.14	9.71	7.84	9.36	131.82	2.72E-08	1.64E-05	ZT16, ZT4
ENSMUSG00000015890	Amdhd1	1.47	1.66	7.05	8.52	6.33	7.99	127.43	3.24E-08	1.87E-05	ZT16, ZT4
ENSMUSG00000059406	Tmprss9	1.88	2.02	7.72	9.60	7.09	9.11	125.78	3.47E-08	1.92E-05	ZT16, ZT4
ENSMUSG00000048216	Gpr85	1.92	1.93	6.45	8.37	5.91	7.84	124.55	3.65E-08	1.94E-05	ZT16, ZT4
ENSMUSG00000069324	Gm5096	2.65	2.92	5.67	8.32	5.30	8.23	122.57	3.96E-08	1.98E-05	ZT16, ZT4
ENSMUSG00000062905	Vmn1r32	5.09	5.12	2.40	7.50	2.18	7.29	121.48	4.15E-08	1.98E-05	ZT16, ZT4
ENSMUSG00000017677	Wsb1	0.93	0.95	12.35	13.28	12.42	13.36	121.28	4.18E-08	1.98E-05	ZT16, ZT4

ENSMUSG00000058624	Gda	-1.58	-1.96	9.06	7.49	9.65	7.69	118.26	4.76E-08	2.18E-05	ZT16, ZT4
ENSMUSG00000056973	Ces1d	-2.30	-2.58	14.45	12.14	15.40	12.82	113.76	5.81E-08	2.57E-05	ZT16, ZT4
ENSMUSG00000051435	Fhad1	4.53	3.29	3.62	8.14	4.29	7.58	112.45	6.17E-08	2.64E-05	ZT16, ZT4
ENSMUSG00000032607	Amt	0.61	1.03	11.66	12.27	11.23	12.26	111.36	6.48E-08	2.69E-05	ZT16, ZT4
ENSMUSG00000074768	Bhmt	2.29	2.78	7.65	9.94	6.94	9.72	108.41	7.44E-08	2.99E-05	ZT16, ZT4
ENSMUSG00000040128	Pnrc1	1.41	1.00	10.60	12.00	10.75	11.75	102.46	9.93E-08	3.82E-05	ZT16, ZT4
ENSMUSG00000022877	Hrg	-2.38	-2.18	9.05	6.67	8.86	6.68	102.18	1.01E-07	3.82E-05	ZT16, ZT4
ENSMUSG00000036452	Arhgap26	0.81	1.33	11.26	12.07	10.78	12.10	100.90	1.07E-07	3.96E-05	ZT16, ZT4
ENSMUSG00000078532	Nkain1	-2.03	-2.27	8.39	6.36	9.54	7.27	99.92	1.13E-07	4.02E-05	ZT16, ZT4
ENSMUSG00000039710	Slc7a12	2.58	2.39	9.57	12.15	10.22	12.62	99.53	1.15E-07	4.02E-05	ZT16, ZT4
ENSMUSG00000018427	Ypel2	1.35	1.22	10.56	11.91	10.62	11.84	98.79	1.20E-07	4.07E-05	ZT16, ZT4
ENSMUSG00000091898	Tnnc1	-1.02	-1.90	6.61	5.59	8.60	6.70	98.08	1.24E-07	4.12E-05	ZT16, ZT4
ENSMUSG00000078706	Gm53	1.62	1.38	9.34	10.96	9.33	10.72	96.98	1.32E-07	4.26E-05	ZT16, ZT4
ENSMUSG00000089678	Agxt2	0.92	0.96	13.23	14.15	13.11	14.06	94.58	1.49E-07	4.72E-05	ZT16, ZT4
ENSMUSG00000029650	Slc46a3	-1.01	-1.16	11.40	10.38	11.63	10.47	92.15	1.70E-07	5.27E-05	ZT16, ZT4
ENSMUSG00000020182	Ddc	0.45	1.43	13.18	13.64	12.39	13.82	91.13	1.80E-07	5.35E-05	ZT16, ZT4
ENSMUSG00000023067	Cdkn1a	1.50	1.56	8.73	10.23	8.61	10.17	90.75	1.84E-07	5.35E-05	ZT16, ZT4
ENSMUSG00000022512	Cldn1	0.94	1.14	10.93	11.87	10.17	11.31	90.66	1.85E-07	5.35E-05	ZT16, ZT4
ENSMUSG00000018900	Slc22a5	-0.86	-1.01	13.90	13.05	14.25	13.24	89.08	2.03E-07	5.72E-05	ZT16, ZT4
ENSMUSG00000051262	Cml3	-1.62	-2.24	7.76	6.14	8.70	6.46	87.73	2.19E-07	5.98E-05	ZT16, ZT4
ENSMUSG00000024575	Pde6a	-1.24	-1.28	10.59	9.35	10.24	8.96	87.58	2.21E-07	5.98E-05	ZT16, ZT4
ENSMUSG00000020889	Nr1d1	-1.90	-0.96	12.04	10.14	9.35	8.39	86.25	2.38E-07	6.33E-05	ZT16, ZT4
ENSMUSG00000028001	Fga	2.10	2.33	11.20	13.30	10.93	13.26	85.23	2.53E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000005547	Cyp2a5	-2.89	-3.30	12.55	9.66	14.40	11.10	84.93	2.58E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000032602	Slc25a20	-0.74	-0.90	11.88	11.14	12.25	11.36	84.61	2.63E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000006542	Prkag3	-1.56	-2.36	8.07	6.51	8.97	6.61	84.40	2.66E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000027870	Hao2	1.73	2.23	14.77	16.50	14.69	16.91	83.93	2.74E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000027347	Rasgrp1	1.03	0.58	8.99	10.01	8.90	9.48	83.85	2.75E-07	6.52E-05	ZT16, ZT4
ENSMUSG00000028989	Angptl7	-2.01	-2.46	9.37	7.35	10.26	7.80	81.98	3.08E-07	7.18E-05	ZT16, ZT4
ENSMUSG00000006575	Rundc3a	-1.35	-1.47	7.97	6.62	8.56	7.09	80.68	3.34E-07	7.65E-05	ZT16, ZT4
ENSMUSG00000028528	Dnajc6	-0.75	-0.61	11.82	11.07	11.88	11.27	80.01	3.48E-07	7.82E-05	ZT16, ZT4
ENSMUSG00000033107	Rnf125	1.91	1.66	6.12	8.03	5.90	7.56	79.79	3.53E-07	7.82E-05	ZT16, ZT4
ENSMUSG00000015357	Clpx	0.58	0.82	13.80	14.38	13.40	14.22	79.38	3.63E-07	7.89E-05	ZT16, ZT4
ENSMUSG00000032902	Slc16a1	0.95	1.15	12.31	13.25	12.15	13.30	77.35	4.13E-07	8.85E-05	ZT16, ZT4

ENSMUSG00000041301	Cftr	0.72	1.12	9.57	10.29	9.62	10.74	76.16	4.47E-07	9.42E-05	ZT16, ZT4
ENSMUSG00000031326	Cdx4	2.44	3.21	4.48	6.92	3.58	6.79	75.77	4.58E-07	9.51E-05	ZT16, ZT4
ENSMUSG00000031938	4931406C07Rik	-0.72	-0.83	15.95	15.22	15.84	15.01	74.98	4.83E-07	9.63E-05	ZT16, ZT4
ENSMUSG00000028607	Cpt2	-0.57	-0.56	13.57	13.00	13.83	13.27	74.98	4.83E-07	9.63E-05	ZT16, ZT4
ENSMUSG00000044505	Lingo4	3.14	0.88	4.75	7.88	6.53	7.41	74.82	4.88E-07	9.63E-05	ZT16, ZT4
ENSMUSG00000028976	Slc2a5	-0.83	-0.89	12.71	11.88	12.65	11.77	74.67	4.93E-07	9.63E-05	ZT16, ZT4
ENSMUSG00000029188	Slc34a2	1.70	1.45	8.00	9.70	7.45	8.89	71.50	6.13E-07	0.000118	ZT16, ZT4
ENSMUSG00000046324	Ermp1	0.65	0.95	12.42	13.07	11.95	12.90	71.27	6.23E-07	0.000118	ZT16, ZT4
ENSMUSG00000002250	Ppard	1.97	2.74	10.79	12.76	9.94	12.68	70.64	6.51E-07	0.000122	ZT16, ZT4
ENSMUSG00000039982	Dtx4	0.85	1.32	10.75	11.60	9.90	11.22	69.85	6.89E-07	0.000127	ZT16, ZT4
ENSMUSG00000024292	Cyp4f14	-1.22	-1.42	7.62	6.40	7.53	6.12	69.35	7.14E-07	0.00013	ZT16, ZT4
ENSMUSG00000035504	Reep6	-1.07	-0.99	11.19	10.12	11.39	10.40	68.72	7.47E-07	0.000134	ZT16, ZT4
ENSMUSG00000031770	Herpud1	-0.51	-0.74	14.08	13.57	15.06	14.31	67.78	8.00E-07	0.000142	ZT16, ZT4
ENSMUSG00000039193	Nlrc4	-1.08	-0.99	8.67	7.59	8.84	7.85	67.38	8.25E-07	0.000143	ZT16, ZT4
ENSMUSG00000025221	Kcnp2	1.57	1.87	6.70	8.27	6.51	8.38	67.29	8.30E-07	0.000143	ZT16, ZT4
ENSMUSG00000079494	Cml5	-2.12	-2.57	10.58	8.46	12.66	10.10	65.43	9.54E-07	0.000162	ZT16, ZT4
ENSMUSG00000033831	Fgb	1.86	2.35	7.90	9.75	8.05	10.40	64.26	1.04E-06	0.000175	ZT16, ZT4
ENSMUSG00000046818	Ddit4l	1.18	1.01	9.73	10.92	9.64	10.65	63.69	1.09E-06	0.000181	ZT16, ZT4
ENSMUSG00000056666	Retsat	-0.96	-1.02	14.39	13.43	14.79	13.77	63.46	1.11E-06	0.000182	ZT16, ZT4
ENSMUSG00000042115	Klhdc8a	0.74	0.71	10.29	11.02	10.17	10.88	62.46	1.20E-06	0.000193	ZT16, ZT4
ENSMUSG00000021263	Degs2	-0.65	-0.73	11.76	11.11	11.66	10.93	62.44	1.20E-06	0.000193	ZT16, ZT4
ENSMUSG00000028527	Ak4	-0.25	-0.75	13.82	13.57	14.80	14.05	62.28	1.22E-06	0.000193	ZT16, ZT4
ENSMUSG00000078597	Cyp4a12b	-2.59	-2.15	10.28	7.69	10.54	8.39	61.94	1.25E-06	0.000196	ZT16, ZT4
ENSMUSG00000039632	Ccdc151	-0.86	-0.55	8.37	7.51	8.33	7.77	61.70	1.28E-06	0.000197	ZT16, ZT4
ENSMUSG00000031382	Asb11	2.17	2.12	7.07	9.24	7.69	9.80	60.71	1.38E-06	0.000211	ZT16, ZT4
ENSMUSG00000028957	Per3	-1.16	-1.03	10.44	9.28	11.19	10.16	60.14	1.45E-06	0.000219	ZT16, ZT4
ENSMUSG00000066071	Cyp4a12a	-2.89	-2.33	13.14	10.25	13.34	11.02	59.24	1.56E-06	0.000232	ZT16, ZT4
ENSMUSG00000042102	Dmgdh	0.74	0.72	12.76	13.50	12.72	13.44	59.12	1.58E-06	0.000232	ZT16, ZT4
ENSMUSG00000063796	Slc22a8	-0.93	-0.81	15.37	14.44	15.37	14.56	59.01	1.59E-06	0.000232	ZT16, ZT4
ENSMUSG00000025479	Cyp2e1	-0.87	-0.90	16.69	15.82	17.13	16.23	58.61	1.64E-06	0.000237	ZT16, ZT4
ENSMUSG00000079037	Prnp	-0.45	-0.95	13.21	12.76	13.82	12.87	58.13	1.71E-06	0.000243	ZT16, ZT4
ENSMUSG00000041073	Nacad	1.25	1.35	6.27	7.52	5.49	6.84	58.02	1.73E-06	0.000243	ZT16, ZT4
ENSMUSG00000029368	Alb	-2.94	-2.71	9.28	6.33	9.79	7.07	57.93	1.74E-06	0.000243	ZT16, ZT4
ENSMUSG00000025347	Mettl7b	-0.74	-0.72	13.77	13.03	14.17	13.45	57.67	1.78E-06	0.000246	ZT16, ZT4

ENSMUSG00000022900	Ildr1	0.59	0.87	10.62	11.22	10.67	11.54	57.35	1.83E-06	0.000246	ZT16, ZT4
ENSMUSG00000037697	Ddhd1	0.74	0.86	10.12	10.86	10.07	10.93	57.31	1.84E-06	0.000246	ZT16, ZT4
ENSMUSG00000026003	Acadl	-0.65	-0.67	14.24	13.60	14.30	13.63	57.31	1.84E-06	0.000246	ZT16, ZT4
ENSMUSG00000031845	Bcmo1	-1.02	-1.17	8.67	7.65	8.24	7.07	56.97	1.89E-06	0.000251	ZT16, ZT4
ENSMUSG00000062184	Hs6st2	-1.07	-0.94	9.24	8.16	8.97	8.03	55.96	2.07E-06	0.000272	ZT16, ZT4
ENSMUSG00000020123	Avpr1a	0.73	0.98	9.81	10.54	9.22	10.20	55.83	2.09E-06	0.000272	ZT16, ZT4
ENSMUSG00000024736	Tmem132a	0.75	1.23	9.31	10.06	9.00	10.23	55.45	2.16E-06	0.000279	ZT16, ZT4
ENSMUSG00000047986	Palm3	0.83	1.31	10.23	11.06	9.43	10.74	55.23	2.20E-06	0.000281	ZT16, ZT4
ENSMUSG00000033610	Pank1	-0.73	-0.77	14.64	13.92	14.88	14.11	54.43	2.36E-06	0.000299	ZT16, ZT4
ENSMUSG00000074639	BC089597	1.20	1.19	11.97	13.17	12.20	13.39	53.92	2.48E-06	0.00031	ZT16, ZT4
ENSMUSG00000041731	Pgm5	0.92	0.85	8.10	9.02	7.92	8.77	53.61	2.55E-06	0.000316	ZT16, ZT4
ENSMUSG00000041078	Grid1	1.80	2.50	6.24	8.04	4.75	7.25	53.53	2.57E-06	0.000316	ZT16, ZT4
ENSMUSG00000021118	Plek2	-0.65	-0.94	7.88	7.24	8.40	7.46	52.64	2.78E-06	0.000337	ZT16, ZT4
ENSMUSG00000022766	Serpind1	1.78	2.53	5.26	7.04	3.98	6.51	52.62	2.79E-06	0.000337	ZT16, ZT4
ENSMUSG00000048387	Osr1	1.03	1.12	6.15	7.18	5.84	6.96	52.32	2.87E-06	0.000343	ZT16, ZT4
ENSMUSG00000071177	Serpina1d	-2.13	-1.82	11.97	9.84	12.12	10.30	51.87	2.99E-06	0.000355	ZT16, ZT4
ENSMUSG00000063446	E130309F12Rik	1.50	1.75	5.36	6.85	4.37	6.12	51.73	3.03E-06	0.000356	ZT16, ZT4
ENSMUSG00000020674	Pxdn	0.40	0.71	11.23	11.63	10.46	11.17	50.54	3.39E-06	0.000394	ZT16, ZT4
ENSMUSG00000059824	Dbp	-1.58	-1.48	10.96	9.38	10.59	9.11	50.50	3.41E-06	0.000394	ZT16, ZT4
ENSMUSG00000037348	Paqr7	-0.45	-0.62	12.81	12.35	13.27	12.65	50.04	3.57E-06	0.000408	ZT16, ZT4
ENSMUSG00000004383	Large	0.59	0.53	9.01	9.60	8.58	9.11	49.75	3.66E-06	0.000416	ZT16, ZT4
ENSMUSG00000020875	Hoxb9	0.74	0.56	10.50	11.24	10.67	11.23	48.96	3.96E-06	0.000443	ZT16, ZT4
ENSMUSG00000004880	Lbr	-0.48	-0.72	11.65	11.18	11.74	11.02	48.93	3.97E-06	0.000443	ZT16, ZT4
ENSMUSG00000068876	Cgn	0.58	0.82	10.31	10.89	9.95	10.77	48.57	4.12E-06	0.000455	ZT16, ZT4
ENSMUSG00000025041	Nt5c2	-0.56	-0.34	12.42	11.85	12.40	12.06	48.51	4.14E-06	0.000455	ZT16, ZT4
ENSMUSG00000053819	Camk2d	0.51	0.53	10.77	11.28	10.48	11.01	48.00	4.36E-06	0.000472	ZT16, ZT4
ENSMUSG00000079495	Gm11128	-1.27	-1.68	11.48	10.21	13.22	11.54	47.97	4.37E-06	0.000472	ZT16, ZT4
ENSMUSG00000024644	Cndp2	-1.19	-0.99	17.02	15.84	17.28	16.30	47.57	4.56E-06	0.000488	ZT16, ZT4
ENSMUSG00000053303	Slc22a26	-1.83	-1.42	11.00	9.16	11.33	9.91	47.32	4.67E-06	0.000496	ZT16, ZT4
ENSMUSG00000024165	Hn1l	0.52	0.85	11.70	12.22	11.29	12.14	47.22	4.72E-06	0.000498	ZT16, ZT4
ENSMUSG00000029772	Ahcy12	0.23	0.68	14.78	15.01	14.39	15.07	46.66	5.00E-06	0.000523	ZT16
ENSMUSG00000027359	Slc27a2	-0.41	-0.59	18.04	17.63	18.28	17.69	46.46	5.11E-06	0.000526	ZT16, ZT4
ENSMUSG00000090622	A930033H14Rik	-0.82	-2.06	6.18	5.36	7.81	5.75	46.44	5.11E-06	0.000526	ZT16, ZT4
ENSMUSG00000027227	Sord	-0.47	-0.68	16.57	16.10	16.86	16.18	46.27	5.20E-06	0.000532	ZT16, ZT4

ENSMUSG00000023262	Acy1	-0.54	-0.77	12.78	12.24	13.31	12.53	45.62	5.57E-06	0.000562	ZT16, ZT4
ENSMUSG00000055653	Gpc3	1.02	0.91	11.03	12.05	11.24	12.15	45.60	5.58E-06	0.000562	ZT16, ZT4
ENSMUSG00000005413	Hmox1	-0.83	-0.72	11.54	10.71	11.82	11.10	45.06	5.91E-06	0.00059	ZT16, ZT4
ENSMUSG00000058997	Vwa8	-0.66	-0.52	14.42	13.76	14.42	13.90	44.60	6.21E-06	0.000615	ZT16, ZT4
ENSMUSG00000033634	Cml2	-1.27	-1.37	12.62	11.35	13.22	11.85	43.91	6.69E-06	0.000658	ZT16, ZT4
ENSMUSG00000057103	Cml1	-0.78	-1.07	14.24	13.46	14.81	13.74	43.72	6.83E-06	0.000667	ZT16, ZT4
ENSMUSG00000034450	Gulo	2.21	1.13	5.08	7.29	6.51	7.64	43.44	7.05E-06	0.000683	ZT16, ZT4
ENSMUSG00000058589	Anks1b	-2.27	-3.40	6.89	4.61	7.25	3.85	43.35	7.12E-06	0.000685	ZT16, ZT4
ENSMUSG00000028713	Cyp4b1	-0.70	-0.64	17.87	17.17	17.70	17.06	43.11	7.31E-06	0.000699	ZT16, ZT4
ENSMUSG00000035699	Slc51a	-1.24	-1.64	12.84	11.60	13.62	11.97	42.91	7.48E-06	0.000708	ZT16, ZT4
ENSMUSG00000030545	Pex11a	-0.38	-0.48	11.99	11.61	12.34	11.86	42.86	7.51E-06	0.000708	ZT16, ZT4
ENSMUSG00000031958	Ldhd	-0.92	-0.60	16.58	15.65	16.58	15.98	42.58	7.75E-06	0.000725	ZT16, ZT4
ENSMUSG00000027187	Cat	-0.49	-0.46	16.16	15.67	16.26	15.80	42.14	8.15E-06	0.000757	ZT16, ZT4
ENSMUSG00000052698	Tln2	-0.51	-0.66	13.86	13.35	13.59	12.93	41.92	8.36E-06	0.000767	ZT16, ZT4
ENSMUSG00000002578	Ikzf4	1.71	1.82	6.85	8.55	5.80	7.61	41.85	8.42E-06	0.000767	ZT16, ZT4
ENSMUSG00000032913	Lrig2	0.75	0.47	10.62	11.37	10.40	10.86	41.82	8.46E-06	0.000767	ZT16, ZT4
ENSMUSG00000031327	Chic1	0.43	0.74	10.49	10.92	10.24	10.98	41.78	8.49E-06	0.000767	ZT16, ZT4
ENSMUSG00000043333	Rhbdl2	0.47	1.19	6.28	6.75	5.75	6.95	41.70	8.57E-06	0.000769	ZT16, ZT4
ENSMUSG00000016552	Foxred2	0.81	1.08	9.40	10.21	8.90	9.98	41.04	9.24E-06	0.000821	ZT16, ZT4
ENSMUSG00000053647	Gper1	0.93	0.92	6.60	7.53	6.83	7.75	41.01	9.28E-06	0.000821	ZT16, ZT4
ENSMUSG00000028003	Lrat	0.54	1.52	9.11	9.65	7.22	8.74	40.33	1.00E-05	0.000877	ZT16
ENSMUSG00000020604	Arsg	0.19	0.77	12.43	12.62	11.68	12.44	40.30	1.01E-05	0.000877	ZT16
ENSMUSG00000028970	Abcb1b	1.03	1.04	9.29	10.32	9.32	10.36	40.28	1.01E-05	0.000877	ZT16, ZT4
ENSMUSG00000028712	Cyp4a31	-0.74	-0.52	13.69	12.96	13.86	13.34	40.17	1.02E-05	0.000882	ZT16, ZT4
ENSMUSG00000020635	Fkbp1b	1.09	1.59	5.58	6.67	5.41	6.99	39.77	1.07E-05	0.000917	ZT16, ZT4
ENSMUSG00000040998	Npnt	0.91	1.07	13.32	14.23	12.92	13.99	39.73	1.08E-05	0.000917	ZT16, ZT4
ENSMUSG00000026621	Marc1	-1.93	-2.81	4.79	2.86	6.58	3.77	39.53	1.10E-05	0.000931	ZT16, ZT4
ENSMUSG00000005268	Prlr	1.84	1.42	10.64	12.47	11.06	12.48	39.50	1.11E-05	0.000931	ZT16, ZT4
ENSMUSG00000039270	Megf9	0.68	0.74	10.48	11.16	10.38	11.12	39.45	1.11E-05	0.000931	ZT16, ZT4
ENSMUSG00000072949	Acot1	-0.80	-0.64	11.31	10.51	11.33	10.69	39.33	1.13E-05	0.000939	ZT16, ZT4
ENSMUSG00000002204	Napsa	-0.64	-0.62	16.79	16.15	17.01	16.40	38.91	1.19E-05	0.000981	ZT16, ZT4
ENSMUSG00000026417	Pigr	0.92	1.03	12.56	13.48	12.38	13.40	38.78	1.21E-05	0.000991	ZT16, ZT4
ENSMUSG00000066366	Serpina1a	-1.52	-1.56	10.15	8.63	10.21	8.65	38.73	1.22E-05	0.000991	ZT16, ZT4
ENSMUSG00000010651	Acaa1b	-0.63	-1.14	13.37	12.73	13.87	12.73	38.62	1.23E-05	0.000999	ZT16, ZT4

