

Supplemental Figures and Tables.

Figure S1. Scatter plots of differential genome-wide correlations between codon usage and mRNA levels between constitutive and facultative genes from indicated organisms and tissues. Pearson correlation coefficients are shown in Figure 1.

Figure S2. (A) Northern blot analysis of De-*Luc* and Opt-*Luc* mRNAs expressed under the control of the *Myc* core promoter and the *Myc* or DSCP IDR. (B) Northern blot analysis of De-*Luc* and Opt-*Luc* mRNA under control of the *Hsp70* core promoter with mutations in the left (MutL), middle (MutM), and right (MutR) 10 nt of the 20-nt CDE sequence. (C) Northern blot analysis of De-*Luc* and Opt-*Luc* mRNA expressed under control of the *Act5C* core promoter with indicated CDE sequences.

Figure S3. (A) Northern blot analysis of *gapdh* and U6 RNA levels in nuclear and total fractions. (B) Northern blot analysis of mRNA levels of *hph* and *Gal4* in indicated stable cell lines. (C) Quantification of the relative *hph* mRNA levels for experiment shown in panel A. (D) Quantification of the relative *Gal4* mRNA levels for experiment shown in panel A. (E) Positive and negative controls for Pol II CTD ChIP assay.

Figure S4. (A) Positive and negative controls for H3K27ac ChIP assay. (B) H3K9me3 ChIP assay for H3K9me3 over the 5' *Myc*-tag region of different constructs. qPCR primers amplify the 5' *Myc*-tag sequence, and data were normalized to F22. (C) H3K27me3 ChIP assay for H3K27me3 over the 5' *Myc*-tag region of indicated constructs. qPCR primers amplify the 5' *Myc*-tag sequence, and data were normalized to a region in 3L. (D) Positive and negative controls for H3K9me3 ChIP assay. (E) Positive and negative controls for H3K27me3 ChIP assay. (F) Positive and negative controls for H3 ChIP assay. Data are means \pm SD. ns: not significant.

Figure S5. Northern blot analyses showing the downregulation of the indicated mRNA after introducing gene specific dsRNA.

Table S1: Nucleotide sequences of the reporter genes and promoters used in this study.

Table S2: RNA-seq samples of human (different tissues), *Drosophila Melanogaster* (different tissues and different time points) and *Neurospora crassa* (different carbo sources) analyzed in Figure 1B-D.

Table S3: Primer sequences used for probe amplification in Northern blot analyses.