ENSMUSG00000029482	Aacs	-0.64	-0.96	13.08	12.44	13.62	12.66	38.10	1.31E-05	0.001057	ZT16, ZT4
ENSMUSG00000017868	Sgk2	-0.49	-0.38	13.66	13.17	13.78	13.39	38.04	1.32E-05	0.001059	ZT16, ZT4
ENSMUSG00000079550	Mpp4	0.01	-1.43	5.73	5.74	7.38	5.95	37.79	1.37E-05	0.001086	ZT16
ENSMUSG00000089694	Gm4477	-1.63	-2.47	7.50	5.87	8.17	5.69	37.71	1.38E-05	0.00109	ZT16, ZT4
ENSMUSG00000021794	Glud1	0.48	0.45	14.48	14.96	14.53	14.98	37.65	1.39E-05	0.001091	ZT16, ZT4
ENSMUSG00000016179	Camk1g	0.67	0.85	8.06	8.73	7.59	8.44	37.61	1.40E-05	0.001091	ZT16, ZT4
ENSMUSG00000021814	Anxa7	-0.51	-0.51	13.54	13.02	13.69	13.18	37.44	1.43E-05	0.001108	ZT16, ZT4
ENSMUSG00000048960	Prex2	-0.44	-0.67	10.78	10.34	11.33	10.66	37.12	1.49E-05	0.001147	ZT16, ZT4
ENSMUSG00000045094	Arhgef37	1.16	1.18	6.99	8.15	6.68	7.86	37.01	1.51E-05	0.001156	ZT16, ZT4
ENSMUSG00000026170	Cyp27a1	-0.47	-0.52	11.96	11.49	12.33	11.80	36.70	1.57E-05	0.001195	ZT16, ZT4
ENSMUSG00000074794	Arrdc3	1.06	0.89	13.09	14.16	13.00	13.89	36.44	1.62E-05	0.001229	ZT16, ZT4
ENSMUSG00000013415	Igf2bp1	-1.34	-0.71	8.74	7.40	8.07	7.36	36.32	1.64E-05	0.001235	ZT16, ZT4
ENSMUSG000000051483	Cbr1	0.72	0.80	11.25	11.97	11.43	12.23	36.32	1.65E-05	0.001235	ZT16, ZT4
ENSMUSG00000031980	Agt	0.51	0.80	12.33	12.84	12.35	13.15	36.27	1.66E-05	0.001235	ZT16, ZT4
ENSMUSG00000060177	Klk1b22	-2.24	-1.68	5.98	3.75	6.33	4.65	36.12	1.69E-05	0.001252	ZT16, ZT4
ENSMUSG00000025934	Gsta3	-1.31	-1.49	13.14	11.83	13.92	12.42	36.05	1.70E-05	0.001252	ZT16, ZT4
ENSMUSG00000030771	Micalcl	0.77	1.54	7.24	8.01	6.49	8.04	36.04	1.71E-05	0.001252	ZT16, ZT4
ENSMUSG00000038526	Car14	-0.44	-0.67	12.77	12.33	12.90	12.23	35.95	1.73E-05	0.00126	ZT16, ZT4
ENSMUSG00000038567	Cyp24a1	-0.80	-1.69	13.57	12.77	12.37	10.68	35.82	1.75E-05	0.001273	ZT16, ZT4
ENSMUSG00000025178	Pi4k2a	0.34	0.56	12.14	12.48	11.95	12.50	35.56	1.82E-05	0.00131	ZT16, ZT4
ENSMUSG00000037465	Klf10	-0.54	-1.01	10.22	9.68	10.82	9.81	35.52	1.83E-05	0.00131	ZT16, ZT4
ENSMUSG00000016528	Mapkapk2	0.50	0.54	12.28	12.77	12.14	12.68	35.22	1.90E-05	0.001349	ZT16, ZT4
ENSMUSG00000061808	Ttr	0.97	0.97	12.47	13.44	12.19	13.16	35.22	1.90E-05	0.001349	ZT16, ZT4
ENSMUSG00000019944	Rhobtb1	1.31	0.66	11.18	12.50	11.32	11.98	35.07	1.94E-05	0.001369	ZT16, ZT4
ENSMUSG00000027239	Mdk	-0.74	-0.54	11.09	10.35	11.01	10.48	35.01	1.95E-05	0.001373	ZT16, ZT4
ENSMUSG00000025871	4833439L19Rik	-0.34	-0.47	15.87	15.53	16.13	15.66	34.79	2.01E-05	0.001406	ZT16, ZT4
ENSMUSG00000044092	C130050O18Rik	0.45	0.98	6.67	7.12	6.34	7.33	34.75	2.02E-05	0.001406	ZT16, ZT4
ENSMUSG00000068742	Cry2	1.04	0.35	10.19	11.23	10.61	10.96	34.53	2.08E-05	0.001441	ZT4
ENSMUSG00000017146	Brca1	0.27	0.92	6.82	7.09	5.97	6.89	34.21	2.17E-05	0.001496	ZT16
ENSMUSG00000024900	Cpt1a	-0.44	-0.50	15.23	14.79	15.03	14.53	34.06	2.22E-05	0.001519	ZT16, ZT4
ENSMUSG00000070348	Ccnd1	-0.83	-0.54	13.54	12.71	13.19	12.65	33.91	2.27E-05	0.001543	ZT16, ZT4
ENSMUSG00000031750	Ii34	-0.93	-0.54	10.81	9.88	10.61	10.06	33.47	2.41E-05	0.001628	ZT16, ZT4
ENSMUSG00000026669	Mcm10	-1.01	-1.21	8.46	7.46	8.95	7.74	33.45	2.41E-05	0.001628	ZT16, ZT4
ENSMUSG00000042251	Pm20d1	-0.59	-0.52	13.06	12.46	13.04	12.52	33.37	2.44E-05	0.001639	ZT16, ZT4

ENSMUSG00000040600	Eps8l3	-1.59	-1.19	7.58	5.99	6.66	5.47	33.28	2.47E-05	0.001651	ZT16, ZT4
ENSMUSG00000021879	Dnah12	0.75	0.89	6.50	7.25	5.68	6.57	33.16	2.51E-05	0.001669	ZT16, ZT4
ENSMUSG00000074919	Gm10787	-2.26	-2.63	6.41	4.15	8.96	6.33	33.07	2.55E-05	0.001683	ZT16, ZT4
ENSMUSG00000037411	Serpine1	-1.26	-1.69	7.71	6.45	9.22	7.53	32.71	2.68E-05	0.00176	ZT16, ZT4
ENSMUSG00000049690	Nckap5	0.89	1.52	8.96	9.85	7.90	9.41	32.64	2.71E-05	0.00177	ZT16, ZT4
ENSMUSG00000020303	Stc2	1.18	0.99	7.38	8.56	6.99	7.98	32.58	2.73E-05	0.001775	ZT16, ZT4
ENSMUSG00000071226	Cecr2	0.58	0.65	9.51	10.09	8.93	9.58	32.54	2.74E-05	0.001777	ZT16, ZT4
ENSMUSG00000031271	Serpina7	1.65	2.22	3.90	5.55	4.34	6.57	32.13	2.91E-05	0.001876	ZT16, ZT4
ENSMUSG00000030800	Prss8	-0.59	-0.48	14.66	14.08	14.82	14.34	32.09	2.93E-05	0.001877	ZT16, ZT4
ENSMUSG00000028494	Plin2	-0.65	-0.58	12.74	12.08	13.12	12.54	31.99	2.97E-05	0.001894	ZT16, ZT4
ENSMUSG00000026473	Glul	-0.24	-0.72	15.07	14.83	15.83	15.12	31.83	3.04E-05	0.001926	ZT16
ENSMUSG00000031488	Rab11fip1	0.51	0.37	10.12	10.63	9.78	10.15	31.81	3.05E-05	0.001926	ZT16, ZT4
ENSMUSG00000043008	Klhl6	-0.45	-0.90	8.96	8.51	9.67	8.77	31.78	3.06E-05	0.001926	ZT16, ZT4
ENSMUSG00000037370	Enpp1	-0.40	-0.50	11.56	11.17	11.48	10.98	31.53	3.17E-05	0.001985	ZT16, ZT4
ENSMUSG00000021702	Thbs4	-1.35	-3.06	4.06	2.71	6.45	3.39	31.47	3.20E-05	0.001995	ZT16, ZT4
ENSMUSG00000049858	Suox	0.41	0.46	12.15	12.57	12.07	12.54	31.27	3.29E-05	0.002043	ZT16, ZT4
ENSMUSG00000010760	Phlda2	-0.63	-0.53	9.65	9.02	9.92	9.40	31.23	3.32E-05	0.002045	ZT16, ZT4
ENSMUSG00000034875	Nudt19	-0.44	-0.97	15.11	14.67	16.29	15.32	31.20	3.33E-05	0.002045	ZT16, ZT4
ENSMUSG00000025196	Cpn1	0.81	0.87	11.41	12.22	11.12	12.00	31.07	3.39E-05	0.002076	ZT16, ZT4
ENSMUSG00000004035	Gstm7	0.90	0.79	8.98	9.88	9.20	9.98	30.99	3.43E-05	0.002092	ZT16, ZT4
ENSMUSG00000026489	Adck3	0.60	0.64	13.42	14.01	12.91	13.55	30.93	3.47E-05	0.002101	ZT16, ZT4
ENSMUSG00000018581	Dnah11	0.69	0.69	7.32	8.02	6.76	7.44	30.52	3.68E-05	0.002219	ZT16, ZT4
ENSMUSG00000033453	Adamts15	0.85	0.81	10.34	11.18	10.08	10.89	30.50	3.69E-05	0.002219	ZT16, ZT4
ENSMUSG00000027249	F2	-1.82	-2.09	6.25	4.43	6.16	4.08	30.39	3.76E-05	0.002247	ZT16, ZT4
ENSMUSG00000066319	Rtp3	-0.72	-0.42	7.58	6.86	7.50	7.09	30.29	3.81E-05	0.002271	ZT16, ZT4
ENSMUSG00000040584	Abcb1a	-0.77	-0.88	8.95	8.17	9.01	8.13	30.23	3.85E-05	0.002281	ZT16, ZT4
ENSMUSG00000066072	Cyp4a10	-1.09	-0.80	13.97	12.87	14.26	13.46	29.92	4.03E-05	0.002378	ZT16, ZT4
ENSMUSG00000079471	Gm7325	1.19	0.52	6.74	7.93	7.64	8.17	29.74	4.15E-05	0.002429	ZT4
ENSMUSG00000038968	Klk1b16	-2.15	-2.23	6.32	4.17	6.80	4.57	29.71	4.16E-05	0.002429	ZT16, ZT4
ENSMUSG00000020019	Ntn4	0.56	0.50	11.43	11.99	11.29	11.79	29.70	4.17E-05	0.002429	ZT16, ZT4
ENSMUSG00000049580	Tsku	-0.89	-1.19	10.36	9.46	10.85	9.65	29.56	4.26E-05	0.002469	ZT16, ZT4
ENSMUSG00000002233	Rhoc	-0.59	-0.24	12.38	11.80	12.37	12.14	29.46	4.32E-05	0.002497	ZT4
ENSMUSG00000075569	Rsph10b	0.90	1.59	5.52	6.42	4.87	6.46	29.37	4.39E-05	0.00252	ZT16, ZT4
ENSMUSG00000004207	Psap	-0.47	-0.28	17.42	16.96	17.34	17.06	29.35	4.40E-05	0.00252	ZT16, ZT4

ENSMUSG00000019906	Lin7a	-0.51	-0.53	8.30	7.79	8.84	8.30	29.28	4.45E-05	0.002534	ZT16, ZT4
ENSMUSG00000027111	Itga6	0.68	0.64	12.69	13.36	12.75	13.39	29.22	4.49E-05	0.002548	ZT16, ZT4
ENSMUSG00000020672	Sntg2	0.62	2.39	6.46	7.08	4.89	7.28	29.15	4.54E-05	0.00256	ZT16
ENSMUSG00000002346	Slc25a42	-0.61	-0.73	12.46	11.85	12.72	11.98	29.14	4.55E-05	0.00256	ZT16, ZT4
ENSMUSG00000095959	Gm10845	-0.14	0.88	7.77	7.63	6.73	7.61	29.11	4.57E-05	0.00256	ZT16
ENSMUSG00000032076	Cadm1	-0.41	-0.47	11.35	10.95	11.24	10.78	29.04	4.61E-05	0.002575	ZT16, ZT4
ENSMUSG00000022562	Oplah	-0.47	-0.66	13.06	12.58	13.34	12.68	28.94	4.69E-05	0.002605	ZT16, ZT4
ENSMUSG00000027774	Gfm1	-0.38	-0.39	13.53	13.14	13.70	13.31	28.84	4.76E-05	0.002636	ZT16, ZT4
ENSMUSG00000038677	Scube3	1.33	1.91	8.07	9.41	6.73	8.64	28.74	4.84E-05	0.002665	ZT16, ZT4
ENSMUSG00000034171	Faah	0.28	0.63	12.11	12.39	11.69	12.32	28.71	4.86E-05	0.002669	ZT16
ENSMUSG00000001155	Ftcd	-0.66	-0.75	10.47	9.81	10.79	10.04	28.55	4.99E-05	0.002724	ZT16, ZT4
ENSMUSG00000034435	Tmem30b	0.68	0.20	10.27	10.96	10.32	10.52	28.27	5.21E-05	0.002833	ZT4
ENSMUSG00000020865	Abcc3	1.06	1.61	7.42	8.48	6.80	8.41	28.26	5.23E-05	0.002833	ZT16, ZT4
ENSMUSG00000037656	Slc20a2	0.30	0.46	12.10	12.41	11.70	12.16	27.86	5.57E-05	0.003005	ZT16, ZT4
ENSMUSG00000025981	Coq10b	-0.75	-0.99	11.46	10.70	12.71	11.72	27.84	5.59E-05	0.003005	ZT16, ZT4
ENSMUSG00000028645	Slc2a1	0.56	0.44	11.34	11.90	11.23	11.67	27.64	5.77E-05	0.003091	ZT16, ZT4
ENSMUSG00000062151	Unc13c	1.02	1.65	6.96	7.97	6.06	7.71	27.54	5.87E-05	0.003119	ZT16, ZT4
ENSMUSG00000026616	Cr2	0.62	0.90	6.98	7.61	6.92	7.83	27.54	5.87E-05	0.003119	ZT16, ZT4
ENSMUSG00000001986	Gria3	0.84	0.89	9.66	10.50	9.35	10.23	27.42	5.98E-05	0.003166	ZT16, ZT4
ENSMUSG00000006345	Ggt1	-0.43	-0.34	16.37	15.95	16.49	16.15	27.21	6.20E-05	0.003266	ZT16, ZT4
ENSMUSG00000029125	Stx18	0.28	0.66	10.71	10.98	10.80	11.45	27.08	6.32E-05	0.00332	ZT16
ENSMUSG00000022389	Tef	-0.38	-0.60	13.90	13.51	14.01	13.42	27.05	6.36E-05	0.003324	ZT16, ZT4
ENSMUSG00000032786	Alas1	-0.58	-0.69	13.60	13.02	15.09	14.41	27.00	6.41E-05	0.003329	ZT16, ZT4
ENSMUSG00000023873	1700010I14Rik	0.57	0.99	6.86	7.42	6.21	7.21	26.97	6.44E-05	0.003329	ZT16, ZT4
ENSMUSG000000051985	Igfn1	1.89	1.97	5.15	7.03	4.51	6.48	26.96	6.46E-05	0.003329	ZT16, ZT4
ENSMUSG00000042041	2010003K11Rik	-1.79	-1.53	7.75	5.97	8.22	6.69	26.94	6.48E-05	0.003329	ZT16, ZT4
ENSMUSG00000042195	Slc35f2	0.35	0.43	9.95	10.30	9.66	10.09	26.93	6.49E-05	0.003329	ZT16, ZT4
ENSMUSG00000074676	Foxs1	-0.09	-0.98	7.37	7.28	7.21	6.23	26.87	6.55E-05	0.003334	ZT16
ENSMUSG00000040405	Havcr1	-1.69	-1.26	7.76	6.07	7.20	5.94	26.87	6.55E-05	0.003334	ZT16, ZT4
ENSMUSG00000038217	Tlcd2	-0.97	-0.72	9.60	8.64	9.84	9.12	26.82	6.61E-05	0.003345	ZT16, ZT4
ENSMUSG00000032883	Acsl3	-0.39	-0.70	10.98	10.59	11.39	10.69	26.81	6.63E-05	0.003345	ZT16, ZT4
ENSMUSG00000006205	Htra1	0.39	0.58	12.94	13.33	12.64	13.23	26.77	6.67E-05	0.003354	ZT16, ZT4
ENSMUSG00000038732	Mboat1	0.94	1.01	8.17	9.11	7.26	8.26	26.44	7.05E-05	0.003533	ZT16, ZT4
ENSMUSG00000055022	Cntn1	-0.39	-0.54	7.30	6.92	7.34	6.80	26.30	7.22E-05	0.003605	ZT16, ZT4

ENSMUSG00000044949	Ubt2	1.13	0.72	5.56	6.69	5.57	6.29	26.23	7.30E-05	0.003632	ZT16, ZT4
ENSMUSG00000039620	6430573F11Rik	0.80	1.04	7.77	8.57	6.93	7.97	26.19	7.35E-05	0.003641	ZT16, ZT4
ENSMUSG00000048763	Hoxb3	0.71	0.82	7.83	8.54	7.64	8.46	26.00	7.60E-05	0.003751	ZT16, ZT4
ENSMUSG00000035031	C8a	-0.93	-0.58	11.21	10.28	11.24	10.66	25.96	7.64E-05	0.003751	ZT16, ZT4
ENSMUSG00000010025	Aldh3a2	-0.53	-0.40	14.73	14.20	14.92	14.52	25.95	7.65E-05	0.003751	ZT16, ZT4
ENSMUSG00000002289	Angptl4	-1.49	-2.19	10.92	9.43	11.24	9.05	25.90	7.73E-05	0.003773	ZT16, ZT4
ENSMUSG00000006724	Cyp27b1	-1.59	-1.07	8.60	7.00	10.38	9.31	25.86	7.78E-05	0.003777	ZT16, ZT4
ENSMUSG00000021281	Tnfaip2	0.48	0.47	11.34	11.82	11.10	11.57	25.85	7.79E-05	0.003777	ZT16, ZT4
ENSMUSG00000026853	Crat	-0.47	-0.42	13.48	13.00	13.71	13.29	25.79	7.88E-05	0.003796	ZT16, ZT4
ENSMUSG00000056708	Ier5	0.98	0.22	9.14	10.12	9.44	9.66	25.78	7.89E-05	0.003796	ZT4
ENSMUSG00000030170	Wnt5b	-0.30	-0.92	7.95	7.65	8.42	7.50	25.74	7.95E-05	0.003809	ZT16
ENSMUSG00000005125	Ndr1	0.45	0.59	17.82	18.27	17.34	17.93	25.61	8.11E-05	0.003876	ZT16, ZT4
ENSMUSG00000021384	Susd3	-0.57	-0.80	11.42	10.84	12.43	11.63	25.50	8.27E-05	0.003924	ZT16, ZT4
ENSMUSG00000043668	Tox3	0.50	0.76	8.37	8.87	7.98	8.74	25.50	8.28E-05	0.003924	ZT16, ZT4
ENSMUSG00000021509	Slc25a48	-0.49	-0.48	11.35	10.87	11.02	10.53	25.45	8.35E-05	0.003937	ZT16, ZT4
ENSMUSG00000073988	Ttpa	-1.09	-1.15	10.28	9.19	11.03	9.89	25.44	8.37E-05	0.003937	ZT16, ZT4
ENSMUSG00000058258	Idi1	0.48	0.95	9.64	10.12	9.36	10.31	25.42	8.39E-05	0.003937	ZT16, ZT4
ENSMUSG00000017978	Cadps2	0.39	0.41	9.80	10.19	9.78	10.19	25.22	8.69E-05	0.004065	ZT16, ZT4
ENSMUSG00000023073	Slc10a2	0.69	0.92	10.97	11.66	11.22	12.14	25.16	8.79E-05	0.00408	ZT16, ZT4
ENSMUSG00000022853	Ehhadh	-0.78	-0.49	16.17	15.39	16.61	16.12	25.16	8.79E-05	0.00408	ZT16, ZT4
ENSMUSG00000036655	Colec11	-0.72	-0.52	7.23	6.51	7.44	6.92	25.11	8.87E-05	0.004103	ZT16, ZT4
ENSMUSG00000028023	Pitx2	0.55	0.71	7.82	8.37	7.66	8.37	25.07	8.93E-05	0.004115	ZT16, ZT4
ENSMUSG00000022408	Fam83f	0.52	0.87	7.46	7.98	6.86	7.73	25.05	8.96E-05	0.004115	ZT16, ZT4
ENSMUSG00000010064	Slc38a3	0.57	0.80	11.52	12.09	11.65	12.45	24.97	9.08E-05	0.004157	ZT16, ZT4
ENSMUSG00000031016	Wee1	-0.37	-0.99	8.71	8.34	9.66	8.67	24.92	9.17E-05	0.004183	ZT16
ENSMUSG00000039633	Lonrf1	-0.23	-1.40	8.74	8.51	9.75	8.35	24.76	9.43E-05	0.004286	ZT16
ENSMUSG00000045284	Dcaf12l1	0.51	0.56	8.65	9.16	8.14	8.69	24.70	9.54E-05	0.004322	ZT16, ZT4
ENSMUSG00000015837	Sqstm1	-0.40	-0.33	15.37	14.97	15.29	14.96	24.64	9.63E-05	0.004342	ZT16, ZT4
ENSMUSG00000015653	Steap2	-0.29	-0.38	13.24	12.94	13.51	13.13	24.63	9.65E-05	0.004342	ZT16, ZT4
ENSMUSG00000005980	Dnase1	-1.04	-1.25	15.52	14.48	15.91	14.66	24.58	9.74E-05	0.00437	ZT16, ZT4
ENSMUSG00000052387	Trpm3	0.86	1.15	5.53	6.40	5.34	6.49	24.55	9.79E-05	0.004378	ZT16, ZT4
ENSMUSG00000042363	Lgalsl	0.49	0.49	10.40	10.88	10.14	10.62	24.45	9.96E-05	0.004433	ZT16, ZT4
ENSMUSG00000096852	Cyp2d12	1.06	1.17	12.10	13.16	12.41	13.59	24.44	9.98E-05	0.004433	ZT16, ZT4
ENSMUSG00000073418	C4b	-0.86	-0.85	8.82	7.96	9.08	8.23	24.38	0.000101	0.004456	ZT16, ZT4

ENSMUSG00000056124	B4galt6	0.54	0.38	9.90	10.44	9.76	10.14	24.38	0.000101	0.004456	ZT16, ZT4
ENSMUSG00000033096	Apmap	0.36	0.60	13.08	13.44	13.07	13.67	24.35	0.0001016	0.004467	ZT16, ZT4
ENSMUSG00000099032	Tcf24	0.63	0.64	8.16	8.79	7.85	8.49	24.29	0.0001026	0.004497	ZT16, ZT4
ENSMUSG00000025533	Asl	-0.37	-0.48	13.86	13.48	13.94	13.46	24.26	0.0001032	0.004508	ZT16, ZT4
ENSMUSG00000039652	Cpeb3	-0.58	-1.02	10.83	10.24	10.76	9.74	24.15	0.0001053	0.004586	ZT16, ZT4
ENSMUSG00000000594	Gm2a	-0.43	-0.29	14.48	14.05	14.44	14.15	24.04	0.0001075	0.004665	ZT16, ZT4
ENSMUSG00000020859	Spag9	-0.26	-0.41	13.65	13.39	13.73	13.31	23.94	0.0001095	0.004723	ZT16, ZT4
ENSMUSG00000033082	Clec1a	-0.53	-0.28	8.56	8.03	8.53	8.25	23.93	0.0001097	0.004723	ZT16, ZT4
ENSMUSG00000074715	Ccl28	1.51	1.91	10.04	11.55	10.54	12.44	23.91	0.0001099	0.004723	ZT16, ZT4
ENSMUSG00000042942	Greb1l	0.82	1.02	10.47	11.29	9.29	10.31	23.84	0.0001113	0.004769	ZT16, ZT4
ENSMUSG00000045215	Asxl3	0.72	1.00	8.72	9.43	8.19	9.20	23.64	0.0001157	0.004933	ZT16, ZT4
ENSMUSG00000039395	Mreg	0.00	-0.97	7.61	7.61	8.11	7.14	23.63	0.0001159	0.004933	ZT16
ENSMUSG00000041193	Pla2g5	0.76	1.06	9.59	10.35	9.24	10.30	23.60	0.0001165	0.004942	ZT16, ZT4
ENSMUSG00000020051	Pah	-0.37	-0.44	16.81	16.44	16.77	16.33	23.54	0.0001177	0.004978	ZT16, ZT4
ENSMUSG00000006641	Slc5a6	-0.64	-0.49	10.38	9.74	9.87	9.39	23.39	0.0001212	0.005109	ZT16, ZT4
ENSMUSG00000029499	Pxmp2	-0.44	-0.64	11.29	10.84	11.93	11.28	23.34	0.0001223	0.005139	ZT16, ZT4
ENSMUSG00000019767	Ccdc170	0.57	1.34	7.15	7.72	6.82	8.16	23.31	0.0001229	0.005146	ZT16
ENSMUSG00000002228	Ppm1j	-1.19	-1.09	7.78	6.58	7.29	6.19	23.27	0.000124	0.005176	ZT16, ZT4
ENSMUSG00000029913	Prdm5	0.59	0.45	8.50	9.10	8.39	8.84	23.21	0.0001254	0.005218	ZT16, ZT4
ENSMUSG00000078651	Aoc2	1.12	0.24	6.51	7.63	6.54	6.79	23.16	0.0001264	0.005245	ZT4
ENSMUSG00000055737	Ghr	-0.34	-0.41	15.71	15.36	15.87	15.46	23.14	0.000127	0.005245	ZT16, ZT4
ENSMUSG00000055866	Per2	1.20	-0.27	9.41	10.61	11.94	11.67	23.13	0.0001272	0.005245	ZT4
ENSMUSG00000038079	Tmem237	-0.91	-1.09	11.02	10.11	11.46	10.37	23.11	0.0001278	0.005253	ZT16, ZT4
ENSMUSG00000054057	A930004D18Rik	0.95	1.07	7.50	8.45	7.14	8.22	23.00	0.0001304	0.005345	ZT16, ZT4
ENSMUSG00000023249	Parp3	-0.45	-0.27	11.30	10.85	11.10	10.84	22.93	0.0001322	0.005386	ZT16, ZT4
ENSMUSG00000079737	3110001I22Rik	-0.41	-0.59	7.23	6.82	7.20	6.60	22.93	0.0001322	0.005386	ZT16, ZT4
ENSMUSG00000026110	Mgat4a	0.41	0.34	10.64	11.04	10.66	10.99	22.90	0.000133	0.0054	ZT16, ZT4
ENSMUSG00000020377	Ltc4s	0.78	0.79	7.89	8.68	8.37	9.16	22.87	0.0001337	0.005412	ZT16, ZT4
ENSMUSG00000032840	2410131K14Rik	0.53	0.11	10.43	10.96	10.76	10.87	22.82	0.000135	0.005448	ZT4
ENSMUSG00000052572	Dlg2	-0.54	-1.22	7.64	7.10	8.26	7.04	22.71	0.0001378	0.005544	ZT16
ENSMUSG00000007989	Fzd3	0.50	0.38	6.84	7.35	6.97	7.35	22.69	0.0001383	0.005549	ZT16, ZT4
ENSMUSG00000044033	Ccdc141	0.44	0.60	11.72	12.16	11.97	12.57	22.57	0.0001415	0.005661	ZT16, ZT4
ENSMUSG00000043614	Vps37d	0.63	0.51	8.42	9.04	7.81	8.33	22.50	0.0001435	0.005723	ZT16, ZT4
ENSMUSG00000022453	Naga	0.32	0.45	11.89	12.21	11.69	12.14	22.46	0.0001445	0.00573	ZT16, ZT4

ENSMUSG00000075585	6330403L08Rik	0.67	0.80	6.87	7.54	6.50	7.30	22.46	0.0001446	0.00573	ZT16, ZT4
ENSMUSG00000076431	Sox4	0.47	0.46	9.60	10.07	9.22	9.69	22.41	0.000146	0.005769	ZT16, ZT4
ENSMUSG00000001773	Folh1	0.74	1.25	13.39	14.13	13.49	14.74	22.39	0.0001466	0.005774	ZT16, ZT4
ENSMUSG000000034917	Tjp3	0.60	0.78	9.26	9.85	8.91	9.68	22.37	0.000147	0.005774	ZT16, ZT4
ENSMUSG000000054074	Skida1	0.70	0.43	8.63	9.33	8.33	8.76	22.31	0.0001487	0.005825	ZT16, ZT4
ENSMUSG000000028125	Abca4	0.80	0.70	9.27	10.07	8.86	9.56	22.30	0.0001492	0.005827	ZT16, ZT4
ENSMUSG000000069372	Ctxn3	-3.21	-2.25	7.77	4.56	6.98	4.73	22.28	0.0001498	0.005832	ZT16, ZT4
ENSMUSG000000024386	Proc	-0.34	-0.27	13.55	13.22	13.54	13.27	22.21	0.0001516	0.005886	ZT16, ZT4
ENSMUSG000000072575	Eddm3b	1.37	1.30	6.46	7.84	6.55	7.85	22.19	0.0001522	0.005894	ZT16, ZT4
ENSMUSG000000027257	Pacsin3	0.42	0.36	10.04	10.46	9.97	10.33	22.08	0.0001556	0.006005	ZT16, ZT4
ENSMUSG000000032564	Cpne4	-0.26	-0.64	10.55	10.29	10.91	10.28	21.98	0.0001589	0.006115	ZT16
ENSMUSG000000041323	Ak7	-0.47	-0.76	8.00	7.54	8.44	7.68	21.85	0.0001629	0.006237	ZT16, ZT4
ENSMUSG000000044393	Dsg2	0.51	0.63	9.08	9.59	8.71	9.33	21.85	0.000163	0.006237	ZT16, ZT4
ENSMUSG000000046056	Sbsn	0.85	0.60	6.85	7.70	6.30	6.90	21.75	0.0001662	0.006324	ZT16, ZT4
ENSMUSG000000041594	Tmtc4	-0.17	-0.45	10.82	10.65	11.16	10.71	21.75	0.0001662	0.006324	ZT16
ENSMUSG000000038059	Smim3	0.30	0.64	9.37	9.67	9.05	9.69	21.68	0.0001683	0.006367	ZT16
ENSMUSG000000040471	Ggt6	0.41	0.64	9.69	10.10	9.06	9.70	21.68	0.0001683	0.006367	ZT16, ZT4
ENSMUSG000000028127	Abcd3	-0.28	-0.38	14.91	14.63	15.20	14.82	21.66	0.0001691	0.006369	ZT16, ZT4
ENSMUSG000000026189	Pecr	-0.39	-0.34	14.80	14.41	14.77	14.43	21.65	0.0001693	0.006369	ZT16, ZT4
ENSMUSG000000056413	Adap1	0.17	0.56	10.18	10.35	9.72	10.28	21.63	0.0001701	0.00638	ZT16
ENSMUSG000000028553	Angptl3	0.90	0.90	9.69	10.58	10.02	10.91	21.60	0.0001711	0.006399	ZT16, ZT4
ENSMUSG000000045594	Glb1	-0.34	-0.31	13.79	13.46	13.78	13.48	21.50	0.0001747	0.006516	ZT16, ZT4
ENSMUSG000000028699	Tspan1	0.38	0.42	10.92	11.30	10.86	11.28	21.47	0.0001755	0.00653	ZT16, ZT4
ENSMUSG000000000690	Hoxb6	0.39	0.25	9.97	10.37	10.03	10.27	21.46	0.0001761	0.006533	ZT16, ZT4
ENSMUSG000000022438	Parvb	1.14	0.86	8.96	10.10	8.62	9.48	21.41	0.0001779	0.006581	ZT16, ZT4
ENSMUSG000000072647	Adam1a	1.16	0.33	4.74	5.90	5.37	5.70	21.38	0.0001788	0.006594	ZT4
ENSMUSG000000028792	Ak2	-0.31	-0.35	13.37	13.06	13.59	13.24	21.36	0.0001797	0.006609	ZT16, ZT4
ENSMUSG000000038172	Ttc39b	-0.31	-0.30	10.43	10.11	10.28	9.98	21.29	0.0001822	0.006663	ZT16, ZT4
ENSMUSG000000056698	Elmod3	-0.37	-0.27	11.22	10.85	11.15	10.88	21.28	0.0001825	0.006663	ZT16, ZT4
ENSMUSG000000037780	Mbl1	-1.46	-1.34	8.29	6.83	8.95	7.60	21.28	0.0001826	0.006663	ZT16, ZT4
ENSMUSG000000004558	Ndrp2	-0.49	-0.48	12.99	12.49	13.18	12.70	21.23	0.0001843	0.006704	ZT16, ZT4
ENSMUSG000000039693	Msantd3	0.58	0.56	7.76	8.34	7.82	8.38	21.15	0.0001874	0.006799	ZT16, ZT4
ENSMUSG000000022613	Miox	-0.74	-0.74	17.27	16.52	17.67	16.93	21.07	0.0001905	0.006893	ZT16, ZT4
ENSMUSG000000022875	Kng1	0.72	1.46	5.64	6.35	5.39	6.85	21.01	0.0001927	0.006928	ZT16

ENSMUSG00000049630	C1ql3	-0.93	-1.07	6.23	5.30	7.11	6.03	21.01	0.0001928	0.006928	ZT16, ZT4
ENSMUSG00000022861	Dgkg	0.48	1.28	9.56	10.04	7.62	8.90	21.00	0.0001932	0.006928	ZT16
ENSMUSG00000024371	C2	-0.46	-0.58	10.19	9.72	10.55	9.97	20.98	0.000194	0.006928	ZT16, ZT4
ENSMUSG00000036745	Ttll7	-0.66	-0.74	8.28	7.62	8.42	7.68	20.98	0.0001941	0.006928	ZT16, ZT4
ENSMUSG00000075478	Slitrk1	0.95	1.26	6.00	6.96	5.16	6.42	20.90	0.0001971	0.007017	ZT16, ZT4
ENSMUSG00000022969	Il10rb	-0.52	-0.48	11.21	10.69	11.34	10.86	20.77	0.0002023	0.007179	ZT16, ZT4
ENSMUSG00000035486	Plk5	-0.64	-1.30	6.14	5.50	7.05	5.75	20.74	0.0002037	0.007179	ZT16
ENSMUSG00000024485	Slc4a9	0.50	0.49	11.90	12.40	11.81	12.30	20.73	0.0002043	0.007179	ZT16, ZT4
ENSMUSG00000078451	Ppil6	0.32	0.54	8.57	8.89	8.38	8.92	20.72	0.0002047	0.007179	ZT16, ZT4
ENSMUSG00000068747	Sort1	0.60	0.45	11.39	11.99	11.09	11.53	20.71	0.0002051	0.007179	ZT16, ZT4
ENSMUSG00000032561	Acpp	0.43	0.42	9.23	9.66	9.09	9.50	20.70	0.0002053	0.007179	ZT16, ZT4
ENSMUSG00000030562	Nox4	-0.44	-0.75	14.97	14.53	15.64	14.89	20.70	0.0002055	0.007179	ZT16, ZT4
ENSMUSG00000027641	Rbl1	0.39	0.45	9.42	9.82	9.18	9.63	20.62	0.000209	0.007257	ZT16, ZT4
ENSMUSG00000038552	Fndc4	0.51	0.24	7.35	7.85	7.20	7.44	20.61	0.0002094	0.007257	ZT4
ENSMUSG00000037129	Tmprss13	1.47	1.43	4.86	6.32	4.78	6.20	20.60	0.0002095	0.007257	ZT16, ZT4
ENSMUSG00000030257	Srgap3	0.88	0.57	9.31	10.18	9.16	9.73	20.58	0.0002105	0.007257	ZT16, ZT4
ENSMUSG00000052974	Cyp2f2	0.25	0.87	7.59	7.84	6.88	7.75	20.58	0.0002105	0.007257	ZT16
ENSMUSG00000056749	Nfil3	1.66	0.40	8.72	10.38	10.10	10.50	20.57	0.000211	0.007257	ZT4
ENSMUSG00000038550	Gm129	-1.99	-1.92	6.79	4.81	7.40	5.47	20.47	0.0002153	0.007389	ZT16, ZT4
ENSMUSG00000037001	Zfp39	0.15	0.57	8.76	8.92	8.03	8.60	20.36	0.0002203	0.00754	ZT16
ENSMUSG00000062410	Hsd3b3	-0.59	-0.97	12.60	12.01	13.48	12.50	20.25	0.0002253	0.007692	ZT16, ZT4
ENSMUSG00000045515	Pou3f3	0.51	0.15	10.91	11.42	10.92	11.07	20.14	0.000231	0.007864	ZT4
ENSMUSG00000021069	Pygl	0.45	0.44	11.00	11.45	11.15	11.60	20.08	0.0002337	0.007938	ZT16, ZT4
ENSMUSG00000026399	Cd55	-0.82	-0.76	10.22	9.41	10.36	9.60	19.95	0.0002405	0.008147	ZT16, ZT4
ENSMUSG00000048087	Gm4737	-0.42	-0.42	12.24	11.82	12.55	12.13	19.89	0.0002434	0.008225	ZT16, ZT4
ENSMUSG00000039629	Strip2	0.62	0.92	8.04	8.66	7.88	8.80	19.84	0.000246	0.008291	ZT16, ZT4
ENSMUSG00000030814	Bcl7c	0.58	0.65	9.06	9.63	8.93	9.58	19.76	0.0002503	0.008393	ZT16, ZT4
ENSMUSG00000032420	Nt5e	0.48	0.59	13.15	13.63	13.64	14.23	19.76	0.0002503	0.008393	ZT16, ZT4
ENSMUSG00000040964	Arhgef10l	0.46	0.94	11.84	12.30	11.22	12.16	19.68	0.0002546	0.008516	ZT16
ENSMUSG00000026687	Aldh9a1	-0.37	-0.45	14.41	14.03	14.48	14.03	19.65	0.0002562	0.008549	ZT16, ZT4
ENSMUSG00000030678	Maz	0.52	0.34	11.10	11.62	11.02	11.36	19.64	0.000257	0.008552	ZT16, ZT4
ENSMUSG00000027199	Gatm	0.23	0.43	16.24	16.46	15.87	16.29	19.58	0.00026	0.008597	ZT16
ENSMUSG00000022564	Grina	-0.38	-0.33	14.98	14.60	15.15	14.82	19.58	0.0002601	0.008597	ZT16, ZT4
ENSMUSG00000009628	Tex15	0.96	1.40	5.64	6.60	5.60	7.00	19.57	0.0002606	0.008597	ZT16, ZT4

ENSMUSG00000034245	Hdac11	0.33	0.43	10.97	11.30	10.70	11.13	19.57	0.0002609	0.008597	ZT16, ZT4
ENSMUSG00000020068	Pbld2	-0.42	-0.58	11.05	10.63	11.14	10.56	19.52	0.0002632	0.008651	ZT16, ZT4
ENSMUSG00000028982	Slc25a33	-0.30	-0.50	9.34	9.05	9.72	9.22	19.41	0.0002701	0.008856	ZT16, ZT4
ENSMUSG00000042118	Bhmt2	0.61	0.60	12.55	13.16	12.28	12.88	19.35	0.0002734	0.008942	ZT16, ZT4
ENSMUSG00000000876	Pxmp4	-0.59	-0.47	12.98	12.39	13.15	12.68	19.32	0.0002753	0.008983	ZT16, ZT4
ENSMUSG00000029636	Wasf3	0.68	0.77	8.40	9.08	8.02	8.79	19.29	0.0002768	0.009008	ZT16, ZT4
ENSMUSG00000030228	Pik3c2g	-0.81	-0.43	9.09	8.28	9.10	8.66	19.25	0.0002795	0.009064	ZT4
ENSMUSG00000034613	Ppm1h	0.65	0.88	11.96	12.61	11.33	12.21	19.24	0.0002798	0.009064	ZT16, ZT4
ENSMUSG00000008658	Rbfox1	-0.35	-0.60	7.53	7.18	7.32	6.72	19.19	0.0002831	0.009147	ZT16
ENSMUSG00000029086	Prom1	0.36	0.70	12.92	13.29	12.50	13.20	19.12	0.0002876	0.00927	ZT16
ENSMUSG00000027690	Slc2a2	-0.46	-0.32	13.93	13.47	13.46	13.15	19.05	0.0002917	0.00938	ZT16, ZT4
ENSMUSG00000011382	Dhdh	-0.39	-0.48	10.28	9.89	10.04	9.56	18.97	0.0002972	0.009533	ZT16, ZT4
ENSMUSG00000041272	Tox	0.85	0.45	6.45	7.30	6.15	6.60	18.91	0.0003011	0.009616	ZT4
ENSMUSG00000002844	Adprh	0.35	0.40	9.83	10.17	9.68	10.08	18.91	0.0003013	0.009616	ZT16, ZT4
ENSMUSG00000038775	Vill	0.39	0.82	12.60	12.99	12.65	13.47	18.87	0.0003035	0.009649	ZT16
ENSMUSG00000020609	Apob	0.41	0.48	14.53	14.94	14.70	15.18	18.84	0.0003054	0.009649	ZT16, ZT4
ENSMUSG00000036158	Prickle1	0.66	0.52	8.68	9.34	8.71	9.23	18.84	0.0003056	0.009649	ZT16, ZT4
ENSMUSG00000039910	Cited2	0.81	0.42	11.07	11.89	10.47	10.89	18.84	0.0003058	0.009649	ZT4
ENSMUSG00000079465	Col4a3	0.66	0.89	14.24	14.90	13.74	14.63	18.84	0.0003059	0.009649	ZT16, ZT4
ENSMUSG00000044352	Sowaha	0.53	0.47	6.62	7.15	6.30	6.77	18.78	0.0003101	0.009758	ZT16, ZT4
ENSMUSG00000068196	Col8a1	0.48	0.51	9.73	10.21	9.17	9.68	18.66	0.0003183	0.009991	ZT16, ZT4
ENSMUSG00000004270	Lpcat3	-0.55	-0.36	13.45	12.90	13.45	13.08	18.64	0.0003197	0.009998	ZT16, ZT4
ENSMUSG00000037458	Azin1	-0.41	-0.32	13.66	13.25	13.97	13.65	18.64	0.00032	0.009998	ZT16, ZT4
ENSMUSG00000037108	Zcwpw1	0.52	0.56	7.92	8.44	8.03	8.59	18.62	0.0003212	0.010013	ZT16, ZT4
ENSMUSG00000031402	Mpp1	-0.36	-0.33	14.03	13.67	14.10	13.77	18.59	0.0003234	0.010058	ZT16, ZT4
ENSMUSG00000057766	Ankrd29	-0.38	-0.31	10.33	9.95	10.51	10.20	18.57	0.000325	0.010084	ZT16, ZT4
ENSMUSG00000020434	4921536K21Rik	0.46	0.88	6.53	6.99	5.81	6.69	18.46	0.0003327	0.010297	ZT16
ENSMUSG00000032826	Ank2	0.44	0.45	8.72	9.17	8.65	9.11	18.45	0.0003334	0.010297	ZT16, ZT4
ENSMUSG00000032278	Paqr5	0.19	0.39	12.75	12.94	12.89	13.27	18.41	0.0003367	0.010372	ZT16
ENSMUSG00000040740	Slc25a34	-0.50	-0.60	10.54	10.03	10.72	10.12	18.39	0.0003381	0.010391	ZT16, ZT4
ENSMUSG00000015405	Ace2	0.43	0.57	12.47	12.90	12.55	13.12	18.35	0.0003411	0.010461	ZT16, ZT4
ENSMUSG00000019856	Fam184a	0.54	0.61	9.78	10.32	9.49	10.11	18.29	0.000346	0.010585	ZT16, ZT4
ENSMUSG00000034731	Dgkh	-0.77	-0.92	8.11	7.34	8.91	7.99	18.27	0.0003475	0.010606	ZT16, ZT4
ENSMUSG00000074476	Spc24	-0.63	-0.19	6.81	6.18	6.70	6.51	18.24	0.0003495	0.010646	ZT4