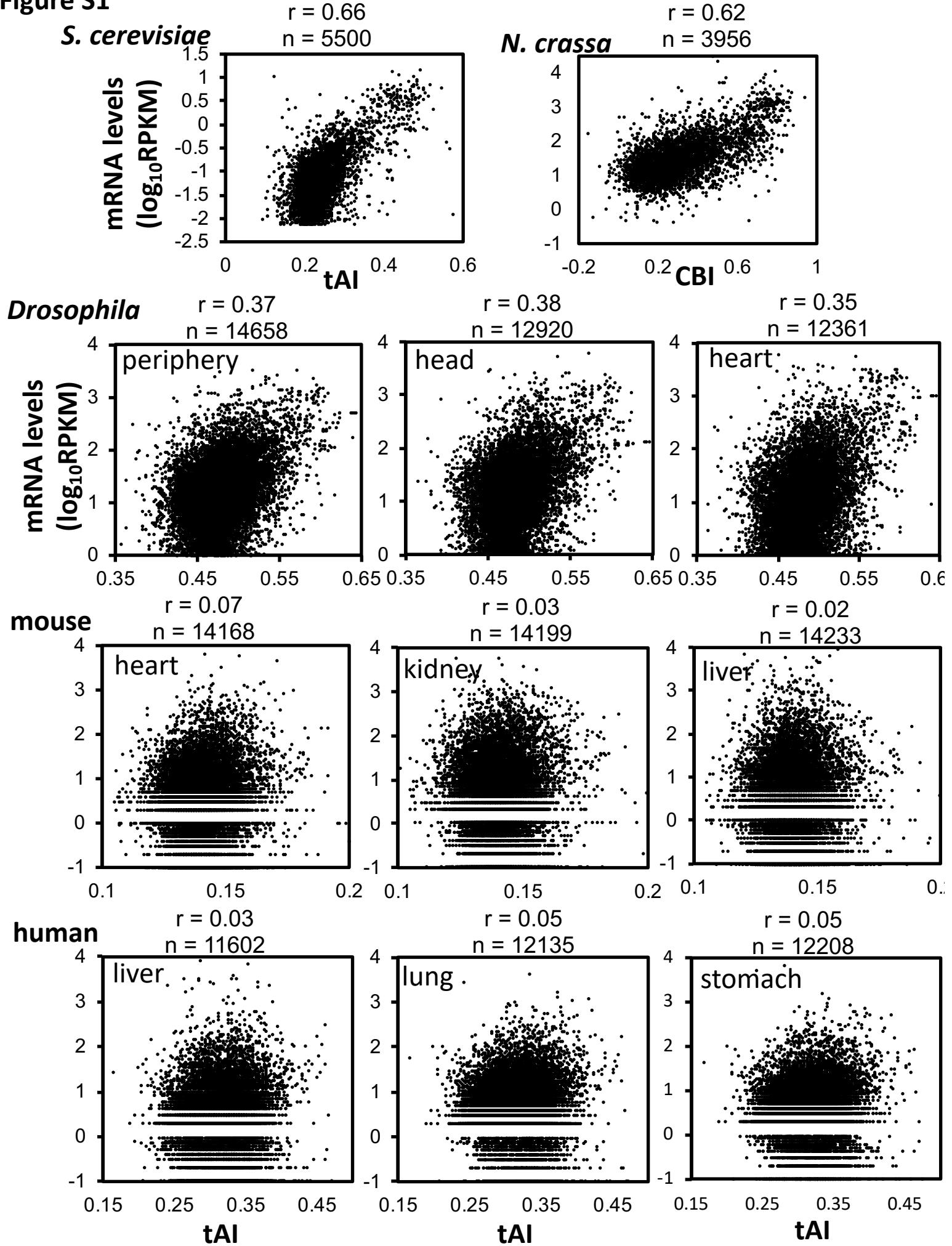
Figure S1

Figure S2

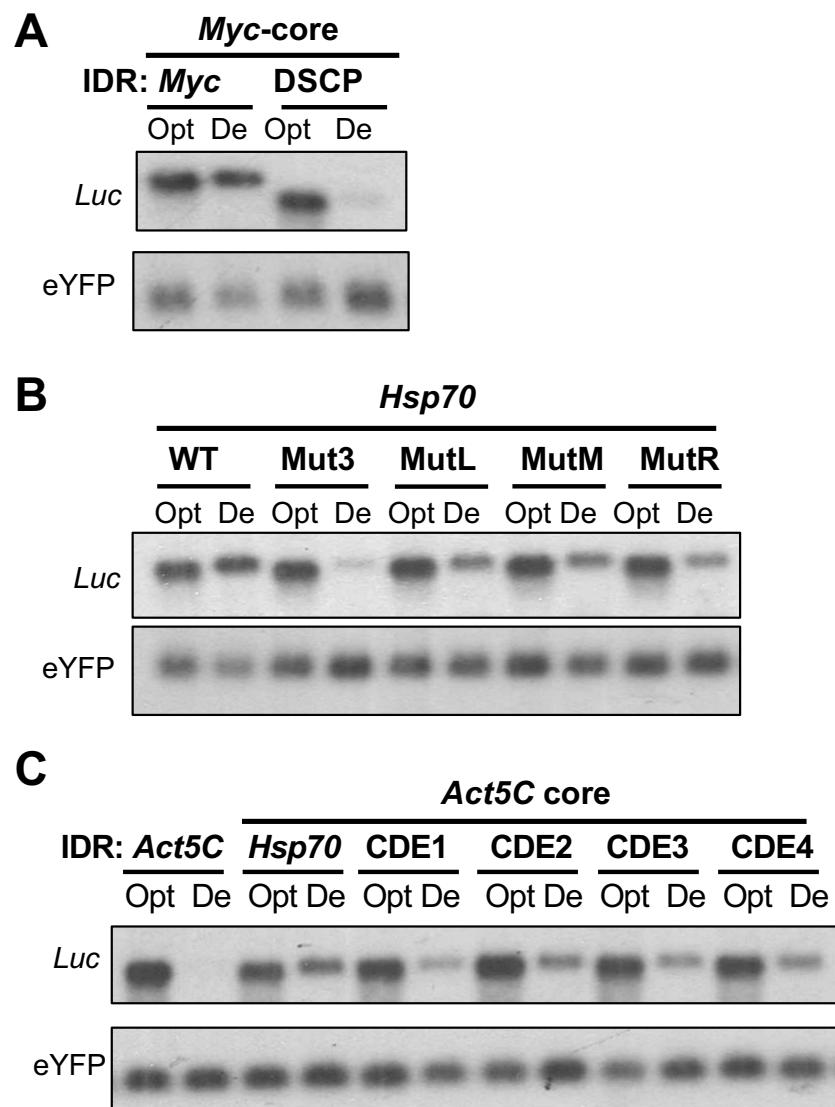


Figure S3

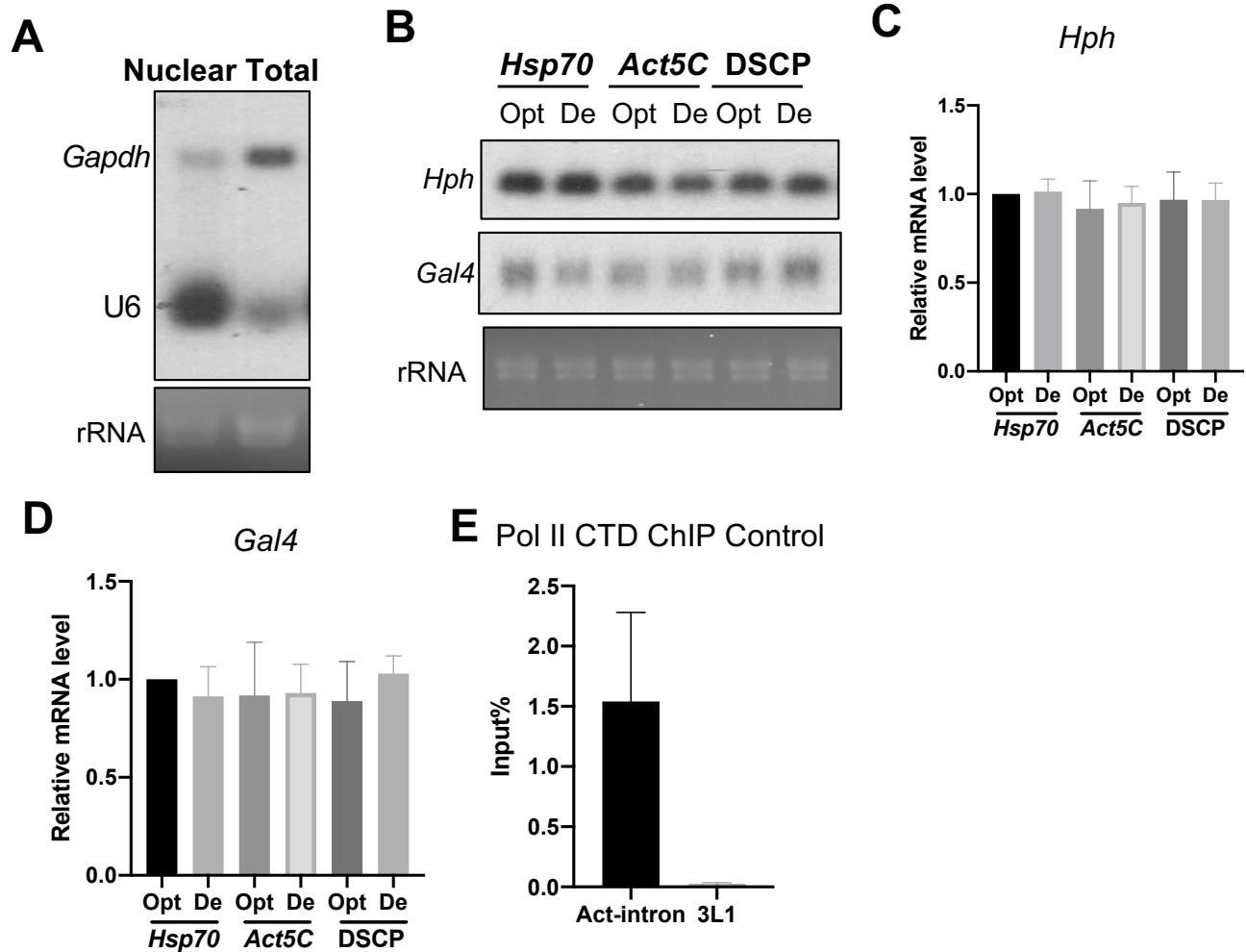


Figure S4

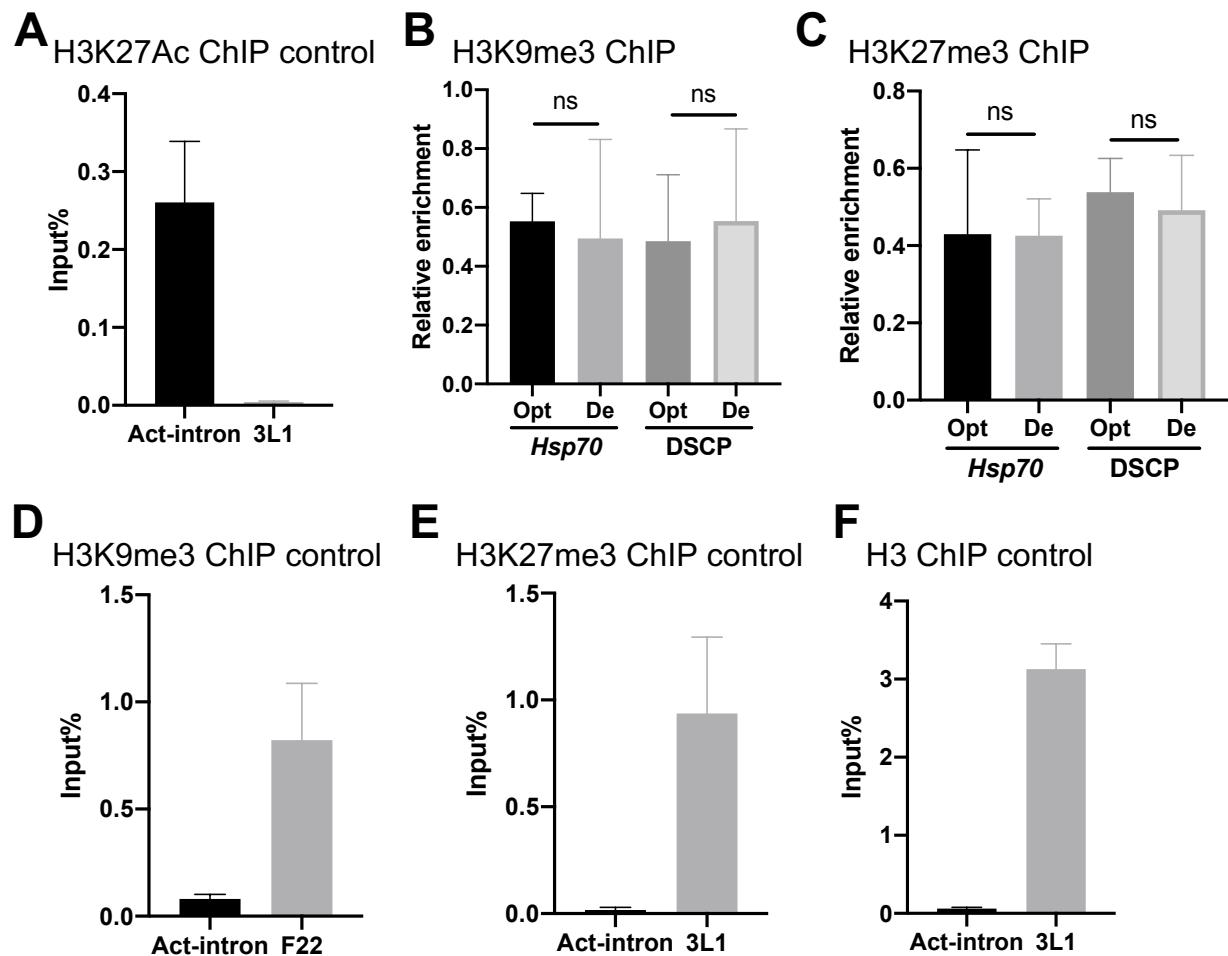


Figure S5

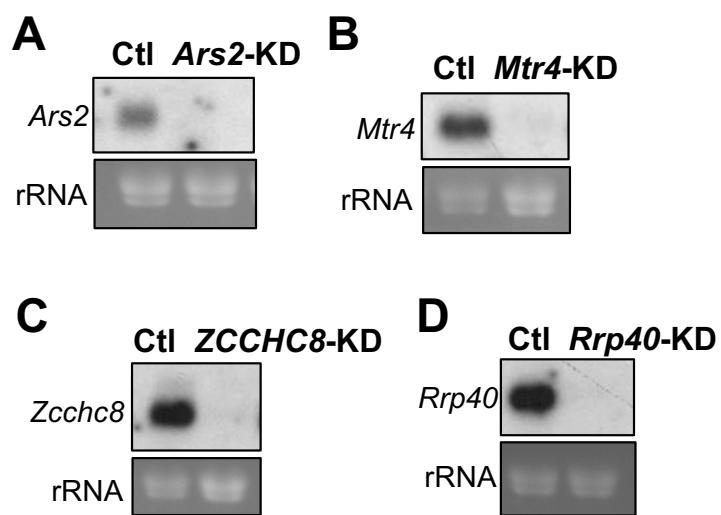


Table S1. Nucleotide sequences of the reporter genes and promoters used in this study

> Opt luciferase