ENSMUSG00000078695	Cisd3	-0.40	-0.32	11.22	10.83	11.37	11.06	18.21	0.0003527	0.010717	ZT16, ZT4
ENSMUSG00000019874	Fabp7	0.08	1.51	9.70	9.78	8.92	10.43	18.19	0.0003536	0.01072	ZT16
ENSMUSG00000022332	Khdrbs3	-0.37	-0.45	10.54	10.17	10.71	10.26	18.11	0.0003601	0.010891	ZT16, ZT4
ENSMUSG00000019969	Psen1	-0.34	-0.40	12.47	12.13	12.70	12.31	18.10	0.0003616	0.010912	ZT16, ZT4
ENSMUSG00000067653	Ankrd23	0.36	0.56	7.72	8.08	7.40	7.96	18.08	0.0003629	0.010928	ZT16, ZT4
ENSMUSG00000021806	Nid2	0.63	0.88	10.62	11.25	9.92	10.81	18.06	0.0003646	0.010952	ZT16, ZT4
ENSMUSG00000027130	Slc12a6	-0.18	-0.51	12.30	12.12	12.96	12.45	18.05	0.0003655	0.010957	ZT16
ENSMUSG00000031147	Magix	0.43	0.47	8.88	9.31	9.02	9.49	18.01	0.0003692	0.011032	ZT16, ZT4
ENSMUSG00000027967	Neurog2	-1.03	-1.28	6.81	5.78	6.97	5.69	18.00	0.0003697	0.011032	ZT16, ZT4
ENSMUSG00000090877	Hspa1b	0.21	-1.38	9.78	9.99	12.29	10.91	17.98	0.0003711	0.01105	ZT16
ENSMUSG00000060002	Chpt1	-0.40	-0.41	16.87	16.47	17.03	16.62	17.94	0.0003746	0.011128	ZT16, ZT4
ENSMUSG00000018931	Gm16515	0.33	0.34	11.03	11.36	10.78	11.13	17.90	0.000378	0.011204	ZT16, ZT4
ENSMUSG00000061740	Cyp2d22	0.39	0.40	10.75	11.14	10.92	11.33	17.83	0.0003843	0.011366	ZT16, ZT4
ENSMUSG00000037071	Scd1	-0.84	-1.06	14.34	13.50	14.56	13.50	17.82	0.0003858	0.011385	ZT16, ZT4
ENSMUSG00000003617	Cp	0.65	0.57	12.31	12.96	12.71	13.28	17.78	0.0003888	0.011449	ZT16, ZT4
ENSMUSG00000047409	Ctdspl	0.41	0.36	11.81	12.22	11.23	11.59	17.77	0.0003899	0.011454	ZT16, ZT4
ENSMUSG00000075012	Fjx1	0.46	0.64	8.20	8.67	7.94	8.58	17.75	0.0003918	0.011486	ZT16, ZT4
ENSMUSG00000018677	Slc25a39	-0.33	-0.39	14.92	14.59	14.96	14.57	17.72	0.0003947	0.011545	ZT16, ZT4
ENSMUSG00000028158	Mttp	-0.42	-0.35	11.28	10.86	11.63	11.28	17.70	0.000396	0.011558	ZT16, ZT4
ENSMUSG00000027993	Trim2	0.42	0.40	11.77	12.19	11.57	11.97	17.66	0.0003998	0.011642	ZT16, ZT4
ENSMUSG00000030785	Cox6a2	-0.35	-0.97	6.19	5.84	6.29	5.32	17.58	0.0004073	0.011835	ZT16
ENSMUSG00000032340	Neo1	0.39	0.39	11.73	12.12	11.48	11.87	17.57	0.0004083	0.011837	ZT16, ZT4
ENSMUSG00000050199	Lgr4	0.30	0.37	13.67	13.97	13.26	13.63	17.55	0.0004101	0.011864	ZT16, ZT4
ENSMUSG00000025534	Gusb	-0.67	-0.44	12.26	11.60	12.24	11.79	17.54	0.0004113	0.011873	ZT16, ZT4
ENSMUSG00000031398	Plxna3	0.87	0.46	7.12	7.99	7.19	7.65	17.53	0.0004126	0.011886	ZT4
ENSMUSG00000070003	Ssbp4	0.64	0.42	8.91	9.55	8.78	9.20	17.50	0.0004153	0.011938	ZT16, ZT4
ENSMUSG00000024521	Pmaip1	-0.78	-0.75	10.37	9.59	10.81	10.06	17.42	0.0004236	0.012148	ZT16, ZT4
ENSMUSG00000036894	Rap2b	0.41	0.36	7.84	8.25	7.23	7.58	17.35	0.0004305	0.012322	ZT16, ZT4
ENSMUSG00000028410	Dnaja1	-0.32	-0.53	12.77	12.45	13.76	13.23	17.31	0.000434	0.012394	ZT16
ENSMUSG00000027356	Fermt1	0.34	0.44	11.37	11.71	11.27	11.71	17.30	0.0004352	0.012402	ZT16, ZT4
ENSMUSG00000042116	Vwa1	-0.37	-0.53	11.77	11.40	12.22	11.69	17.28	0.0004374	0.012438	ZT16, ZT4
ENSMUSG00000004668	Abca13	-0.48	-0.50	13.50	13.01	13.58	13.09	17.20	0.0004453	0.012636	ZT16, ZT4
ENSMUSG00000037016	Frem2	0.70	0.71	9.80	10.50	9.32	10.03	17.12	0.0004549	0.012879	ZT16, ZT4
ENSMUSG00000049191	Rgag4	0.88	0.61	8.71	9.59	8.46	9.07	17.08	0.0004585	0.012954	ZT16, ZT4

ENSMUSG00000030525	Chrna7	0.94	0.78	5.14	6.08	5.75	6.53	17.03	0.0004639	0.013078	ZT16, ZT4
ENSMUSG00000002257	Def6	0.47	0.69	7.44	7.91	7.00	7.68	17.01	0.000467	0.013137	ZT16, ZT4
ENSMUSG00000022602	Arc	0.05	-2.09	6.98	7.03	8.89	6.80	16.99	0.0004689	0.013164	ZT16
ENSMUSG00000001761	Smo	0.34	0.46	11.19	11.53	10.69	11.15	16.97	0.0004706	0.013183	ZT16, ZT4
ENSMUSG000000041720	Pi4ka	0.69	0.78	13.68	14.37	13.13	13.91	16.89	0.0004806	0.013437	ZT16, ZT4
ENSMUSG000000011305	Plin5	-0.89	-0.72	8.25	7.36	8.38	7.66	16.86	0.0004843	0.01351	ZT16, ZT4
ENSMUSG000000024781	Lipa	-0.44	-0.58	14.94	14.50	15.09	14.51	16.77	0.0004941	0.013726	ZT16, ZT4
ENSMUSG000000022351	Sqle	-0.51	-0.47	12.61	12.10	12.71	12.24	16.77	0.0004941	0.013726	ZT16, ZT4
ENSMUSG000000042797	Aqp11	-0.37	-0.47	11.40	11.02	11.56	11.09	16.76	0.0004956	0.013726	ZT16, ZT4
ENSMUSG000000030603	Psmc4	-0.42	-0.22	13.02	12.60	13.15	12.92	16.76	0.0004962	0.013726	ZT4
ENSMUSG000000060639	Hist1h4i	-0.65	-0.60	7.79	7.14	8.19	7.59	16.74	0.0004975	0.013735	ZT16, ZT4
ENSMUSG000000020828	Pld2	0.40	0.27	8.99	9.39	8.94	9.21	16.73	0.0004995	0.01376	ZT16, ZT4
ENSMUSG000000021336	Slc17a4	0.56	0.86	9.27	9.83	8.35	9.21	16.69	0.0005038	0.013851	ZT16
ENSMUSG000000016239	Lonrf3	1.08	0.12	7.29	8.37	8.72	8.84	16.66	0.0005075	0.013905	ZT4
ENSMUSG000000022583	Ly6f	-1.85	-1.74	5.79	3.95	6.60	4.86	16.65	0.000509	0.013905	ZT16, ZT4
ENSMUSG000000024621	Csf1r	-0.34	-0.33	12.40	12.06	12.26	11.93	16.64	0.0005108	0.013905	ZT16, ZT4
ENSMUSG000000044626	Liph	1.28	0.62	4.71	6.00	4.78	5.40	16.64	0.0005109	0.013905	ZT4
ENSMUSG000000041075	Fzd7	0.67	0.28	9.97	10.64	9.76	10.05	16.63	0.000511	0.013905	ZT4
ENSMUSG000000060703	Cd302	-0.59	-0.82	11.94	11.34	12.56	11.74	16.61	0.0005145	0.013972	ZT16, ZT4
ENSMUSG000000027698	Nceh1	-0.33	-0.30	14.38	14.05	14.42	14.12	16.60	0.0005159	0.01398	ZT16, ZT4
ENSMUSG000000020186	Csrp2	-0.56	-0.56	12.92	12.37	13.35	12.80	16.57	0.0005196	0.014052	ZT16, ZT4
ENSMUSG000000025921	Rdh10	0.30	0.47	12.28	12.59	12.28	12.74	16.54	0.0005231	0.014118	ZT16
ENSMUSG000000086784	Isoc2a	-0.44	-0.57	13.37	12.93	13.60	13.03	16.51	0.0005262	0.01416	ZT16, ZT4
ENSMUSG000000004655	Aqp1	-0.32	-0.30	16.06	15.74	16.36	16.06	16.51	0.0005274	0.01416	ZT16, ZT4
ENSMUSG000000024151	Msh2	0.36	0.41	9.82	10.18	9.45	9.86	16.50	0.0005278	0.01416	ZT16, ZT4
ENSMUSG000000040820	Hlcs	0.24	0.50	9.18	9.43	8.56	9.06	16.48	0.0005304	0.014199	ZT16
ENSMUSG000000031217	Efnb1	0.42	0.38	10.14	10.56	10.12	10.49	16.44	0.0005359	0.014314	ZT16, ZT4
ENSMUSG000000001700	Gramd3	-0.25	-0.36	11.44	11.19	11.63	11.27	16.43	0.0005368	0.014314	ZT16, ZT4
ENSMUSG000000001334	Fndc5	0.58	0.68	7.55	8.13	7.48	8.16	16.42	0.0005392	0.014348	ZT16, ZT4
ENSMUSG000000043088	Il17re	0.60	0.69	9.00	9.60	8.94	9.64	16.41	0.0005404	0.014351	ZT16, ZT4
ENSMUSG000000039835	Nhs1	0.58	0.64	10.69	11.26	10.24	10.88	16.39	0.0005421	0.014369	ZT16, ZT4
ENSMUSG000000055799	Tcf7l1	0.59	0.76	7.95	8.54	7.30	8.06	16.37	0.0005458	0.014437	ZT16, ZT4
ENSMUSG000000002324	Rec8	0.39	0.46	9.09	9.48	9.11	9.57	16.34	0.0005491	0.014495	ZT16, ZT4
ENSMUSG000000040183	Ankrd6	-0.28	-0.65	8.27	7.99	8.52	7.86	16.32	0.0005518	0.014539	ZT16

ENSMUSG00000036957	Lrfn3	1.07	1.16	7.29	8.37	6.82	7.98	16.28	0.0005573	0.014624	ZT16, ZT4
ENSMUSG00000026107	Nabp1	-0.47	-0.27	12.55	12.08	12.60	12.33	16.28	0.0005583	0.014624	ZT4
ENSMUSG00000020782	Lgl2	0.35	0.60	12.48	12.82	12.24	12.84	16.27	0.0005584	0.014624	ZT16
ENSMUSG00000016194	Hsd11b1	-1.26	-1.05	13.44	12.18	13.76	12.71	16.19	0.0005708	0.01492	ZT16, ZT4
ENSMUSG00000028571	Cyp2j13	-0.56	-0.54	14.81	14.26	15.14	14.60	16.07	0.0005875	0.015306	ZT16, ZT4
ENSMUSG00000021311	Mtr	0.34	0.59	10.71	11.05	10.54	11.14	16.07	0.0005878	0.015306	ZT16
ENSMUSG00000048911	Rnf24	-0.87	-0.89	12.32	11.45	12.32	11.43	16.06	0.0005892	0.015312	ZT16, ZT4
ENSMUSG00000051278	4930422G04Rik	0.26	0.46	6.88	7.14	6.29	6.75	16.04	0.0005921	0.015356	ZT16
ENSMUSG00000074435	Smcp	-1.01	-0.81	8.06	7.05	8.54	7.73	16.03	0.0005934	0.01536	ZT16, ZT4
ENSMUSG00000021178	Psmc1	-0.36	-0.29	12.78	12.41	12.91	12.61	16.01	0.0005966	0.015414	ZT16, ZT4
ENSMUSG00000068037	Mas1	-0.79	-0.12	7.80	7.01	6.55	6.43	15.98	0.000601	0.015495	ZT4
ENSMUSG00000026435	Slc45a3	0.60	0.55	11.29	11.89	11.32	11.87	15.95	0.0006055	0.015581	ZT16, ZT4
ENSMUSG00000058952	Cfi	0.63	0.51	8.99	9.62	9.18	9.69	15.92	0.0006099	0.015647	ZT16, ZT4
ENSMUSG00000058420	Syt17	0.46	0.92	7.41	7.87	7.09	8.00	15.92	0.0006104	0.015647	ZT16
ENSMUSG00000048915	Efna5	0.86	0.81	5.95	6.81	5.33	6.13	15.89	0.0006146	0.015723	ZT16, ZT4
ENSMUSG00000022595	Lypd2	0.68	0.27	6.58	7.25	6.47	6.74	15.88	0.0006157	0.015723	ZT4
ENSMUSG00000042156	Dzip1	0.70	0.52	7.82	8.52	7.55	8.08	15.79	0.00063	0.016057	ZT16, ZT4
ENSMUSG00000043342	Hoxd9	0.44	0.32	10.08	10.52	10.28	10.59	15.75	0.0006379	0.016227	ZT16, ZT4
ENSMUSG00000029919	Hpgds	-0.68	-0.78	7.67	6.98	7.48	6.70	15.71	0.0006434	0.016328	ZT16, ZT4
ENSMUSG00000031880	Rrad	-0.35	-0.73	7.23	6.88	7.20	6.47	15.71	0.0006443	0.016328	ZT16
ENSMUSG00000028399	Ptprd	-0.12	-0.47	13.15	13.03	13.54	13.08	15.67	0.0006496	0.016429	ZT16
ENSMUSG00000017713	Tha1	-0.33	-0.25	9.55	9.22	9.85	9.59	15.57	0.0006664	0.016823	ZT16, ZT4
ENSMUSG00000031775	Plip	-0.56	0.03	11.39	10.83	11.04	11.07	15.55	0.0006698	0.016877	ZT4
ENSMUSG00000031202	Rab39b	0.30	0.46	6.83	7.13	7.12	7.58	15.54	0.0006716	0.016892	ZT16
ENSMUSG00000039824	Myl6b	-0.77	-0.62	8.84	8.07	8.33	7.71	15.49	0.0006809	0.017092	ZT16, ZT4
ENSMUSG00000055555	4930502E18Rik	-2.05	-1.74	6.98	4.93	7.68	5.94	15.45	0.000688	0.017236	ZT16, ZT4
ENSMUSG00000020774	Aspa	-1.08	-1.16	13.53	12.45	13.76	12.60	15.44	0.0006892	0.017236	ZT16, ZT4
ENSMUSG00000049353	Rd3	1.08	0.60	4.69	5.77	4.85	5.45	15.41	0.0006953	0.017355	ZT4
ENSMUSG00000032377	Plscr4	-0.24	-0.36	11.10	10.87	11.33	10.97	15.36	0.0007047	0.017557	ZT16
ENSMUSG00000042487	Leo1	0.46	0.36	9.79	10.26	9.90	10.26	15.31	0.0007127	0.017723	ZT16, ZT4
ENSMUSG00000073434	Wdr90	0.63	0.80	8.73	9.36	8.30	9.10	15.30	0.0007162	0.017776	ZT16, ZT4
ENSMUSG00000047281	Sfn	0.42	0.39	8.21	8.63	8.46	8.85	15.28	0.0007199	0.017834	ZT16, ZT4
ENSMUSG00000003948	Mmd	0.45	0.17	10.21	10.66	10.04	10.21	15.27	0.0007213	0.017835	ZT4
ENSMUSG00000036169	Sostdc1	0.58	0.44	11.82	12.40	11.15	11.60	15.26	0.0007231	0.017848	ZT16, ZT4

ENSMUSG00000041052	Slc7a13	-0.73	-0.56	16.21	15.48	16.58	16.02	15.25	0.0007253	0.017849	ZT16, ZT4
ENSMUSG00000039286	Fndc3b	0.34	0.38	11.62	11.96	11.57	11.95	15.24	0.0007258	0.017849	ZT16, ZT4
ENSMUSG00000021062	Rab15	0.79	0.51	7.95	8.74	7.93	8.43	15.16	0.0007413	0.018196	ZT4
ENSMUSG00000014905	Dnajb9	-0.27	-0.45	11.88	11.61	12.70	12.25	15.13	0.0007478	0.018308	ZT16
ENSMUSG00000024042	Sik1	-0.33	-1.00	10.96	10.64	11.63	10.63	15.12	0.0007489	0.018308	ZT16
ENSMUSG00000031886	Ces2e	-0.70	-0.47	10.41	9.71	10.66	10.19	15.12	0.00075	0.018308	ZT4
ENSMUSG00000034854	Mfsd12	0.36	0.54	9.16	9.52	9.11	9.65	15.09	0.0007555	0.018396	ZT16
ENSMUSG00000017724	Etv4	0.97	0.90	6.10	7.07	5.88	6.77	15.09	0.0007564	0.018396	ZT16, ZT4
ENSMUSG00000045294	Insig1	-0.36	-0.92	11.52	11.16	12.06	11.14	15.05	0.0007642	0.018519	ZT16
ENSMUSG00000006390	Elovl1	-0.39	-0.26	12.97	12.58	12.96	12.70	15.04	0.000766	0.018519	ZT4
ENSMUSG00000023019	Gpd1	-0.29	-0.20	14.93	14.63	15.13	14.93	15.02	0.0007687	0.018519	ZT4
ENSMUSG00000034930	Rtkn	-0.16	-0.70	10.53	10.36	10.94	10.24	15.02	0.0007697	0.018519	ZT16
ENSMUSG00000028341	Nr4a3	-0.31	-1.28	4.57	4.26	6.04	4.76	15.02	0.0007698	0.018519	ZT16
ENSMUSG00000031698	Mylk3	-0.48	-0.89	8.04	7.56	8.39	7.50	15.02	0.0007707	0.018519	ZT16
ENSMUSG00000001768	Rin2	0.31	0.49	12.07	12.39	11.82	12.31	15.01	0.0007712	0.018519	ZT16
ENSMUSG00000048482	Bdnf	-0.77	-0.77	8.51	7.74	9.07	8.30	15.00	0.0007747	0.018553	ZT16, ZT4
ENSMUSG00000020467	Efemp1	0.47	0.23	10.36	10.83	10.67	10.90	14.99	0.0007754	0.018553	ZT4
ENSMUSG00000022464	Slc38a4	-0.84	-0.57	9.16	8.31	9.08	8.52	14.98	0.0007788	0.0186	ZT4
ENSMUSG000000062480	Acat3	-0.53	-0.52	9.66	9.13	10.47	9.95	14.89	0.0007963	0.018981	ZT16, ZT4
ENSMUSG00000020080	Hkdc1	0.42	0.55	7.35	7.77	7.38	7.93	14.89	0.0007976	0.018981	ZT16, ZT4
ENSMUSG00000026600	Soat1	0.38	0.26	10.31	10.70	10.19	10.45	14.87	0.0008006	0.019018	ZT4
ENSMUSG00000046432	Ngfrap1	0.50	0.44	9.43	9.92	9.21	9.64	14.83	0.0008092	0.01917	ZT16, ZT4
ENSMUSG00000090369	4933411K16Rik	0.67	0.65	5.72	6.39	5.58	6.23	14.82	0.0008114	0.01917	ZT16, ZT4
ENSMUSG00000039960	Rhou	0.75	0.25	7.31	8.06	7.77	8.03	14.82	0.0008114	0.01917	ZT4
ENSMUSG00000029206	Nsun7	0.80	0.95	5.72	6.52	5.02	5.96	14.81	0.0008128	0.01917	ZT16, ZT4
ENSMUSG00000042282	Gucy2f	0.86	1.38	5.05	5.91	3.72	5.10	14.78	0.0008201	0.019289	ZT16
ENSMUSG00000020733	Slc9a3r1	-0.26	-0.27	14.44	14.17	14.64	14.37	14.78	0.0008207	0.019289	ZT16, ZT4
ENSMUSG00000019832	Rab32	-0.50	-0.31	10.36	9.87	10.26	9.95	14.75	0.0008275	0.01938	ZT4
ENSMUSG00000035004	Igsf6	-0.41	-0.62	6.46	6.05	6.31	5.69	14.75	0.0008279	0.01938	ZT16
ENSMUSG00000033685	Ucp2	-0.74	-1.11	12.81	12.07	12.87	11.76	14.74	0.000829	0.01938	ZT16
ENSMUSG00000025150	Cbr2	-0.75	-0.62	7.59	6.84	7.80	7.17	14.73	0.0008313	0.0194	ZT16, ZT4
ENSMUSG00000023905	Tnfrsf12a	-0.80	-0.69	10.09	9.28	10.79	10.09	14.71	0.0008355	0.019462	ZT16, ZT4
ENSMUSG00000031384	Asb9	0.30	1.10	11.17	11.47	10.50	11.60	14.70	0.000837	0.019462	ZT16
ENSMUSG00000023044	Csad	-0.48	-0.29	14.32	13.84	14.26	13.97	14.70	0.0008383	0.019462	ZT4

ENSMUSG00000040569	Slc26a7	-1.03	-0.31	8.61	7.58	8.04	7.73	14.69	0.0008407	0.019483	ZT4
ENSMUSG00000015843	Rxrg	-2.25	-0.68	5.67	3.42	5.01	4.33	14.67	0.0008451	0.019529	ZT4
ENSMUSG00000061825	Ces2c	-0.67	-0.54	12.83	12.16	13.18	12.64	14.67	0.0008456	0.019529	ZT16, ZT4
ENSMUSG00000026255	Efh1	0.41	0.38	12.47	12.88	12.65	13.03	14.65	0.0008501	0.019597	ZT16, ZT4
ENSMUSG00000039648	Ccbl1	-0.50	-0.60	12.75	12.25	12.96	12.36	14.61	0.0008578	0.01974	ZT16, ZT4
ENSMUSG00000067071	Hes6	-0.54	-0.55	11.50	10.96	11.81	11.26	14.60	0.000861	0.019758	ZT16, ZT4
ENSMUSG00000039323	Igfbp2	0.89	0.88	7.11	8.00	7.47	8.36	14.60	0.0008615	0.019758	ZT16, ZT4
ENSMUSG00000025511	Tspan4	-0.42	-0.69	11.43	11.01	12.23	11.54	14.57	0.0008677	0.019867	ZT16
ENSMUSG00000012123	Aim1l	-1.59	-1.68	6.35	4.76	6.13	4.45	14.56	0.0008693	0.019869	ZT16, ZT4
ENSMUSG00000079277	Hoxd3	0.72	0.43	10.16	10.88	10.18	10.62	14.52	0.0008795	0.020068	ZT4
ENSMUSG00000073755	5730409E04Rik	0.24	0.59	8.57	8.82	8.20	8.79	14.47	0.0008915	0.020262	ZT16
ENSMUSG00000018736	Ndel1	-0.19	-0.37	13.09	12.90	13.39	13.02	14.46	0.0008929	0.020262	ZT16
ENSMUSG00000022040	Ephx2	-0.66	-0.65	15.28	14.62	15.70	15.05	14.46	0.000893	0.020262	ZT16, ZT4
ENSMUSG00000074063	Osgin1	-0.38	-0.84	11.88	11.49	12.82	11.98	14.46	0.0008941	0.020262	ZT16
ENSMUSG00000000326	Comt	0.06	0.47	13.94	14.00	13.53	14.00	14.41	0.000906	0.020495	ZT16
ENSMUSG00000056116	H2-T22	-0.33	-0.23	12.36	12.03	12.41	12.18	14.40	0.0009075	0.020495	ZT4
ENSMUSG00000028979	Masp2	-1.68	-1.82	6.23	4.55	6.34	4.52	14.37	0.0009149	0.020627	ZT16, ZT4
ENSMUSG00000018012	Rac3	0.88	0.16	6.06	6.94	6.42	6.58	14.34	0.0009236	0.020786	ZT4
ENSMUSG00000039519	Cyp7b1	0.41	0.75	14.03	14.44	14.06	14.81	14.33	0.0009257	0.020797	ZT16
ENSMUSG00000043885	Slc36a4	0.35	0.19	10.04	10.39	9.84	10.04	14.33	0.0009272	0.020797	ZT4
ENSMUSG00000022218	Tgm1	-0.60	-0.51	10.79	10.19	11.10	10.59	14.32	0.0009295	0.020815	ZT16, ZT4
ENSMUSG00000003541	Ier3	-0.23	-0.71	10.89	10.66	11.88	11.17	14.31	0.0009323	0.020827	ZT16
ENSMUSG00000050737	Ptges	0.37	0.53	10.43	10.81	10.10	10.62	14.30	0.0009332	0.020827	ZT16
ENSMUSG00000034308	Sdr42e1	0.15	0.58	8.84	8.99	8.33	8.90	14.29	0.0009367	0.020871	ZT16
ENSMUSG00000041700	Lhfpl1	0.38	1.20	5.12	5.51	4.93	6.14	14.20	0.0009593	0.021338	ZT16
ENSMUSG00000029108	Pcdh7	0.54	0.55	8.59	9.13	8.11	8.65	14.17	0.0009675	0.02148	ZT16, ZT4
ENSMUSG00000050022	Amz1	-0.89	-0.36	7.96	7.07	6.74	6.38	14.17	0.000969	0.02148	ZT4
ENSMUSG00000022948	Setd4	0.66	0.47	7.05	7.71	7.17	7.64	14.14	0.0009752	0.021584	ZT4
ENSMUSG00000002393	Nr2f6	0.67	0.10	11.62	12.29	11.85	11.95	14.11	0.0009835	0.02173	ZT4
ENSMUSG00000045064	Zc2hc1c	0.54	0.49	9.40	9.94	9.24	9.74	14.09	0.0009885	0.021805	ZT16, ZT4
ENSMUSG00000035849	Krt222	-1.03	-0.84	6.61	5.58	6.04	5.20	14.07	0.0009942	0.021889	ZT16, ZT4
ENSMUSG00000019734	Tmc4	0.47	0.31	11.38	11.84	11.66	11.97	14.07	0.0009961	0.021889	ZT4
ENSMUSG00000000325	Arvcf	0.25	0.67	11.60	11.85	11.11	11.78	14.06	0.0009973	0.021889	ZT16
ENSMUSG00000079445	B3gnt7	0.22	0.56	8.07	8.28	7.96	8.53	14.04	0.0010017	0.02195	ZT16

ENSMUSG00000038777	Sema6c	0.93	0.39	6.51	7.45	6.06	6.46	14.03	0.0010068	0.022024	ZT4
ENSMUSG00000043085	Tmem82	-0.24	-0.28	10.42	10.18	10.52	10.24	14.01	0.0010116	0.022094	ZT16, ZT4
ENSMUSG00000000154	Slc22a18	-0.45	-0.26	15.22	14.77	15.25	14.99	13.98	0.0010209	0.022227	ZT4
ENSMUSG00000056501	Cebpb	0.97	-0.51	7.40	8.37	8.30	7.79	13.98	0.0010211	0.022227	ZT4
ENSMUSG00000055312	0610012H03Rik	-0.42	-0.30	13.51	13.09	13.71	13.41	13.94	0.0010299	0.022347	ZT4
ENSMUSG00000022231	Sema5a	0.41	0.38	11.39	11.80	10.97	11.34	13.94	0.0010299	0.022347	ZT16, ZT4
ENSMUSG00000021061	Sptb	0.27	0.46	7.93	8.21	6.91	7.37	13.94	0.0010322	0.022359	ZT16
ENSMUSG00000050097	Ces2b	-0.66	-0.70	9.71	9.05	10.10	9.40	13.90	0.0010436	0.022569	ZT16, ZT4
ENSMUSG00000038569	Rad9b	0.53	0.37	7.96	8.49	7.94	8.31	13.87	0.0010516	0.022675	ZT4
ENSMUSG00000021565	Slc6a19	-0.60	-0.38	15.40	14.80	14.55	14.17	13.87	0.0010519	0.022675	ZT4
ENSMUSG00000026542	Apcs	0.64	1.50	6.90	7.55	6.25	7.75	13.86	0.0010554	0.022714	ZT16
ENSMUSG00000010048	lfrd2	-0.56	-0.30	11.82	11.26	12.01	11.71	13.81	0.0010693	0.022976	ZT4
ENSMUSG00000026664	Phyh	-0.33	-0.42	15.28	14.95	15.51	15.09	13.77	0.0010818	0.023208	ZT16, ZT4
ENSMUSG00000007570	Fance	0.32	0.39	8.95	9.26	8.71	9.10	13.75	0.0010886	0.023315	ZT16, ZT4
ENSMUSG00000014329	Bicc1	0.43	0.57	13.06	13.49	12.65	13.23	13.73	0.0010933	0.023378	ZT16
ENSMUSG00000068323	Slc4a5	0.72	0.83	6.13	6.85	5.91	6.74	13.71	0.001099	0.023462	ZT16, ZT4
ENSMUSG00000022199	Slc22a17	0.54	0.53	10.35	10.89	10.17	10.69	13.68	0.00111	0.023626	ZT16, ZT4
ENSMUSG00000030091	Nup210	0.53	0.54	10.77	11.31	10.08	10.63	13.68	0.0011102	0.023626	ZT16, ZT4
ENSMUSG00000056366	Fabp3-ps1	-0.65	-0.69	11.00	10.35	11.49	10.80	13.67	0.0011136	0.023661	ZT16, ZT4
ENSMUSG00000038872	Zfhx3	0.68	0.24	7.14	7.82	7.23	7.48	13.66	0.0011171	0.023695	ZT4
ENSMUSG00000031381	Piga	0.44	0.10	10.73	11.17	11.16	11.25	13.61	0.0011315	0.023964	ZT4
ENSMUSG00000038065	2410066E13Rik	-0.36	-0.42	11.14	10.78	11.27	10.85	13.60	0.0011355	0.02401	ZT16, ZT4
ENSMUSG00000032815	Fanca	0.36	0.29	8.12	8.48	8.11	8.40	13.56	0.0011464	0.024202	ZT16, ZT4
ENSMUSG00000039238	Zfp750	0.48	0.83	8.94	9.42	8.03	8.86	13.55	0.0011507	0.024217	ZT16
ENSMUSG00000059939	9430015G10Rik	0.49	0.15	8.30	8.80	8.26	8.41	13.55	0.0011508	0.024217	ZT4
ENSMUSG00000096847	Tmem151b	0.70	0.69	6.27	6.97	5.89	6.58	13.53	0.001158	0.024331	ZT16, ZT4
ENSMUSG00000033068	Entpd6	0.34	0.43	9.90	10.24	9.62	10.05	13.48	0.0011749	0.02464	ZT16, ZT4
ENSMUSG00000090164	BC035044	-1.24	-0.62	5.50	4.26	5.93	5.31	13.47	0.0011764	0.02464	ZT4
ENSMUSG00000031548	Sfrp1	0.28	0.27	12.71	12.98	12.47	12.74	13.45	0.0011844	0.024725	ZT16, ZT4
ENSMUSG00000033467	Crlf2	-0.08	-0.63	7.19	7.10	7.30	6.67	13.45	0.001185	0.024725	ZT16
ENSMUSG00000023072	Cep89	0.22	0.35	10.50	10.73	10.28	10.63	13.44	0.0011861	0.024725	ZT16
ENSMUSG00000041362	4930506M07Rik	0.34	0.59	10.76	11.09	10.38	10.97	13.41	0.0011986	0.024941	ZT16
ENSMUSG00000061689	Dlgap4	0.46	0.43	10.38	10.84	10.26	10.69	13.40	0.0012002	0.024941	ZT16, ZT4
ENSMUSG00000015112	Slc25a13	-0.11	-0.37	13.38	13.27	13.67	13.30	13.40	0.0012028	0.024956	ZT16

ENSMUSG00000023963	Cyp39a1	-0.07	-0.39	9.67	9.59	9.84	9.46	13.39	0.0012059	0.024982	ZT16
ENSMUSG00000062713	Sim2	0.83	0.61	8.32	9.15	8.07	8.68	13.36	0.0012152	0.025097	ZT4
ENSMUSG00000032081	Apoc3	0.57	0.64	8.54	9.12	8.58	9.22	13.36	0.0012153	0.025097	ZT16, ZT4
ENSMUSG00000027597	Ahcy	-0.46	-0.49	12.14	11.69	12.43	11.94	13.32	0.001228	0.025321	ZT16, ZT4
ENSMUSG00000031838	Ifi30	-0.37	-0.38	11.91	11.54	12.20	11.82	13.31	0.0012326	0.025377	ZT16, ZT4
ENSMUSG00000026764	Kif5c	0.46	0.31	7.07	7.54	7.07	7.39	13.27	0.0012462	0.025589	ZT4
ENSMUSG00000015094	Npdc1	0.42	0.34	10.42	10.84	10.20	10.54	13.27	0.0012482	0.025589	ZT16, ZT4
ENSMUSG00000032091	Tmprss4	-1.10	-1.18	5.92	4.83	6.19	5.00	13.26	0.001249	0.025589	ZT16, ZT4
ENSMUSG00000046731	Kctd11	-0.13	-0.70	8.50	8.37	8.88	8.17	13.26	0.0012506	0.025589	ZT16
ENSMUSG00000001166	Oas1c	-0.56	-0.77	8.54	7.98	8.40	7.63	13.21	0.0012692	0.025925	ZT16
ENSMUSG00000024565	Sall3	0.70	1.08	7.68	8.38	6.90	7.98	13.20	0.001271	0.025925	ZT16
ENSMUSG00000001270	Ckb	0.29	0.61	11.82	12.11	11.71	12.32	13.20	0.0012741	0.025949	ZT16
ENSMUSG00000055415	Atp10b	0.44	0.47	8.13	8.57	7.93	8.41	13.19	0.0012762	0.025953	ZT16, ZT4
ENSMUSG00000050395	Tnfsf15	-0.79	-0.11	7.30	6.51	6.29	6.18	13.18	0.0012799	0.025988	ZT4
ENSMUSG00000006154	Eps8l1	0.96	-0.02	8.29	9.25	8.54	8.52	13.15	0.0012892	0.026064	ZT4
ENSMUSG00000032123	Dpagt1	-0.34	-0.20	10.92	10.58	11.01	10.80	13.15	0.0012905	0.026064	ZT4
ENSMUSG00000024150	Mcf2	-0.21	-0.30	13.65	13.43	13.97	13.67	13.15	0.0012923	0.026064	ZT16
ENSMUSG00000035540	Gc	0.44	0.23	11.73	12.17	11.98	12.21	13.14	0.0012938	0.026064	ZT4
ENSMUSG00000057156	Homez	0.33	0.44	9.97	10.31	9.61	10.05	13.14	0.0012951	0.026064	ZT16
ENSMUSG00000066278	Vps37b	0.28	0.27	9.56	9.83	9.46	9.72	13.14	0.0012955	0.026064	ZT16, ZT4
ENSMUSG00000059970	Hspa2	0.67	0.40	8.38	9.04	8.72	9.12	13.13	0.0013	0.026098	ZT4
ENSMUSG00000038522	Al317395	-0.26	-0.37	13.58	13.32	13.83	13.47	13.12	0.0013011	0.026098	ZT16
ENSMUSG00000028018	Gstdc	0.30	0.24	9.06	9.37	8.95	9.19	13.10	0.0013108	0.026254	ZT16, ZT4
ENSMUSG00000022779	Top3b	0.21	0.39	11.89	12.09	11.72	12.11	13.09	0.0013132	0.026262	ZT16
ENSMUSG00000039878	Slc39a5	0.41	0.43	11.23	11.64	11.19	11.62	13.06	0.0013252	0.026461	ZT16, ZT4
ENSMUSG00000050295	Foxc1	0.62	0.15	8.64	9.26	8.77	8.92	13.05	0.00133	0.026482	ZT4
ENSMUSG00000025790	Slco3a1	-0.37	-0.39	13.17	12.80	13.32	12.93	13.05	0.0013302	0.026482	ZT16, ZT4
ENSMUSG00000063683	Glyat	-0.85	-0.82	15.72	14.87	16.31	15.49	13.01	0.0013437	0.026645	ZT16, ZT4
ENSMUSG00000046417	Fam211a	0.46	0.47	7.16	7.62	6.89	7.36	13.01	0.0013448	0.026645	ZT16, ZT4
ENSMUSG00000094935	Gm9726	-0.61	-0.14	7.25	6.64	6.71	6.57	13.01	0.0013463	0.026645	ZT4
ENSMUSG00000047407	Tgif1	0.45	0.11	9.46	9.91	9.22	9.33	13.01	0.0013464	0.026645	ZT4
ENSMUSG00000035852	Misp	0.14	0.41	9.89	10.03	10.10	10.51	12.99	0.0013532	0.02674	ZT16
ENSMUSG00000032718	Mansc1	0.34	0.47	8.44	8.78	7.87	8.34	12.96	0.0013634	0.02687	ZT16
ENSMUSG00000037868	Egr2	0.36	-2.69	5.15	5.51	8.22	5.54	12.96	0.0013639	0.02687	ZT16

ENSMUSG00000027189	Trim44	0.29	0.35	13.03	13.32	12.78	13.13	12.96	0.001366	0.026873	ZT16, ZT4
ENSMUSG00000021087	Rtn1	0.95	0.69	6.53	7.48	6.40	7.10	12.94	0.0013716	0.026942	ZT4
ENSMUSG00000019960	Dusp6	-0.12	-0.65	12.38	12.26	13.06	12.40	12.94	0.0013745	0.02696	ZT16
ENSMUSG00000025869	Nop16	-0.28	-0.43	10.41	10.13	11.05	10.62	12.93	0.0013772	0.026973	ZT16
ENSMUSG00000026156	B3gat2	0.59	0.39	11.46	12.05	10.93	11.32	12.91	0.0013847	0.027052	ZT4
ENSMUSG00000032802	Srxn1	-0.42	-0.19	12.33	11.91	12.29	12.10	12.91	0.0013853	0.027052	ZT4
ENSMUSG000000051674	Dcun1d4	-0.33	-0.19	12.38	12.05	12.46	12.28	12.90	0.0013878	0.02706	ZT4
ENSMUSG00000038298	Pdzk1	-0.21	-0.33	16.27	16.05	16.53	16.20	12.74	0.0014571	0.028361	ZT16
ENSMUSG00000071633	Gm4952	-1.10	-0.45	9.06	7.96	9.09	8.64	12.73	0.0014587	0.028361	ZT4
ENSMUSG00000018659	Pnpo	-0.35	-0.36	12.68	12.33	13.15	12.79	12.73	0.0014623	0.028389	ZT16, ZT4
ENSMUSG00000024795	Kif20b	-0.99	-0.59	10.62	9.64	11.45	10.86	12.71	0.0014674	0.028412	ZT4
ENSMUSG00000019564	Arid3a	0.61	0.56	8.95	9.56	8.61	9.17	12.71	0.0014678	0.028412	ZT16, ZT4
ENSMUSG00000039063	Echdc3	0.36	0.39	11.23	11.58	11.30	11.69	12.70	0.0014727	0.028465	ZT16, ZT4
ENSMUSG00000034918	Cdhr2	0.31	0.36	11.99	12.30	12.06	12.42	12.69	0.0014778	0.028465	ZT16, ZT4
ENSMUSG00000038692	Hoxb4	0.54	0.48	9.73	10.26	9.57	10.05	12.69	0.0014779	0.028465	ZT16, ZT4
ENSMUSG00000046223	Plaur	-0.14	-0.59	8.08	7.94	7.97	7.38	12.69	0.0014791	0.028465	ZT16
ENSMUSG00000029193	Cckar	0.36	0.60	12.58	12.93	12.11	12.70	12.66	0.0014932	0.028695	ZT16
ENSMUSG00000005089	Slc1a2	-0.58	-0.80	8.36	7.78	8.24	7.44	12.64	0.0014992	0.028769	ZT16
ENSMUSG00000054863	Fam19a5	0.46	0.65	7.86	8.32	7.32	7.97	12.63	0.0015031	0.028803	ZT16
ENSMUSG00000048485	Zbtb8b	0.65	0.50	6.67	7.32	6.49	6.99	12.62	0.0015107	0.028906	ZT4
ENSMUSG00000052512	Nav2	1.15	1.47	10.64	11.79	9.63	11.10	12.61	0.0015132	0.028907	ZT16
ENSMUSG00000029330	Cds1	0.34	0.38	11.27	11.62	10.99	11.37	12.61	0.0015151	0.028907	ZT16, ZT4
ENSMUSG00000019715	Gle1	0.30	0.27	11.33	11.64	11.08	11.35	12.59	0.0015236	0.029026	ZT16, ZT4
ENSMUSG00000029843	Slc13a4	-0.37	-0.57	8.66	8.29	8.99	8.41	12.57	0.0015319	0.029143	ZT16
ENSMUSG00000068086	Cyp2d9	-0.63	-0.43	13.60	12.96	13.87	13.44	12.54	0.0015438	0.029327	ZT4
ENSMUSG00000022139	Mbnl2	-0.21	-0.32	12.88	12.66	13.15	12.83	12.53	0.0015508	0.029419	ZT16
ENSMUSG00000031431	Tsc22d3	0.71	-0.27	11.32	12.03	12.84	12.57	12.50	0.0015656	0.029655	ZT4
ENSMUSG00000049152	Ugt3a2	-0.56	-0.33	17.21	16.65	17.38	17.05	12.49	0.0015677	0.029655	ZT4
ENSMUSG00000043017	Ptgir	-0.14	-0.63	7.63	7.49	8.04	7.41	12.48	0.0015737	0.029727	ZT16
ENSMUSG00000060126	Tpt1	0.74	-0.12	9.19	9.93	9.97	9.86	12.47	0.0015804	0.029811	ZT4
ENSMUSG00000056429	Tgoln1	-0.35	-0.16	15.25	14.91	15.32	15.16	12.46	0.0015844	0.029844	ZT4
ENSMUSG00000054939	Zfp174	0.31	0.38	8.16	8.47	7.97	8.35	12.44	0.0015947	0.029968	ZT16
ENSMUSG00000038071	Npy6r	-1.96	-2.54	5.36	3.39	5.70	3.16	12.43	0.0015956	0.029968	ZT16
ENSMUSG00000049511	Htr1b	0.58	0.42	7.28	7.85	7.12	7.55	12.42	0.0016026	0.030018	ZT4

ENSMUSG00000064065	Ipcef1	0.28	0.41	10.17	10.44	10.11	10.52	12.42	0.0016028	0.030018	ZT16
ENSMUSG00000040312	Cchcr1	0.14	0.42	8.69	8.83	7.99	8.41	12.40	0.0016103	0.030118	ZT16
ENSMUSG00000074140	Zfp319	0.63	0.20	7.24	7.87	7.14	7.35	12.39	0.0016148	0.030129	ZT4
ENSMUSG00000032827	Ppp1r9a	0.46	0.53	10.02	10.48	9.68	10.22	12.39	0.0016154	0.030129	ZT16, ZT4
ENSMUSG00000032254	Kif23	0.53	0.61	7.79	8.32	7.39	8.00	12.38	0.0016224	0.030198	ZT16, ZT4
ENSMUSG00000003546	Klc4	-0.37	-0.21	12.81	12.44	12.97	12.75	12.38	0.0016238	0.030198	ZT4
ENSMUSG00000071723	Gspt2	0.81	0.18	6.82	7.63	6.67	6.85	12.37	0.001626	0.030198	ZT4
ENSMUSG00000028261	Ndufaf4	-0.57	-0.54	12.29	11.72	13.10	12.55	12.35	0.0016356	0.030334	ZT16, ZT4
ENSMUSG00000035495	Tstd2	0.44	0.74	11.63	12.07	11.16	11.90	12.34	0.0016407	0.030359	ZT16
ENSMUSG00000027171	Prrg4	-0.64	-1.25	8.22	7.58	7.83	6.59	12.34	0.0016422	0.030359	ZT16
ENSMUSG00000052727	Map1b	0.45	0.42	7.92	8.37	7.75	8.17	12.34	0.0016438	0.030359	ZT16, ZT4
ENSMUSG00000038143	Stox2	0.61	0.52	8.81	9.42	8.47	8.99	12.32	0.0016509	0.030448	ZT16, ZT4
ENSMUSG00000029657	Hsph1	-0.41	-0.59	13.24	12.83	14.29	13.70	12.31	0.0016552	0.030485	ZT16
ENSMUSG00000028932	Psmc2	-0.42	-0.26	12.91	12.49	13.06	12.80	12.30	0.0016628	0.030582	ZT4
ENSMUSG00000049307	Fut4	0.18	0.53	6.63	6.81	6.15	6.68	12.28	0.0016713	0.030696	ZT16
ENSMUSG00000014077	Chp1	-0.26	-0.22	13.49	13.23	13.67	13.45	12.26	0.0016847	0.030899	ZT16, ZT4
ENSMUSG00000050164	Mchr1	-1.30	-0.86	6.45	5.15	6.96	6.10	12.24	0.0016908	0.030937	ZT4
ENSMUSG00000079262	Slco1a6	-0.90	-0.81	14.67	13.77	15.21	14.40	12.24	0.0016914	0.030937	ZT16, ZT4
ENSMUSG00000036225	Kctd1	0.49	0.47	9.16	9.65	9.00	9.47	12.21	0.0017101	0.031206	ZT16, ZT4
ENSMUSG00000054850	6330419J24Rik	-0.36	-0.96	8.06	7.70	7.87	6.92	12.20	0.0017108	0.031206	ZT16
ENSMUSG00000028773	Fabp3	-0.74	-0.69	9.55	8.81	10.05	9.36	12.17	0.0017267	0.031453	ZT16, ZT4
ENSMUSG00000008167	Fbxw9	0.26	0.50	9.94	10.20	9.64	10.14	12.17	0.00173	0.031469	ZT16
ENSMUSG00000038893	Fam117a	0.43	0.03	9.06	9.49	9.26	9.28	12.16	0.0017334	0.031488	ZT4
ENSMUSG00000045555	Mettl24	-0.68	-0.82	6.27	5.59	6.11	5.29	12.15	0.0017397	0.031531	ZT16
ENSMUSG00000042073	Abhd14b	-0.27	-0.24	14.35	14.08	14.34	14.11	12.15	0.0017405	0.031531	ZT16, ZT4
ENSMUSG00000022982	Sod1	-0.24	-0.39	13.61	13.37	13.74	13.34	12.10	0.0017669	0.031965	ZT16
ENSMUSG00000038541	Srd5a2	-1.01	-1.10	8.27	7.26	8.35	7.25	12.09	0.0017747	0.032029	ZT16, ZT4
ENSMUSG00000031161	Hdac6	0.19	0.43	12.45	12.63	12.13	12.55	12.08	0.0017752	0.032029	ZT16
ENSMUSG00000029380	Cxcl1	-0.47	-1.91	6.41	5.94	8.33	6.42	12.07	0.001785	0.032113	ZT16
ENSMUSG00000025082	Vwa2	0.32	0.40	10.72	11.05	10.41	10.81	12.06	0.0017869	0.032113	ZT16
ENSMUSG00000038641	Akr1d1	-0.60	-0.43	12.07	11.46	12.29	11.86	12.06	0.0017871	0.032113	ZT4
ENSMUSG00000039364	Sectm1b	-0.34	-0.32	12.02	11.68	11.90	11.58	12.06	0.0017909	0.032125	ZT16, ZT4
ENSMUSG00000000303	Cdh1	0.36	0.41	13.04	13.41	12.85	13.26	12.05	0.0017926	0.032125	ZT16, ZT4
ENSMUSG00000057286	St6galnac2	-0.40	-0.12	13.24	12.84	13.28	13.16	12.05	0.001796	0.032142	ZT4