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 CATCGAGGTGGATATCACCTACGCCAGTACTCGAGATGAGCGTGCCTGGCGAGGCCATGAAGC
 GCTACGGCCTGAACACCAACCACCGCATCGTGGTGTGCAGCGAGAACAGCCTGCAGTTCTTCATGCCG
 TGCTGGCGCCCTGTTCATGGCGTGGCGTGGCCCCGCCAACGATATCTACAACGAGCGAGCTGC
 TGAACAGCATGGGCATCAGCCAGCCCACCGTGGTGTGAGCAAGAAGGGCCTGCAGAAGATCCTG
 AACGTGCAGAAGAAGCTGCCCATATCCAGAAGATCATCATGGATAGCAAGACCGATTACCAAGGGC
 TTCCAGAGCATGTACACCTCGTGCACAGCACCTGCCCTGGCTCAACGAGTACGATTCTGTGCCG
 AGAGCTTCGATCGCGATAAGACCATGCCCTGATCATGAACAGCAGCGGCAGCACCGGCCCTGCCAAG
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 GGGCTACCTGATCTCGGCTCCCGTGGTGTGATGTACCGCTCGAGGAGGAGCTGTTCTGCGCAG
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 CTGATCGATAAGTACGATCTGAGCAACCTGCACGAGATGCCAGCGGCCGGCCCTGAGCAAGGA
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 CCACCAGGCCATCTGATCACCCCGAGGGCGATGATAAGCCGGCGCTGGGCAAGGTGGTGC
 TTCTCGAGGCCAAGGTGGATCTGGATACCGGAAGACCCCTGGCGTGAACCAGCGCGAGCT
 GTGCGTGCCTGGCCCGCATGATCATGAGCGGCTACGTGAACAACCCGAGGCCACCGCCCTGATCG
 ATAAGGATGGCTGGCTGCACAGCGCGATATGCCCTACTGGATGAGGATGAGCACTTCTCATCGTGG
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 GACCGGCAAGCTGGATGCCCGCAAGATCCGCGAGATCCTGATCAAGGCCAAGAAGGGCGGCAAGATC
 GCCGTGTA