ENSMUSG00000020720	Psmid12	-0.36	-0.31	12.55	12.19	12.82	12.51	12.01	0.0018145	0.032429	ZT16, ZT4
ENSMUSG00000002797	Ggct	0.62	0.90	11.95	12.57	11.77	12.67	11.97	0.0018367	0.032781	ZT16
ENSMUSG00000041058	Wwp1	-0.22	-0.31	14.02	13.80	14.14	13.83	11.96	0.0018437	0.032862	ZT16
ENSMUSG00000036138	Acaa1a	-0.16	-0.32	12.61	12.45	12.62	12.30	11.94	0.0018575	0.033063	ZT16
ENSMUSG00000034593	Myo5a	-0.37	-0.46	12.62	12.25	12.99	12.53	11.93	0.0018612	0.033086	ZT16
ENSMUSG00000026103	Gls	0.34	0.38	13.81	14.16	14.00	14.38	11.92	0.0018682	0.033165	ZT16, ZT4
ENSMUSG00000075284	Wipf1	0.60	0.36	9.20	9.80	9.23	9.60	11.91	0.001871	0.033171	ZT4
ENSMUSG00000047496	Rnf152	0.50	0.42	11.46	11.96	11.08	11.50	11.91	0.001876	0.033215	ZT4
ENSMUSG00000037907	Ankrd13b	0.71	0.74	9.51	10.22	8.64	9.38	11.88	0.0018896	0.033411	ZT16, ZT4
ENSMUSG00000031278	Acsl4	-0.06	-0.38	12.00	11.94	12.36	11.98	11.86	0.0019019	0.033585	ZT16
ENSMUSG00000002475	Abhd3	-0.46	-0.34	13.31	12.85	13.55	13.21	11.84	0.0019121	0.033719	ZT4
ENSMUSG00000007950	Abhd8	0.59	0.23	8.59	9.18	8.65	8.88	11.80	0.0019392	0.034152	ZT4
ENSMUSG00000062729	Ppox	0.23	0.31	11.28	11.51	11.10	11.41	11.79	0.0019468	0.034241	ZT16
ENSMUSG00000024803	Ankrd1	-0.51	-0.72	6.76	6.25	7.20	6.48	11.78	0.0019502	0.034255	ZT16
ENSMUSG00000047586	Nccrp1	0.83	0.38	10.13	10.96	10.25	10.63	11.78	0.0019537	0.034271	ZT4
ENSMUSG00000030963	Umod	-0.55	-0.38	18.22	17.66	18.63	18.24	11.75	0.0019674	0.034446	ZT4
ENSMUSG00000043252	Tmem64	0.13	0.42	13.67	13.80	13.61	14.03	11.75	0.0019689	0.034446	ZT16
ENSMUSG00000033767	D930015E06Rik	-0.20	-0.51	9.06	8.86	8.96	8.44	11.75	0.0019715	0.034446	ZT16
ENSMUSG00000095105	Edaradd	0.25	0.84	6.79	7.04	6.27	7.11	11.73	0.0019822	0.034531	ZT16
ENSMUSG00000097061	9330151L19Rik	0.33	0.39	8.92	9.25	8.70	9.09	11.73	0.0019836	0.034531	ZT16
ENSMUSG00000037669	1110057K04Rik	-0.32	-0.23	11.59	11.27	11.84	11.62	11.73	0.0019841	0.034531	ZT4
ENSMUSG00000024866	Acy3	-0.54	-0.35	17.30	16.76	17.35	16.99	11.72	0.0019867	0.034531	ZT4
ENSMUSG00000038704	Aspdh	-0.43	-0.23	12.59	12.16	12.43	12.20	11.71	0.0019921	0.03458	ZT4
ENSMUSG00000007908	Hmgcl1	-0.48	-0.20	7.31	6.83	7.35	7.15	11.70	0.001998	0.034594	ZT4
ENSMUSG00000002769	Gnmt	-0.25	-0.40	10.34	10.09	10.46	10.06	11.70	0.0020004	0.034594	ZT16
ENSMUSG00000029821	Dfna5	-0.37	-0.32	9.32	8.95	9.31	8.98	11.70	0.0020007	0.034594	ZT16, ZT4
ENSMUSG00000002944	Cd36	-0.82	-0.66	15.86	15.04	16.22	15.56	11.69	0.0020048	0.034619	ZT4
ENSMUSG00000075256	Cerkl	0.94	1.47	5.59	6.53	4.73	6.19	11.69	0.0020084	0.034635	ZT16
ENSMUSG00000048772	Tmem53	0.22	0.49	10.11	10.32	9.84	10.33	11.62	0.002054	0.035376	ZT16
ENSMUSG00000035640	Dos	0.59	0.32	7.40	7.99	7.27	7.59	11.58	0.002078	0.035743	ZT4
ENSMUSG00000024663	Rab3il1	-0.40	0.03	11.49	11.09	11.46	11.50	11.56	0.0020915	0.035928	ZT4
ENSMUSG00000032850	Rnft2	0.81	0.98	7.11	7.92	6.03	7.01	11.53	0.002114	0.036269	ZT16
ENSMUSG00000018909	Arrb1	0.48	0.59	12.21	12.69	11.84	12.43	11.51	0.0021227	0.03637	ZT16
ENSMUSG00000090165	Ugt1a10	2.59	1.40	7.14	9.73	8.54	9.94	11.50	0.0021306	0.036459	ZT4

ENSMUSG00000042097	Zfp239	0.33	0.55	8.33	8.66	8.21	8.76	11.49	0.0021372	0.036524	ZT16
ENSMUSG00000030298	Sec13	-0.29	-0.33	12.52	12.22	12.92	12.58	11.48	0.0021439	0.036592	ZT16, ZT4
ENSMUSG00000022353	Mtss1	-0.15	-0.43	12.27	12.11	12.30	11.87	11.44	0.0021705	0.037	ZT16
ENSMUSG00000028024	Enpep	-0.30	-0.35	13.82	13.51	14.05	13.70	11.43	0.0021812	0.037133	ZT16
ENSMUSG00000026728	Vim	-0.33	-0.22	11.65	11.32	11.75	11.54	11.41	0.0021954	0.037328	ZT4
ENSMUSG00000011179	Odc1	-0.71	-0.70	14.47	13.76	14.87	14.17	11.40	0.002201	0.037374	ZT16, ZT4
ENSMUSG00000022437	Samm50	-0.26	-0.25	13.32	13.06	13.52	13.27	11.39	0.0022048	0.037391	ZT16, ZT4
ENSMUSG00000026971	Itgb6	0.00	0.68	13.48	13.48	12.92	13.60	11.39	0.0022113	0.037454	ZT16
ENSMUSG00000058006	Mdn1	-0.37	-0.12	10.94	10.56	11.01	10.89	11.35	0.0022396	0.037885	ZT4
ENSMUSG00000031029	Eif3f	0.53	0.12	11.16	11.69	11.09	11.21	11.34	0.0022472	0.037966	ZT4
ENSMUSG00000039865	Slc44a3	0.30	0.42	9.63	9.92	9.56	9.97	11.31	0.0022684	0.038226	ZT16
ENSMUSG00000021094	Dhrs7	-0.21	-0.47	9.57	9.36	9.87	9.40	11.31	0.0022684	0.038226	ZT16
ENSMUSG00000022415	Syngn1	0.25	0.26	10.05	10.30	9.87	10.13	11.30	0.0022737	0.038267	ZT16, ZT4
ENSMUSG00000026656	Fcgr2b	-0.04	0.37	11.73	11.69	11.22	11.59	11.29	0.0022828	0.038351	ZT16
ENSMUSG00000037263	1700055N04Rik	-0.73	-0.67	7.25	6.53	7.21	6.54	11.28	0.0022845	0.038351	ZT16, ZT4
ENSMUSG00000031024	St5	0.37	0.41	11.21	11.58	10.88	11.29	11.24	0.0023149	0.038812	ZT16, ZT4
ENSMUSG00000019894	Slc6a15	-0.36	-0.52	11.67	11.31	11.96	11.44	11.24	0.002321	0.038867	ZT16
ENSMUSG00000020572	Nampt	-0.48	-0.84	13.72	13.24	14.63	13.79	11.22	0.0023288	0.038947	ZT16
ENSMUSG00000029664	Tfpi2	0.23	0.75	10.89	11.12	10.93	11.68	11.22	0.0023361	0.038996	ZT16
ENSMUSG00000073125	Xlr3b	-0.24	2.57	6.43	6.18	5.63	8.21	11.21	0.0023376	0.038996	ZT16
ENSMUSG00000095300	Gm906	-1.17	-0.99	6.61	5.44	7.23	6.25	11.20	0.0023456	0.039034	ZT4
ENSMUSG00000022636	Alcam	0.26	0.37	11.48	11.74	11.53	11.90	11.20	0.0023457	0.039034	ZT16
ENSMUSG00000035829	Ppp1r26	0.49	0.37	8.01	8.50	7.52	7.88	11.20	0.0023493	0.039044	ZT4
ENSMUSG00000008035	Mid1ip1	-0.17	-0.46	11.33	11.16	11.79	11.33	11.19	0.0023571	0.039124	ZT16
ENSMUSG00000026875	Traf1	-0.46	-0.54	7.17	6.72	7.04	6.50	11.17	0.0023714	0.03928	ZT16
ENSMUSG00000040447	Spns2	0.14	0.34	11.07	11.21	11.29	11.63	11.17	0.0023724	0.03928	ZT16
ENSMUSG00000024014	Pim1	0.58	0.18	7.72	8.30	7.51	7.69	11.12	0.0024109	0.039854	ZT4
ENSMUSG00000030894	Tpp1	-0.31	-0.16	14.57	14.26	14.60	14.44	11.12	0.002413	0.039854	ZT4
ENSMUSG00000096199	Ptrhd1	-0.36	-0.31	12.72	12.35	12.85	12.54	11.10	0.0024221	0.039953	ZT4
ENSMUSG00000025925	Terf1	0.46	0.45	9.51	9.97	9.66	10.11	11.10	0.002429	0.039973	ZT16, ZT4
ENSMUSG00000029432	Gbas	0.36	0.16	12.21	12.57	12.03	12.20	11.09	0.0024301	0.039973	ZT4
ENSMUSG00000047638	Nr1h4	-0.53	-0.51	13.43	12.90	13.73	13.22	11.09	0.0024323	0.039973	ZT16, ZT4
ENSMUSG00000024098	Twsg1	0.27	0.27	12.49	12.76	12.51	12.78	11.07	0.0024493	0.040203	ZT16, ZT4
ENSMUSG00000043300	B3galnt1	0.42	0.32	10.05	10.47	10.00	10.32	11.06	0.002455	0.040216	ZT4

ENSMUSG00000041028	Ghitm	-0.39	-0.32	15.77	15.38	15.98	15.66	11.06	0.0024573	0.040216	ZT4
ENSMUSG00000022325	Pop1	-0.38	-0.30	10.60	10.23	10.53	10.22	11.06	0.0024592	0.040216	ZT4
ENSMUSG00000042406	Atf4	-0.16	-0.42	12.62	12.46	13.26	12.84	11.03	0.0024786	0.040484	ZT16
ENSMUSG00000020086	H2afy2	0.28	0.50	8.69	8.97	8.16	8.67	11.02	0.0024876	0.040489	ZT16
ENSMUSG00000030022	Adamts9	0.13	0.36	10.14	10.27	10.08	10.44	11.02	0.0024889	0.040489	ZT16
ENSMUSG00000061028	Clasrp	0.69	0.17	8.72	9.40	8.80	8.97	11.02	0.0024905	0.040489	ZT4
ENSMUSG00000042453	Reln	-0.59	-0.36	8.46	7.88	8.22	7.86	11.02	0.0024911	0.040489	ZT4
ENSMUSG00000055015	Gm9961	3.63	3.09	1.13	4.75	2.48	5.56	11.00	0.0025095	0.040726	ZT4
ENSMUSG00000020743	Mif4gd	0.37	0.31	11.15	11.52	10.95	11.26	10.99	0.0025118	0.040726	ZT4
ENSMUSG00000029098	Acox3	-0.25	-0.32	14.40	14.16	14.58	14.25	10.99	0.0025156	0.040729	ZT16
ENSMUSG00000025231	Sufu	0.39	0.46	11.61	12.01	11.16	11.62	10.99	0.0025182	0.040729	ZT16
ENSMUSG00000060131	Atp8b4	-0.90	-0.67	8.04	7.14	7.52	6.84	10.98	0.0025241	0.040775	ZT4
ENSMUSG00000072964	Bhlhb9	0.43	0.24	9.36	9.79	9.40	9.64	10.97	0.002531	0.040837	ZT4
ENSMUSG00000049723	Mmp12	-0.75	-0.30	8.22	7.47	7.47	7.17	10.96	0.0025399	0.040931	ZT4
ENSMUSG00000049502	Dtx3l	0.22	0.50	10.31	10.53	9.96	10.46	10.93	0.0025674	0.041324	ZT16
ENSMUSG00000028937	Acot7	-0.24	-0.34	9.46	9.23	9.73	9.38	10.91	0.0025786	0.041455	ZT16
ENSMUSG00000075044	Slc22a29	0.67	0.64	8.86	9.53	8.90	9.54	10.87	0.0026134	0.041963	ZT16, ZT4
ENSMUSG00000020265	Sumo3	0.20	0.36	12.60	12.81	12.24	12.60	10.86	0.0026259	0.042075	ZT16
ENSMUSG00000063268	Parp10	-0.57	-0.30	11.13	10.57	10.56	10.26	10.86	0.0026275	0.042075	ZT4
ENSMUSG00000051495	Irf2bp2	0.47	0.13	11.40	11.86	11.46	11.60	10.85	0.0026299	0.042075	ZT4
ENSMUSG00000048376	F2r	-0.19	-0.37	11.97	11.78	11.82	11.45	10.84	0.0026452	0.042182	ZT16
ENSMUSG00000042436	Mfap4	-0.82	-0.37	7.46	6.64	6.89	6.52	10.84	0.002646	0.042182	ZT4
ENSMUSG00000024041	Cryaa	-1.01	-1.07	6.21	5.20	6.79	5.72	10.84	0.0026461	0.042182	ZT16, ZT4
ENSMUSG00000026638	Irf6	0.20	0.47	12.69	12.88	12.36	12.83	10.82	0.002657	0.042305	ZT16
ENSMUSG00000037989	Wnk2	0.90	0.80	6.48	7.39	5.77	6.57	10.80	0.0026805	0.042627	ZT4
ENSMUSG00000006818	Sod2	-0.14	-0.29	14.25	14.11	14.48	14.18	10.79	0.0026837	0.042628	ZT16
ENSMUSG00000021559	Dapk1	0.78	0.67	11.37	12.15	10.91	11.57	10.79	0.0026883	0.04265	ZT4
ENSMUSG00000042498	D330045A20Rik	0.80	0.75	7.45	8.24	8.00	8.75	10.78	0.002695	0.042705	ZT16, ZT4
ENSMUSG00000040003	Magi2	0.66	0.29	8.86	9.52	8.80	9.09	10.77	0.002702	0.042765	ZT4
ENSMUSG00000030849	Fgfr2	0.33	0.34	10.07	10.40	9.82	10.15	10.77	0.0027071	0.042783	ZT16, ZT4
ENSMUSG00000027894	Slc6a17	0.69	0.80	9.80	10.49	9.25	10.04	10.76	0.0027096	0.042783	ZT16
ENSMUSG00000020882	Cacnb1	0.46	0.53	7.06	7.53	6.54	7.07	10.76	0.0027132	0.042789	ZT16
ENSMUSG00000031004	Mki67	-0.64	0.22	8.63	7.98	8.08	8.29	10.74	0.0027314	0.043025	ZT4
ENSMUSG00000022055	Nefl	-1.20	-1.33	5.92	4.72	5.91	4.58	10.73	0.0027447	0.043145	ZT16

ENSMUSG00000036053	Fmnl2	0.33	0.33	10.14	10.48	10.24	10.56	10.72	0.0027455	0.043145	ZT16, ZT4
ENSMUSG00000029082	Bst1	0.35	0.32	9.26	9.61	9.21	9.53	10.71	0.0027571	0.043276	ZT4
ENSMUSG00000026603	Smyd2	-0.42	-0.51	10.43	10.02	10.70	10.19	10.69	0.0027732	0.043417	ZT16
ENSMUSG00000028132	Tmem56	-0.46	-0.33	11.60	11.14	11.62	11.28	10.69	0.0027778	0.043417	ZT4
ENSMUSG00000071855	Ccdc112	0.57	0.38	7.55	8.12	7.53	7.90	10.69	0.0027785	0.043417	ZT4
ENSMUSG00000023243	Kcnk5	-0.37	-0.69	13.19	12.82	13.66	12.97	10.69	0.0027792	0.043417	ZT16
ENSMUSG00000062397	Zfp706	-0.12	-0.42	13.69	13.57	13.96	13.54	10.67	0.002797	0.043644	ZT16
ENSMUSG00000036368	Rmdn2	0.19	0.48	8.37	8.56	8.31	8.78	10.66	0.0028087	0.043776	ZT16
ENSMUSG00000038497	Tmco3	-0.41	-0.17	12.96	12.55	12.73	12.55	10.65	0.0028162	0.04384	ZT4
ENSMUSG00000040105	Ppapdc2	0.40	0.27	10.89	11.29	10.73	11.00	10.62	0.0028432	0.04421	ZT4
ENSMUSG00000030246	Ldhb	-0.40	-0.39	15.86	15.46	16.15	15.76	10.60	0.0028583	0.044392	ZT16, ZT4
ENSMUSG00000038600	Atp6v0a4	0.26	0.37	13.93	14.20	13.65	14.02	10.59	0.0028715	0.044545	ZT16
ENSMUSG00000018846	Pank3	-0.24	-0.36	13.04	12.80	13.09	12.73	10.59	0.0028765	0.044571	ZT16
ENSMUSG00000042622	Maff	0.21	-1.20	6.92	7.13	7.85	6.64	10.57	0.0028921	0.044676	ZT16
ENSMUSG00000052364	B630019K06Rik	0.53	0.43	6.80	7.32	6.79	7.22	10.57	0.0028921	0.044676	ZT4
ENSMUSG00000038279	Nop2	-0.35	-0.15	11.00	10.65	11.38	11.23	10.57	0.0028934	0.044676	ZT4
ENSMUSG00000090150	Acad11	-0.49	-0.41	14.63	14.14	15.07	14.66	10.56	0.0029042	0.044787	ZT4
ENSMUSG00000004356	Utp20	-0.39	-0.14	11.70	11.31	11.68	11.53	10.55	0.0029074	0.044787	ZT4
ENSMUSG00000062542	Syt9	0.36	0.68	6.60	6.96	6.51	7.19	10.53	0.0029271	0.045014	ZT16
ENSMUSG00000004233	Wars2	0.07	0.40	9.91	9.98	9.54	9.93	10.53	0.0029288	0.045014	ZT16
ENSMUSG00000095930	Nim1	-0.56	-0.29	8.71	8.16	8.25	7.96	10.52	0.0029363	0.045077	ZT4
ENSMUSG00000036989	Trim3	0.29	0.36	10.60	10.89	10.28	10.65	10.52	0.0029446	0.045152	ZT16
ENSMUSG00000030089	Slc41a3	0.63	0.84	7.88	8.51	7.29	8.12	10.50	0.0029597	0.045299	ZT16
ENSMUSG00000022123	Scel	0.26	0.24	9.62	9.87	9.64	9.88	10.50	0.0029611	0.045299	ZT4
ENSMUSG00000060600	Eno3	0.43	0.13	8.02	8.45	8.18	8.31	10.49	0.0029687	0.045346	ZT4
ENSMUSG00000031283	Chrdl1	0.07	0.63	9.95	10.02	9.60	10.23	10.49	0.0029729	0.045346	ZT16
ENSMUSG00000029363	Rfc5	0.27	0.29	8.77	9.04	8.34	8.63	10.48	0.0029772	0.045346	ZT16
ENSMUSG00000038576	Susd4	-0.32	-0.34	8.86	8.54	8.85	8.51	10.48	0.0029778	0.045346	ZT16
ENSMUSG00000029135	Fosl2	0.16	-0.57	9.69	9.85	9.75	9.17	10.47	0.002992	0.045511	ZT16
ENSMUSG00000066058	Cldn19	0.35	0.48	11.00	11.35	10.80	11.28	10.46	0.0030041	0.045524	ZT16
ENSMUSG00000022229	Atp12a	0.76	3.68	5.17	5.93	1.24	4.92	10.46	0.0030045	0.045524	ZT16
ENSMUSG00000024782	Ak3	-0.21	-0.25	14.71	14.50	14.74	14.49	10.46	0.0030052	0.045524	ZT16
ENSMUSG00000024694	Keg1	-0.65	-0.53	17.56	16.91	18.10	17.57	10.45	0.0030066	0.045524	ZT4
ENSMUSG00000005251	Ripk4	-0.14	-0.36	10.44	10.30	10.76	10.39	10.44	0.0030217	0.0457	ZT16

ENSMUSG00000034584	Exp5	0.42	0.82	9.16	9.58	8.86	9.68	10.42	0.0030406	0.045894	ZT16
ENSMUSG00000026343	Gpr39	0.30	0.40	7.76	8.06	8.02	8.42	10.42	0.0030414	0.045894	ZT16
ENSMUSG00000025130	P4hb	-0.35	-0.25	16.07	15.72	16.28	16.03	10.41	0.0030556	0.046008	ZT4
ENSMUSG00000001473	Tubb6	-0.83	-0.45	8.82	8.00	8.94	8.49	10.41	0.0030576	0.046008	ZT4
ENSMUSG00000028940	Hes2	-0.90	-0.54	5.85	4.95	5.42	4.88	10.40	0.0030594	0.046008	ZT4
ENSMUSG00000029192	Tbc1d14	0.14	0.36	12.65	12.79	12.54	12.90	10.39	0.0030729	0.046127	ZT16
ENSMUSG00000026692	Fmo4	0.29	0.39	11.18	11.48	10.72	11.10	10.39	0.0030766	0.046127	ZT16
ENSMUSG00000031910	Has3	0.51	0.38	5.57	6.08	5.30	5.68	10.39	0.0030777	0.046127	ZT4
ENSMUSG00000022550	Adck5	0.35	0.42	10.77	11.12	10.56	10.98	10.37	0.0030977	0.046374	ZT16
ENSMUSG00000032540	Abhd5	-0.33	-0.34	12.07	11.74	12.22	11.88	10.35	0.0031157	0.046509	ZT16
ENSMUSG00000036712	Cyld	-0.24	-0.29	12.24	12.00	12.23	11.94	10.35	0.0031186	0.046509	ZT16
ENSMUSG00000022286	Grhl2	0.35	0.33	8.78	9.13	8.68	9.01	10.35	0.0031207	0.046509	ZT4
ENSMUSG00000038700	Hoxb5	0.74	0.75	8.11	8.85	7.52	8.27	10.34	0.0031239	0.046509	ZT16, ZT4
ENSMUSG00000054708	Ankrd24	0.51	0.33	9.80	10.31	9.53	9.86	10.34	0.0031257	0.046509	ZT4
ENSMUSG00000044231	Nhlrc1	0.36	0.73	7.21	7.56	6.52	7.25	10.34	0.0031302	0.046509	ZT16
ENSMUSG00000005483	Dnajb1	-0.21	-0.57	11.03	10.82	12.24	11.68	10.34	0.0031312	0.046509	ZT16
ENSMUSG00000054422	Fabp1	-1.49	-0.74	5.81	4.32	7.12	6.38	10.32	0.003144	0.046577	ZT4
ENSMUSG00000000049	Apoh	0.80	0.77	10.15	10.96	10.38	11.15	10.32	0.003153	0.046577	ZT4
ENSMUSG00000024857	Cabp2	0.66	1.26	4.84	5.51	4.58	5.84	10.31	0.0031558	0.046577	ZT16
ENSMUSG00000044647	Csrnp3	0.04	0.75	8.30	8.34	7.62	8.37	10.31	0.0031566	0.046577	ZT16
ENSMUSG00000024747	Aldh1a7	-0.67	-0.53	10.08	9.41	10.69	10.16	10.31	0.0031584	0.046577	ZT4
ENSMUSG00000018821	Avpi1	-0.29	-0.30	9.24	8.95	9.35	9.05	10.31	0.0031602	0.046577	ZT16
ENSMUSG00000090698	Apold1	0.12	-0.99	7.32	7.45	7.81	6.81	10.31	0.0031603	0.046577	ZT16
ENSMUSG00000044864	Ankrd50	0.30	0.39	10.45	10.75	9.82	10.21	10.30	0.0031677	0.046633	ZT16
ENSMUSG00000003477	Inmt	-0.97	-1.23	16.20	15.23	17.01	15.78	10.30	0.0031744	0.046681	ZT16
ENSMUSG00000029238	Clock	0.11	0.40	12.19	12.30	12.37	12.77	10.29	0.0031785	0.046686	ZT16
ENSMUSG00000019433	Gipc1	0.22	0.26	11.02	11.23	10.89	11.15	10.29	0.0031824	0.046686	ZT16
ENSMUSG00000039304	Tnfsf10	-0.55	-0.44	12.20	11.65	12.12	11.69	10.29	0.0031853	0.046686	ZT4
ENSMUSG00000038633	Degs1	-0.34	-0.23	14.24	13.90	14.36	14.13	10.26	0.0032135	0.047047	ZT4
ENSMUSG00000003518	Dusp3	-0.39	-0.23	12.44	12.05	12.52	12.29	10.25	0.0032256	0.047162	ZT4
ENSMUSG00000026566	Mpzl1	0.28	0.29	10.54	10.82	10.14	10.42	10.25	0.0032284	0.047162	ZT16
ENSMUSG00000028378	Ptgr1	-0.42	-0.89	10.29	9.87	10.85	9.96	10.24	0.0032341	0.047194	ZT16
ENSMUSG00000002083	Bbc3	0.97	0.37	5.63	6.60	5.03	5.40	10.24	0.0032408	0.047239	ZT4
ENSMUSG00000027478	Dnmt3b	0.95	0.42	6.75	7.70	6.53	6.95	10.22	0.0032547	0.047389	ZT4

ENSMUSG00000038260	Trpm4	0.55	0.36	8.56	9.11	8.13	8.50	10.22	0.0032611	0.047389	ZT4
ENSMUSG00000073295	Nudt11	0.63	0.34	6.95	7.58	6.90	7.25	10.22	0.0032618	0.047389	ZT4
ENSMUSG00000028977	Casz1	0.87	0.46	8.83	9.70	8.58	9.05	10.21	0.0032658	0.047395	ZT4
ENSMUSG00000071178	Serpina1b	-1.17	-1.01	8.79	7.62	9.15	8.14	10.20	0.0032793	0.047539	ZT4
ENSMUSG00000048905	4930539E08Rik	0.28	1.20	6.74	7.02	4.65	5.85	10.20	0.0032837	0.04755	ZT16
ENSMUSG00000031090	Nadsyn1	-0.28	-0.23	11.16	10.88	11.32	11.08	10.18	0.0032978	0.047703	ZT4
ENSMUSG00000074215	Gm10643	0.45	0.26	6.27	6.72	6.10	6.36	10.17	0.0033103	0.047833	ZT4
ENSMUSG00000042817	Flt3	-0.95	-0.31	6.29	5.33	6.00	5.68	10.17	0.0033183	0.047845	ZT4
ENSMUSG00000033533	Acsn1	0.34	0.45	13.72	14.06	13.91	14.36	10.17	0.0033185	0.047845	ZT16
ENSMUSG00000008305	Tle1	0.33	0.25	9.08	9.41	9.14	9.40	10.16	0.003322	0.047845	ZT4
ENSMUSG00000024462	Gabbr1	0.56	0.25	10.16	10.72	9.87	10.13	10.14	0.0033525	0.048231	ZT4
ENSMUSG00000022468	Endou	0.38	0.89	7.25	7.63	6.21	7.10	10.13	0.0033617	0.048312	ZT16
ENSMUSG00000026547	Tagln2	-0.12	-0.27	12.55	12.42	12.87	12.60	10.11	0.0033795	0.048468	ZT16
ENSMUSG00000017453	Pipox	-0.50	-0.47	15.00	14.49	15.36	14.89	10.11	0.0033799	0.048468	ZT4
ENSMUSG00000045672	Col27a1	-0.33	-0.97	10.74	10.41	11.44	10.47	10.10	0.0033943	0.048622	ZT16
ENSMUSG00000034957	Cebpa	0.49	0.17	9.36	9.85	9.51	9.68	10.09	0.0034134	0.048843	ZT4
ENSMUSG00000028559	Osbpl9	-0.33	-0.46	14.39	14.06	14.91	14.45	10.06	0.0034407	0.049181	ZT16
ENSMUSG00000050100	Hmx2	0.70	0.16	8.11	8.81	8.11	8.27	10.05	0.0034605	0.04938	ZT4
ENSMUSG00000021186	Fbln5	-0.15	-0.30	13.45	13.30	13.39	13.09	10.04	0.0034639	0.04938	ZT16
ENSMUSG00000056487	Mettl7a2	-0.20	-0.49	11.74	11.54	11.91	11.42	10.04	0.0034658	0.04938	ZT16
ENSMUSG00000033902	Mapkbp1	0.62	0.64	9.72	10.33	9.28	9.92	10.04	0.0034695	0.049381	ZT16
ENSMUSG00000033653	Vps8	-0.39	-0.22	11.96	11.57	11.95	11.72	10.03	0.0034833	0.049523	ZT4

Supplemental Table 5. GO Biological processes significantly enriched in cKO mice (differentially expressed genes).

Description	GO ID	P-value	Enrichment Factor	ZT time	Genes
oxoacid metabolic process	GO:0043436	5.20E-19	3.38	ZT4, ZT16	Hpgds, Ppard, Scd1, Marc1, Slc22a5, Acot1, Cyp4a10, Tha1, Cyp4f14, Acadl, Cyp2e1, Lipa, Arg2, Ahcy, Crat, Cpt2, Nox4, Hkdc1, Azin1, Cpt1a, Ftcd, Aacs, Hao2, Acsl3, Asl, Ephx2, Bhmt, Ankrd23, Enpp1, Pecer, Gulo, Aspa, Ddc, Phyh, Agxt2, Suox, Prkag3, Cyp2d12, Hs6st2, Gls, Glud1, Slc27a2, Slco1a6, Amt, Ltc4s, Cyp2d22, Abcd3, Ccbl1, Pah, Nr1h4, Cyp4a31, Ghr, Amdhd1, Pla2g5, Acy1, Angptl3, Cyp2j13, Dmgdh, Ces1d, Ldhb, Aldh9a1, Ggt1, Bhmt2, Ehhadh, Folh1, Acaa1b, Odc1, Cyp2a5, Cyp2a4
organic acid metabolic process	GO:0006082	1.64E-18	3.31	ZT4, ZT16	Hpgds, Ppard, Scd1, Slc22a5, Cyp4a10, Acot1, Tha1, Cyp4f14, Acadl, Cyp2e1, Lipa, Arg2, Ahcy, Crat, Cpt2, Nox4, Cpt1a, Hkdc1, Azin1, Ftcd, Aacs, Hao2, Acsl3, Ephx2, Asl, Bhmt, Ankrd23, Pecer, Aspa, Gulo, Phyh, Ddc, Agxt2, Prkag3, Cyp2d12, Gls, Glud1, Slc27a2, Slco1a6, Ltc4s, Amt, Cyp2d22, Abcd3, Ccbl1, Pah, Nr1h4, Cyp4a31, Ghr, Amdhd1, Pla2g5, Acy1, Angptl3, Cyp2j13, Dmgdh, Ces1d, Ldhb, Ggt1, Aldh9a1, Bhmt2, Ehhadh, Folh1, Acaa1b, Odc1, Cyp2a5, Cyp2a4
carboxylic acid metabolic process	GO:0019752	3.57E-18	3.42	ZT4, ZT16	Odc1, Cyp2a5, Cyp2a4

cellular lipid metabolic process	GO:0044255	5.95E-16	3.27	ZT4, ZT16	Hpgds, B4galt6, Ppard, Scd1, Cyp4a10, Acot1, Pi4ka, Lpcat3, Cyp4f14, Acadl, Cyp2e1, Lipa, Crat, Apoc3, Cpt2, Idi1, Pi4k2a, Cpt1a, Retsat, Aacs, Hao2, Acsl3, Ephx2, Aldh3a2, Psap, Mttp, Ankrd23, Pecr, Phyh, Naga, Prkag3, Cyp2d12, Gm2a, Bcml1, Chpt1, Slc27a2, Csf1r, Dgkh, Ltc4s, Cyp2d22, Abcd3, Ttr, Apob, Pla2g7, Cyp4a31, Cat, Ghr, Pla2g5, Cds1, Degs2, Angptl3, Cyp2j13, Ces1d, Mboat1, Ggt1, Pld2, Ehhadh, Acaa1b, Cyp2a5, Cyp2a4
monocarboxylic acid metabolic process	GO:0032787	1.54E-14	3.81	ZT4, ZT16	Hpgds, Ppard, Scd1, Slc22a5, Prkag3, Cyp2d12, Acot1, Cyp4a10, Cyp4f14, Acadl, Cyp2e1, Lipa, Slc27a2, Crat, Cpt2, Slco1a6, Ltc4s, Cyp2d22, Hkdc1, Cpt1a, Abcd3, Ccbl1, Nr1h4, Aacs, Cyp4a31, Hao2, Ghr, Pla2g5, Acsl3, Ephx2, Angptl3, Cyp2j13, Ankrd23, Ces1d, Ldhd, Aldh9a1, Ggt1, Pecr, Aspa, Ehhadh, Phyh, Acaa1b, Agxt2, Cyp2a5, Cyp2a4
fatty acid metabolic process	GO:0006631	3.83E-14	4.53	ZT4, ZT16	Hpgds, Ppard, Scd1, Prkag3, Cyp2d12, Cyp4a10, Acot1, Cyp4f14, Cyp2e1, Acadl, Lipa, Slc27a2, Crat, Cpt2, Ltc4s, Cyp2d22, Cpt1a, Abcd3, Aacs, Cyp4a31, Hao2, Ghr, Pla2g5, Acsl3, Ephx2, Angptl3, Ankrd23, Cyp2j13, Ces1d, Ggt1, Pecr, Ehhadh, Phyh, Acaa1b, Cyp2a5, Cyp2a4
chemical homeostasis	GO:0048878	3.59E-12	2.8	ZT4, ZT16	Slc22a17, Cldn1, Nr1d2, Scd1, Cyp27b1, Agt, Neo1, Acadl, Slc4a5, Apoc3, Aqp1, Slc34a2, Hkdc1, Slc9a3r1, Aqp8, Ttpa, Chrna7, Aacs, Cp, Slc39a5, Ccl28, F2, Pde6a, Herpud1, Ephx2, Hmox1, Mttp, Slc16a1, Psen1, Stc2, Cftr, Pygl, Slc4a9, Fabp3, Sox4, Enpp1, Angptl4, Chp1, Steap2, Prnp, Napsa, Avpr1a, Slco1a6, Fkbp1b, Grina, Aqp11, Anxa7, Tmprss13, Sfn, Apob, Cdh1, Cry1, Angptl3, Car14, Camk2d, Ank2
organic hydroxy compound metabolic process	GO:1901615	5.13E-12	3.85	ZT4, ZT16	Cyp27b1, Slc22a5, Cyp4a10, Chpt1, Miox, Acadl, Lipa, Sord, Slc27a2, Crat, Apoc3, Slco1a6, Cyp2d22, Sqle, Cpt1a, Ttr, Retsat, Ttpa, Nr1h4, Apob, Pnpo, Cyp4a31, Cat, Hao2, Pla2g5, Cyp27a1, Aldh3a2, Degs2, Mttp, Angptl3, Cftr, Ldhd, Aldh9a1, Pecr, Cyp24a1, Ddc

organic anion transport	GO:0015711	6.16E-12	4.13	ZT4, ZT16	Slc2a2, Slc2a1, Slc22a17, Abca4, Slc22a5, Abcc3, Slc7a12, Abca13, Slc5a6, Slc22a8, Slc4a5, Slc27a2, Atp10b, Slc7a13, Plin2, Abcd3, Slc9a3r1, Aqp8, Slco3a1, Slc22a29, Pla2g5, Acsl3, Slc22a26, Slc25a42, Bdnf, Psen1, Cftr, Slc16a1, Slc4a9, Fabp3, Slc38a3, Slc51a, Slc10a2
anion transport	GO:0006820	4.37E-10	3.29	ZT4, ZT16	Slc2a2, Slc2a1, Slc22a17, Abca4, Slc22a5, Abcc3, Slc7a12, Slc5a6, Slc20a2, Abca13, Slc27a2, Slc22a8, Slc4a5, Atp10b, Slc7a13, Plin2, Abcd3, Slc34a2, Slc9a3r1, Aqp8, Slco3a1, Slc22a29, Pla2g5, Slc22a26, Acsl3, Slc25a42, Bdnf, Cftr, Psen1, Slc16a1, Slc4a9, Fabp3, Enpp1, Slc38a3, Slc51a, Slc10a2
protein activation cascade	GO:0072376	2.52E-08	8.99	ZT4, ZT16	C4b, Cfi, Masp2, Fga, Mbl1, Cd55, Fgg, C2, Cr2, C8a, Fgb Apob, Pla2g7, Cyp4a31, Cyp27b1, Cyp4a10, Gm2a, Pla2g5, Acadl, Lipa, Hsd11b1, Slc27a2, Srd5a2, Angptl3, Apoc3, Ces1d, Ddhd1, Pld2, Abcd3, Ehhadh, Phyh, Naga, Nceh1
lipid catabolic process	GO:0016042	3.70E-08	4	ZT4, ZT16	Slc22a5, Abcc3, Slc5a6, Pla2g5, Acsl3, Slc27a2, Slc16a1, Fabp3, Plin2, Abcd3, Slc9a3r1, Aqp8, Slco3a1, Slc51a, Slc10a2
monocarboxylic acid transport	GO:0015718	4.09E-08	5.82	ZT4, ZT16	Cyp4a31, Cyp2d12, Cyp4a10, Acot1, Cyp4f14, Acsl3, Ephx2, Cyp2e1, Acadl, Slc27a2, Cyp2j13, Cyp2d22, Cpt1a, Cyp2a5, Cyp2a4
long-chain fatty acid metabolic process	GO:0001676	4.69E-08	5.76	ZT4, ZT16	Pah, Ghr, Tha1, Amdhd1, Glc, Asl, Glud1, Bhmt, Arg2, Ahcy, Amt, Dmgdh, Ggt1, Bhmt2, Nox4, Ccbl1, Azin1, Folh1, Agxt2, Odc1, Ftc
alpha-amino acid metabolic process	GO:1901605	5.14E-08	4.09	ZT4, ZT16	Hpgds, Scd1, Cyp27b1, Prkag3, Tha1, Chpt1, Glc, Glud1, Slc27a2, Ahcy, Ltc4s, Abcd3, Pah, Pnpo, Adck3, Pla2g5, Acsl3, Cyp27a1, Asl, Bhmt, Cftr, Ldhd, Ggt1, Pecr, Bhmt2, Gulo, Agxt2
small molecule biosynthetic process	GO:0044283	6.87E-08	3.29	ZT4, ZT16	Pah, Cyp4a31, Cyp27b1, Cyp4a10, Amdhd1, Tha1, Miox, Glc, Acadl, Glud1, Sord, Arg2, Slc27a2, Ahcy, Ces1d, Amt, Abcd3, Ehhadh, Phyh, Agxt2, Ftc
small molecule catabolic process	GO:0044282	8.64E-08	3.97	ZT4, ZT16	Pah, Cyp4a31, Cyp4a10, Amdhd1, Tha1, Glc, Acadl, Glud1, Arg2, Slc27a2, Ahcy, Ces1d, Amt, Abcd3, Ehhadh, Phyh, Agxt2, Ftc
organic acid catabolic process	GO:0016054	1.14E-07	4.49	ZT4, ZT16	Pah, Cyp4a31, Cyp4a10, Amdhd1, Tha1, Glc, Acadl, Glud1, Arg2, Slc27a2, Ahcy, Ces1d, Amt, Abcd3, Ehhadh, Phyh, Agxt2, Ftc
carboxylic acid catabolic process	GO:0046395	1.14E-07	4.49	ZT4, ZT16	Slc27a2, Ahcy, Ces1d, Amt, Abcd3, Ehhadh, Phyh, Agxt2, Ftc

cellular chemical homeostasis	GO:0055082	1.65E-07	2.76	ZT4, ZT16	Prnp, Agt, Slc4a5, Avpr1a, Apoc3, Aqp1, Fkbp1b, Hkdc1, Slc34a2, Grina, Slc9a3r1, Aqp11, Aqp8, Anxa7, Ttpa, Chrna7, Aacs, Cp, Slc39a5, Ccl28, F2, Pde6a, Herpud1, Hmox1, Cftr, Stc2, Psen1, Slc4a9, Enpp1, Sox4, Chp1, Camk2d, Ank2
unsaturated fatty acid metabolic process	GO:0033559	1.71E-07	5.24	ZT4, ZT16	Hpgds, Scd1, Cyp4a31, Cyp2d12, Cyp4a10, Cyp4f14, Pla2g5, Cyp2e1, Ephx2, Cyp2j13, Ltc4s, Ggt1, Cyp2d22, Cyp2a5, Cyp2a4 Pah, Hpgds, Scd1, Prkag3, Tha1, Pla2g5, Acsl3, Gls, Asl, Glud1, Bhmt, Slc27a2, Ahcy, Ltc4s, Ldhd, Ggt1, Bhmt2, Pecr, Gulo, Abcd3, Agxt2
organic acid biosynthetic process	GO:0016053	2.30E-07	3.75	ZT4, ZT16	Pah, Hpgds, Scd1, Prkag3, Tha1, Pla2g5, Acsl3, Gls, Asl, Glud1, Bhmt, Slc27a2, Ahcy, Ltc4s, Ldhd, Ggt1, Bhmt2, Pecr, Gulo, Abcd3, Agxt2
carboxylic acid biosynthetic process	GO:0046394	2.30E-07	3.75	ZT4, ZT16	Slc22a5, Abcc3, Slc7a12, Slc5a6, Pla2g5, Acsl3, Slc27a2, Bdnf, Psen1, Slc7a13, Slc16a1, Fabp3, Plin2, Abcd3, Slc9a3r1, Slc38a3, Aqp8, Slco3a1, Slc51a, Slc10a2
carboxylic acid transport	GO:0046942	3.04E-07	3.84	ZT4, ZT16	1300002K09Rik, Apob, Abca4, Abcc3, Abca13, Pla2g5, Acsl3, Slc27a2, Mttp, Apoc3, Atp10b, Cftr, Fabp3, Plin2, Abcd3, Slc9a3r1, Aqp8, Slco3a1, Slc51a, Slc10a2
lipid transport	GO:0006869	3.58E-07	3.8	ZT4, ZT16	Slc9a3r1, Aqp8, Slco3a1, Slc51a, Slc10a2
organic acid transport	GO:0015849	3.58E-07	3.8	ZT4, ZT16	Slc22a5, Abcc3, Slc7a12, Slc5a6, Pla2g5, Acsl3, Slc27a2, Bdnf, Psen1, Slc7a13, Slc16a1, Fabp3, Plin2, Abcd3, Slc9a3r1, Slc38a3, Aqp8, Slco3a1, Slc51a, Slc10a2
cellular amino acid metabolic process	GO:0006520	4.22E-07	3.37	ZT4, ZT16	Pah, Ghr, Amdhd1, Tha1, Gls, Asl, Glud1, Bhmt, Acy1, Arg2, Ahcy, Amt, Dmgdh, Ggt1, Bhmt2, Nox4, Azin1, Ddc, Ccbl1, Folh1, Agxt2, Odc1, Ftcd
amino-acid betaine metabolic process	GO:0006577	4.46E-07	17.72	ZT4, ZT16	Crat, Slc22a5, Aldh9a1, Cpt1a, Acadl, Bhmt
ion homeostasis	GO:0050801	7.40E-07	2.54	ZT4, ZT16	Prnp, Slc22a17, Cyp27b1, Agt, Neo1, Slc4a5, Avpr1a, Fkbp1b, Slc34a2, Grina, Slc9a3r1, Anxa7, Aqp11, Ttpa, Chrna7, Cp, Slc39a5, Ccl28, F2, Pde6a, Herpud1, Hmox1, Angptl3, Cftr, Stc2, Psen1, Slc4a9, Fabp3, Enpp1, Car14, Chp1, Camk2d, Ank2, Steap2 Nr1h4, Apob, Scd1, Cat, Cyp27b1, Hsd3b3, Cyp27a1, Cyp2e1, Lipa, Hsd11b1, Slc27a2, Srd5a2, Mttp, Angptl3, Apoc3, Cftr, Slco1a6, Sqle, Cyp24a1
steroid metabolic process	GO:0008202	7.64E-07	3.78	ZT4, ZT16	

vitamin metabolic process	GO:0006766	1.62E-06	7.85	ZT4, ZT16	Ppard, Pnpo, Cyp27b1, Gulo, Cyp24a1, Cbr1, Cyp27a1, Acpp, Ttpa, Prnp, Slc22a17, Cyp27b1, Agt, Neo1, Slc4a5, Avpr1a, Fkbp1b, Slc34a2, Grina, Slc9a3r1, Anxa7, Aqp11, Ttpa, Chrna7, Cp, Slc39a5, Ccl28, F2, Pde6a, Herpud1, Hmox1, Cftr, Psen1, Stc2,
inorganic ion homeostasis	GO:0098771	2.15E-06	2.5	ZT4, ZT16	Slc4a9, Enpp1, Car14, Chp1, Camk2d, Steap2, Ank2 Slc2a2, Slc2a1, 1300002K09Rik, Slc22a17, Abca4, Cyp27b1, Slc22a5, Lin7a, Slc20a2, Serpina7, Spag9, Slc22a8, Slc4a5, Apoc3, Aqp1, Rab11fip1, Slc34a2, Abcb1b, Aqp8, Abcb1a, Ttpa, Chrna7, Map1b, Slc39a5, Acsl3, Pigr, Tspan1, Mtth, Slc16a1, Cftr, Psen1, Fabp3, Enpp1, Kcnp2, Ddc, Chp1, Slc10a2, Slc45a3, Slc2a5, Slc46a3, Prkag3, Abcc3, Slc27a2, Slc7a13, Fgg, Gle1, Plin2, Abcd3, Ccnd1, Aqp11, Apob, Pla2g5, Hrg, Slc25a42, Car14, Pld2, Unc13c, Prickle1, Cadps2, Slc38a3, Slc25a33, Prss8, Agt, Slc7a12, Abca13, Slc5a6, Atp10b, Pi4k2a, Slc9a3r1, Sort1, Gria3, Cp, Herpud1, Bdnf, Grid1, Slc4a9, Tnfaip2, Slc51a, Steap2, Fgfr2, Prlr, Cd302, Trpm3, Slco1a6, Gjb2, Fkbp1b, Nlrc4, Ttr, Sec13, Slco3a1, Slc22a29,
single-organism transport	GO:0044765	2.47E-06	1.58	ZT4, ZT16	Slc22a26, Samm50, Syng1, Camk2d, Slc23a3, Rasgrp1, Ank2, 1300002K09Rik, Apob, Abca4, Slc22a5, Abcc3, Abca13, Slc16a1,
organic hydroxy compound transport	GO:0015850	2.70E-06	4.52	ZT4, ZT16	Cftr, Psen1, Aqp1, Slc9a3r1, Aqp8, Slc51a, Slc10a2, Hpgds, Cyp4a31, Cyp4a10, Cyp2d12, Cyp4f14, Pla2g5, Cyp2e1,
icosanoid metabolic process	GO:0006690	3.44E-06	4.75	ZT4, ZT16	Cyp2j13, Ltc4s, Cyp2d22, Ggt1, Cyp2a5, Cyp2a4
regulation of cellular response to oxidative stress	GO:1900407	1.28E-06	12.63	ZT16	Fbln5, Sod2, Sod1, Nr4a3, Hsph1, Hdac6, Atf4
regulation of response to oxidative stress	GO:1902882	2.09E-06	11.78	ZT16	Fbln5, Sod2, Sod1, Nr4a3, Hsph1, Hdac6, Atf4

Supplemental Table 6. Plasma metabolome data: Control vs cKO mice.

Amino acids & Biogenic amines (μM)

	Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=5)		p (t-test)
	mean	SD	mean	SD		mean	SD	mean	SD	
Ala	289.50	105.73	318.50	76.25	NS	274.83	60.77	349.90	105.80	NS
Arg	64.98	36.65	76.90	20.18	NS	56.92	7.19	94.47	10.86	7E-05
Asn	27.52	14.83	23.45	3.54	NS	22.90	9.59	22.45	4.36	NS
Asp	0.09	0.22	0.03	0.08	NS	0.86	1.13	1.09	1.20	NS
Cit	65.03	25.38	92.15	20.60	NS	64.10	23.08	62.33	8.10	NS
Gln	650.17	149.41	521.67	87.44	NS	650.33	204.01	657.60	112.06	NS
Glu	48.50	9.54	81.52	21.40	0.0062	46.73	9.08	61.13	14.21	NS
Gly	248.00	63.07	232.50	58.85	NS	213.50	51.88	210.50	91.68	NS
His	61.57	8.48	63.32	3.61	NS	58.03	7.43	69.75	13.38	NS
Ile	80.00	26.29	84.98	16.67	NS	72.02	17.38	68.53	18.03	NS
Leu	134.98	46.68	145.50	24.69	NS	118.98	26.55	125.31	32.80	NS
Lys	290.17	46.90	308.17	67.97	NS	218.17	65.14	269.20	54.33	NS
Met	47.05	10.68	44.23	7.98	NS	39.28	5.92	56.01	14.59	0.0294
Orn	93.57	44.68	86.95	17.90	NS	63.72	18.46	66.16	13.08	NS
Phe	65.58	17.39	64.28	5.99	NS	67.15	6.44	65.10	13.95	NS
Pro	88.90	32.20	90.85	21.08	NS	91.25	19.17	99.90	27.76	NS
Ser	115.92	43.36	122.48	34.47	NS	124.35	71.31	110.80	32.53	NS
Thr	109.75	24.73	100.33	25.39	NS	109.12	18.65	115.89	15.35	NS
Trp	69.47	20.05	62.88	20.79	NS	79.50	17.81	60.60	21.12	NS
Tyr	87.22	23.88	91.85	9.01	NS	59.53	12.40	70.60	23.58	NS
Val	249.83	102.55	251.33	24.89	NS	259.33	24.20	260.30	59.04	NS
Ac-Orn	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
ADMA	0.89	0.20	0.91	0.18	NS	0.55	0.13	0.79	0.14	0.0145
alpha-AAA	12.41	2.93	13.67	2.80	NS	9.52	4.42	9.20	6.05	NS
c4-OH-Pro	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
Carnosine	0.79	0.16	0.90	0.20	NS	0.72	0.05	0.91	0.16	0.0226
Creatinine	14.85	2.20	22.77	2.01	7E-05	13.03	1.05	21.90	3.13	0.0001
DOPA	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
Dopamine	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
Histamine	0.28	0.11	0.30	0.13	NS	0.21	0.07	0.21	0.09	NS
Kynurenine	0.23	0.12	0.49	0.29	NS	0.46	0.13	0.51	0.15	NS
Met-SO	2.36	0.81	2.47	0.70	NS	3.85	0.97	4.61	1.23	NS
Nitro-Tyr	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
PEA	0.00	0.00	0.00	0.00	NS	0.00	0.00	0.00	0.00	NS
Putrescine	0.63	0.24	0.76	0.39	NS	0.39	0.16	0.29	0.14	NS
SDMA	0.16	0.38	0.59	0.46	NS	0.14	0.34	0.00	0.00	NS
Serotonin	1.21	1.98	0.59	0.27	NS	0.98	0.44	0.70	0.13	NS
Spermidine	0.52	0.21	0.62	0.15	NS	0.38	0.05	0.36	0.05	NS
Spermine	0.17	0.01	0.18	0.02	NS	0.16	0.01	0.16	0.01	NS
t4-OH-Pro	18.38	7.03	18.65	3.34	NS	24.80	8.95	27.14	4.55	NS

Taurine	309.50	47.94	339.67	38.56	NS	257.17	22.41	308.40	40.35	0.0255
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Acylcarnitines (μM)

	Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=5)		p (t-test)
	mean	SD	mean	SD		mean	SD	mean	SD	
C0	18.6250	2.2475	10.0018	1.7913	2E-05	15.4867	2.9145	8.8401	1.8097	0.0017
C2	4.7788	2.2256	2.8003	1.0550	NS	3.3960	1.3358	1.9407	0.6766	NS
C3	0.1679	0.0799	0.0980	0.0303	NS	0.1746	0.0748	0.0778	0.0212	0.0214
C3:1	0.0138	0.0028	0.0126	0.0012	NS	0.0132	0.0019	0.0128	0.0012	NS
C3-DC	0.0821	0.0144	0.0692	0.0098	NS	0.0683	0.0094	0.0694	0.009	NS
C3-OH	0.0202	0.0014	0.0199	0.0015	NS	0.0200	0.0024	0.0208	0.0021	NS
C4	0.1510	0.067	0.0916	0.020	NS	0.1306	0.0602	0.0782	0.021	NS
C4:1	0.0389	0.0113	0.0367	0.0103	NS	0.0335	0.0066	0.0357	0.0028	NS
C5	0.0887	0.0337	0.0608	0.0124	NS	0.0800	0.0150	0.0601	0.0134	0.0471
C5:1	0.0335	0.0072	0.031	0.0023	NS	0.0312	0.0046	0.0343	0.0037	NS
C5:1-DC	0.0109	0.0019	0.0102	0.0014	NS	0.0081	0.0017	0.0099	0.0017	NS
C5-DC	0.0139	0.003	0.0169	0.0049	NS	0.0160	0.0020	0.0153	0.0032	NS
C5-M-DC	0.0310	0.0018	0.0328	0.002	NS	0.0320	0.0015	0.0332	0.0033	NS
C5-OH	0.0587	0.0062	0.0531	0.0042	NS	0.0523	0.0067	0.0492	0.0061	NS
C6	0.0453	0.0049	0.0451	0.0057	NS	0.0406	0.0041	0.0436	0.0051	NS
C6:1	0.0303	0.0033	0.0296	0.0047	NS	0.0268	0.0012	0.0336	0.0013	8E-06
C7-DC	0.0093	0.0016	0.0112	0.0016	NS	0.0106	0.0013	0.0111	0.003	NS
C8	0.1161	0.0093	0.1179	0.0115	NS	0.1017	0.0074	0.114	0.0114	NS
C9	0.0195	0.0033	0.0210	0.0025	NS	0.0183	0.0027	0.0201	0.0014	NS
C10	0.1389	0.0334	0.1260	0.0310	NS	0.1204	0.0138	0.1343	0.0177	NS
C10:1	0.0409	0.0046	0.0385	0.0058	NS	0.0368	0.007	0.0407	0.0057	NS
C10:2	0.0438	0.0055	0.0463	0.0038	NS	0.0443	0.0034	0.0472	0.0036	NS
C12	0.0401	0.0053	0.0397	0.0083	NS	0.0360	0.002	0.0353	0.0032	NS
C12:1	0.0408	0.0063	0.0411	0.0087	NS	0.0405	0.0056	0.0443	0.0061	NS
C12-DC	0.0894	0.0049	0.0918	0.0063	NS	0.0884	0.0042	0.0908	0.0024	NS
C14	0.0334	0.0137	0.0298	0.0097	NS	0.0197	0.0021	0.0174	0.001	NS
C14:1	0.0425	0.0068	0.0423	0.0065	NS	0.0297	0.0038	0.0353	0.0013	0.0115
C14:1-OH	0.0107	0.0019	0.0095	0.0019	NS	0.0076	0.0013	0.008	0.001	NS
C14:2	0.0085	0.0024	0.0073	0.0021	NS	0.0052	0.0006	0.0059	0.0009	NS
C14:2-OH	0.0113	0.0020	0.0114	0.0009	NS	0.0107	0.0011	0.0105	0.0005	NS
C16	0.1096	0.0469	0.0961	0.0355	NS	0.0541	0.0091	0.0463	0.0055	NS
C16:1	0.0408	0.0120	0.0399	0.0115	NS	0.0282	0.0012	0.0277	0.0024	NS
C16:1-OH	0.0074	0.0017	0.0073	0.0013	NS	0.0051	0.0008	0.0051	0.0004	NS
C16:2	0.0077	0.0027	0.0080	0.0021	NS	0.0054	0.0006	0.0054	0.0006	NS
C16:2-OH	0.0097	0.0010	0.0099	0.0015	NS	0.0093	0.0015	0.01	0.0011	NS
C16-OH	0.0130	0.0009	0.0117	0.0017	NS	0.0123	0.0024	0.0118	0.0015	NS
C18	0.0333	0.0076	0.0327	0.0075	NS	0.022	0.004	0.026	0.003	NS
C18:1	0.0914	0.0449	0.0894	0.0365	NS	0.0402	0.0076	0.0393	0.0045	NS
C18:1-OH	0.0148	0.0034	0.0149	0.0026	NS	0.0116	0.0027	0.0114	0.0007	NS
C18:2	0.0375	0.0199	0.0324	0.0107	NS	0.0162	0.0028	0.016	0.0031	NS

Lysophosphatidylcholines (μM)

	Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=6)		p (t-test)
	mean	SD	mean	SD		mean	SD	mean	SD	
lysoPC a										
C14:0	2.7752	0.2097	2.8368	0.2043	NS	2.531	0.1742	2.5193	0.1419	NS
lysoPC a										
C16:0	227.17	26.992	202	26.015	NS	213.5	24.761	204.3	15.007	NS
lysoPC a										
C16:1	5.6563	2.0782	4.0555	1.2966	NS	4.007	0.9617	2.6472	0.8135	0.034
lysoPC a										
C17:0	4.1055	0.6568	3.9348	0.7215	NS	4.0232	0.4172	4.1439	0.2903	NS
lysoPC a										
C18:0	79.905	7.2309	82.847	4.7755	NS	80.228	4.9004	86.032	4.6575	NS
lysoPC a										
C18:1	51.647	13.601	44.482	11.101	NS	39.065	5.6918	36.414	6.441	NS
lysoPC a										
C18:2	134.67	21.824	137.17	8.9088	NS	118	13.968	159.3	23.35	0.005
lysoPC a										
C20:3	8.2847	2.3606	7.0668	1.3618	NS	5.315	1.1523	5.2322	1.5094	NS
lysoPC a										
C20:4	19.923	7.1135	17.323	2.2546	NS	15.793	3.2647	15.206	3.0183	NS
lysoPC a										
C24:0	0.7503	0.0744	0.7999	0.0773	NS	0.6778	0.0403	0.707	0.042	NS
lysoPC a										
C26:0	0.187	0.0509	0.2535	0.0161	0.0123	0.142	0.0271	0.179	0.0739	NS
lysoPC a										
C26:1	0.088	0.0331	0.093	0.0171	NS	0.0654	0.008	0.0795	0.021	NS
lysoPC a										
C28:0	0.2555	0.0391	0.3376	0.0686	0.0290	0.2167	0.0302	0.2746	0.0477	0.0366
lysoPC a										
C28:1	0.1731	0.03	0.2131	0.0243	0.0293	0.1523	0.033	0.1588	0.063	NS

Phosphatidylcholines (μM)

	Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=6)		p (t-test)
	mean	SD	mean	SD		mean	SD	mean	SD	
PC aa C24:0	0.0680	0.0214	0.0714	0.0128	NS	0.0458	0.0060	0.0539	0.0119	NS
PC aa C26:0	0.6724	0.0757	0.7554	0.0648	NS	0.6507	0.0637	0.7157	0.1177	NS
PC aa C28:1	0.2316	0.0548	0.2802	0.0608	NS	0.1861	0.0495	0.2242	0.0416	NS
PC aa C30:0	0.5658	0.0428	0.7065	0.1450	0.0457	0.5989	0.0758	0.723	0.04	0.0095
PC aa C30:2	0.0213	0.0225	0.0124	0.0183	NS	0.0217	0.0145	0.0128	0.0205	NS
PC aa C32:0	6.3915	0.5778	6.4912	0.7401	NS	7.4052	0.9264	7.3699	0.4106	NS
PC aa C32:1	2.5478	0.7517	2.3600	1.1577	NS	2.1003	0.6700	1.5239	0.3815	NS
PC aa C32:2	0.6863	0.066	0.7644	0.1600	NS	0.6549	0.1342	0.792	0.1442	NS
PC aa C32:3	0.1477	0.0144	0.1649	0.0226	NS	0.1313	0.0190	0.1651	0.011	0.0067

PC aa C34:1	111.76	24.13	100.31	39.48	NS	81.91	23.78	65.33	7.59	NS
PC aa C34:2	275.17	37.72	291.17	32.39	NS	264.33	45.84	328.30	9.55	0.014
PC aa C34:3	9.3452	1.1079	9.2813	1.8304	NS	7.6142	2.0726	7.8238	1.5792	NS
PC aa C34:4	0.2634	0.0271	0.2876	0.0394	NS	0.2668	0.073	0.2791	0.056	NS
PC aa C36:0	2.8318	0.3803	3.0322	0.3144	NS	2.7243	0.3951	3.2971	0.1521	0.0141
PC aa C36:1	25.2	3.6196	27.248	6.0584	NS	21.71	3.9572	23.371	1.3074	NS
PC aa C36:2	166	24.356	188.5	17.93	NS	166.17	19.073	202.2	7.328	0.0033
PC aa C36:3	64.59	8.1341	64.438	8.4052	NS	60.05	10.013	66.153	6.3682	NS
PC aa C36:4	59.302	4.3831	60.412	3.5756	NS	54.485	8.3557	59.636	3.7666	NS
PC aa C36:5	8.489	1.7186	8.8063	1.7075	NS	8.1357	2.6941	8.2777	2.2617	NS
PC aa C36:6	0.3138	0.0539	0.351	0.054	NS	0.2922	0.0828	0.302	0.062	NS
PC aa C38:0	2.263	0.1804	2.5848	0.3369	NS	2.1763	0.3396	2.7279	0.1142	0.0073
PC aa C38:1	0.9592	0.0731	0.8814	0.241	NS	0.6899	0.1375	0.7681	0.072	NS
PC aa C38:3	20.315	2.3447	20.833	2.7949	NS	17.25	2.3421	18.082	1.8866	NS
PC aa C38:4	28.495	0.5367	30.518	2.5153	NS	24.292	3.4646	24.059	2.5836	NS
PC aa C38:5	19.09	2.4518	18.568	3.5646	NS	14.929	3.0398	12.449	2.3986	NS
PC aa C38:6	84.878	10.751	88.983	19.227	NS	61.192	15.882	56.641	4.774	NS
PC aa C40:1	0.4288	0.0328	0.5127	0.0604	0.0135	0.3868	0.0166	0.4686	0.0457	0.0026
PC aa C40:2	0.5867	0.0719	0.8356	0.1794	0.0103	0.4604	0.0669	0.6395	0.037	0.0005
PC aa C40:3	0.9679	0.1601	1.1464	0.2486	NS	0.7646	0.1327	0.9689	0.0896	0.0171
PC aa C40:4	2.0057	0.1995	2.2823	0.3309	NS	1.5575	0.2158	1.69	0.1598	NS
PC aa C40:5	2.9758	0.5594	2.8755	0.7497	NS	2.118	0.4302	1.7351	0.2034	NS
PC aa C40:6	28.762	4.8445	33.983	7.8407	NS	23.002	6.3151	22.479	1.7257	NS
PC aa C42:0	0.1377	0.0219	0.1456	0.0142	NS	0.137	0.0222	0.1499	0.0104	NS
PC aa C42:1	0.1332	0.0258	0.1341	0.0205	NS	0.1089	0.0123	0.1466	0.0259	0.0112
PC aa C42:2	0.4081	0.0643	0.483	0.0812	NS	0.3696	0.0516	0.4414	0.0483	0.0421
PC aa C42:4	0.2185	0.0293	0.2912	0.0573	0.0198	0.1917	0.0259	0.2393	0.0142	0.0053
PC aa C42:5	0.3262	0.0247	0.403	0.1033	NS	0.2718	0.0456	0.2965	0.0437	NS
PC aa C42:6	1.6687	0.1928	2.1737	0.5108	NS	1.3127	0.291	1.5295	0.0786	NS
PC ae C30:0	0.1938	0.0558	0.2213	0.0511	NS	0.2074	0.0334	0.2104	0.0576	NS
PC ae C30:1	0.1521	0.028	0.1676	0.027	NS	0.1394	0.0202	0.1639	0.017	NS
PC ae C30:2	0.224	0.0178	0.218	0.0075	NS	0.2142	0.0188	0.2231	0.023	NS
PC ae C32:1	0.4478	0.0225	0.5001	0.0493	0.0397	0.4417	0.0645	0.5313	0.0241	0.0171
PC ae C32:2	0.2922	0.0413	0.3342	0.0586	NS	0.2889	0.0517	0.3581	0.0308	0.0279
PC ae C34:0	0.7187	0.0745	0.7917	0.0979	NS	0.7012	0.0797	0.9528	0.0806	0.0006
PC ae C34:1	2.6322	0.2662	2.6088	0.3478	NS	2.4257	0.4099	2.3668	0.0687	NS
PC ae C34:2	3.9002	0.4	4.4973	0.7079	NS	3.76	0.5421	5.0285	0.3373	0.0014
PC ae C34:3	1.3665	0.0758	1.5623	0.288	NS	1.3244	0.2466	1.7168	0.0756	0.0079
PC ae C36:0	0.8662	0.0936	0.8089	0.1077	NS	0.7985	0.1388	0.9261	0.0411	NS
PC ae C36:1	3.35	0.3688	3.165	0.4952	NS	2.7425	0.6376	3.1135	0.4046	NS
PC ae C36:2	8.439	1.5106	9.3508	2.0102	NS	8.3855	1.1415	10.711	1.0351	0.0067
PC ae C36:3	2.7943	0.2686	3.0678	0.4874	NS	2.4968	0.3909	3.0763	0.2152	0.0163
PC ae C36:4	2.3653	0.3505	2.555	0.3842	NS	2.8238	0.3241	3.4833	0.188	0.0031
PC ae C36:5	2.1203	0.2657	2.2335	0.3376	NS	2.3618	0.4391	2.7611	0.1589	NS
PC ae C38:0	2.4443	0.3291	2.5148	0.4317	NS	1.8588	0.4786	1.8636	0.3731	NS
PC ae C38:1	1.4958	0.2439	1.5313	0.2885	NS	1.307	0.2384	1.4818	0.0563	NS

PC ae C38:2	7.0845	1.5694	7.2058	2.0632	NS	7.431	1.4934	9.5854	1.2434	0.0305
PC ae C38:3	1.7868	0.3217	1.7812	0.3883	NS	1.6232	0.2162	1.8157	0.2142	NS
PC ae C38:4	2.1525	0.2772	2.3052	0.3314	NS	2.1563	0.2544	2.4833	0.215	0.0492
PC ae C38:5	2.7713	0.3668	3.0087	0.4107	NS	2.9373	0.4489	3.597	0.2034	0.0145
PC ae C38:6	2.5725	0.2583	2.9133	0.4273	NS	2.7878	0.4443	3.3062	0.1487	0.0352
PC ae C40:1	2.2137	0.1092	2.679	0.3077	0.0058	1.6832	0.3184	2.1289	0.2531	0.0323
PC ae C40:2	0.7901	0.0683	0.8216	0.1186	NS	0.6369	0.1295	0.7072	0.0521	NS
PC ae C40:3	0.8234	0.1221	0.8204	0.1451	NS	0.6738	0.1071	0.7557	0.0949	NS
PC ae C40:4	1.1998	0.1785	1.2831	0.2708	NS	1.117	0.1322	1.2611	0.1244	NS
PC ae C40:5	1.521	0.21	1.6442	0.2643	NS	1.3473	0.2226	1.5657	0.0866	NS
PC ae C40:6	2.2543	0.176	2.525	0.1606	0.0194	1.9383	0.3981	2.1363	0.1532	NS
PC ae C42:0	1.4083	0.1481	1.5288	0.191	NS	1.1837	0.1114	1.1716	0.0933	NS
PC ae C42:1	0.4001	0.052	0.4901	0.0637	0.023	0.3243	0.0405	0.3573	0.0363	NS
PC ae C42:2	0.4269	0.0605	0.4578	0.0754	NS	0.3183	0.0571	0.3538	0.0341	NS
PC ae C42:3	0.7422	0.0896	0.8314	0.118	NS	0.5485	0.1242	0.5884	0.0938	NS
PC ae C42:4	0.2187	0.0303	0.238	0.0311	NS	0.1841	0.0409	0.2107	0.0363	NS
PC ae C42:5	0.9613	0.0907	1.0369	0.094	NS	0.9004	0.0798	0.9467	0.0312	NS
PC ae C44:3	0.0779	0.0084	0.0906	0.0072	0.0185	0.0663	0.0134	0.0759	0.0088	NS
PC ae C44:4	0.1161	0.0123	0.1167	0.0103	NS	0.1029	0.0138	0.1102	0.0086	NS
PC ae C44:5	0.2083	0.0197	0.2751	0.0462	0.0086	0.173	0.0371	0.2179	0.0261	0.0494
PC ae C44:6	0.1573	0.0179	0.1879	0.0244	0.0323	0.155	0.026	0.1851	0.0247	NS

Sphingomyelins (μM)

	Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=6)		p (t-test)
	mean	SD	mean	SD		mean	SD	mean	SD	
SM (OH)										
C14:1	0.8131	0.1242	0.7746	0.1751	NS	0.8452	0.0623	1.0112	0.0962	0.0071
SM (OH)										
C16:1	0.2355	0.0301	0.2599	0.0508	NS	0.2544	0.032	0.3082	0.0344	0.0249
SM (OH)										
C22:1	1.7232	0.435	1.7837	0.3141	NS	1.4269	0.3944	1.9829	0.3373	0.0349
SM (OH)										
C22:2	2.0005	0.24	1.9558	0.3579	NS	1.675	0.317	2.1369	0.2845	0.0329
SM (OH)										
C24:1	0.2858	0.0352	0.3218	0.0553	NS	0.267	0.0496	0.2752	0.043	NS
SM C16:0	14.902	1.208	16.43	0.9823	0.037	15.43	1.0112	18.582	2.1249	0.0101
SM C16:1	2.887	0.5226	3.3677	0.5409	NS	2.4955	0.5353	3.4462	0.3312	0.0074
SM C18:0	0.9438	0.1505	1.1823	0.0981	0.0087	1.0281	0.0709	1.434	0.2368	0.003
SM C18:1	0.5099	0.043	0.63	0.0393	0.0005	0.5258	0.0635	0.6921	0.0875	0.0053
SM C20:2	0.0392	0.0115	0.0405	0.0188	NS	0.044	0.0161	0.04	0.0127	NS
SM C22:3	0	0	0	0	NS	0.0037	0.0091	0	0	NS
SM C24:0	10.661	1.2221	12.935	1.725	0.025	9.6673	2.0557	11.011	0.8308	NS
SM C24:1	16.807	2.3727	19.977	2.7287	NS	15.153	1.6983	19.621	2.343	0.0052
SM C26:0	0.0249	0.033	0.0377	0.0121	NS	0.065	0.0162	0.0747	0.0267	NS
SM C26:1	0.0333	0.041	0.0525	0.046	NS	0.0363	0.0291	0.0239	0.0194	NS

Hexoses (μM)

Ctrl (ZT4, n=6)		cKO (ZT4, n=6)		p (t-test)	Ctrl (ZT16, n=6)		cKO (ZT16, n=6)		p (t-test)
mean	SD	mean	SD		mean	SD	mean	SD	
17744	5934.4	16679	5784.4	NS	16306	4194.8	17205	2538.5	NS