> De luciferase

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 CTATGTATACTTTGTAACCTCTACCTCCTGGTTAATGAATATGACTTGTACCTGAATCTTG
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AAATATAAAGGGTATCAAGTAGCACCTGCAGAATTAGAATCTATATTACAACATCCTAATATATTG
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TTAAGAGGGGGGGTAGTATTGTAGACGAAGTACCTAAAGGGTAACTGGGAAATTAGACGCAAGAAA
ATAAGAGAAATTTAAATAAAAGCAAAAAAGGGGGAAATAGCAGTATAA

> Opt YFP

ATGGTGAGCAAGGGGAGGAGCTGTCACCGGGGTGGTCCCCATCCTGGCGAGCTGGACGGCGACG
TAAACGCCACAAGTCAGCGTCCGGCGAGGGCGAGGGCGATGCCACCTACGGCAAGCTGACCTG
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ACCAGCAGAACACCCCCATGGCGACGGCCCGTGCCTGCCGACAACCAACTACCTGAGTACCA
CCGCCCTGAGCAAAGACCCCAACGAGAAGCGCGATCACATGGCCTGCTGGAGTTCGTACCGCCGCC
GGGATCACTCGGCATGGACGAGCTGACAAGTAA

> De YFP

ATGGTATCTAAAGGGGAGAATTATTACTGGGTTAGTACCTATATTAGAATTAGACGGGACGTA
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ATTATATGTACTACTGGAAATTACCTGTACCTGGCTACTTAGTAACACTACTTTGGTATGGTTAC
AATGTTTGCAAGATATCCTGACCATATGAAACAACATGACTTTAAATCTGAATGCCGAAGGGTA
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AAAAGTAAATTAAAGACATAATAGAAGACGGGCTGTACAATTAGCAGACCAATTATCAACA
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CTAAAGACCTAATGAAAAAGAGACCATATGGTATTAGAATTGTAACGCAGGGATAACTTT
AGGGATGGACGAATTATATAATAA

Core promoter is unlined region

> Act5C promoter

GCTAAGCGGGCTTATAAAACGGGCTGGGGACCAAGTTTCAATACACTACCGTTGAGTTCTGTGCTG
TGTGGATACTCCTCCGACACAAAGCCGCTCCATGCCAGCAGCGTCAATCCAGAGACACCAACCG
AAAGACTTAATTATTTATTAAATTAAATAAAACACACCAAAT

> DSCP promoter

CGCCCGGGGATCGAGCGCAGCGGTATAAAGGGCGCGGGTGGCTGAGAGCATCAGTTGTGAATGAA
TGTCGAGCCGAGCAGACGTGCCGCTGCCTCGTTAATATCCTTGAATAAGCCAACTTGAATCACAAG
ACGCATACCAAACGGCATTCCGGTACTGTTGGTAAAGGCCACC

> Tub promoter

TGGCCACACTGCGGCCATCGTATAAAGCCC CGCTCTCCAAAGCGAATGCACTAATTTC
CAAGTGTGAAAGCGGACAGTTGTGTTGTTGACTGCTATAAGCGAAAGATAATTAAAGTAAAAGTTCAAAA
GCCTAAAACAAATACAAATGAGGGAAATCGTCACATCCAAGCTGGCAGTGCAGCGAACCAATCGGC
GCCAAG

> Hsp70 promoter

CGCCGGAGTATAAATAGAGGCGCTTGTCTACGGAGCGACAATTCAATTCAAACAAGCAAAGTGAACAC
GTCGCTAACGCAAAGCTAACGAAATAACAAGCGCAGCTGAACAAGCTAAACAATCTGAGTAAAGTG
CAAGTTAAAGTGAATCAATTAAAAGTAACCAGCAC

> cMyc promoter

TACGATAGAAATTATTAAAGCCACAGACAACATGAAACGGGCACTATTCTGTGGCGTCGCGTGTCA
GTTCACCGCGGGTAATTCAAGAGAACATCGTTGTGGATTGGATTTCGCTGTTCCGCCGATAACAAAA
AAAAAAAAACCAAACGCTATATAAATAGTTCTGTAGTAAACCTGAAGCAACACGTTAAAATATACAAC
TACTACTAACAACTGTCACAGCCAAGTTACAAAGTGTAAATC

> Per promoter

TGCGAGTGCACGGGGCTTATACACCGGAGCTGCGATGCGAGCACTAGTGTTCGTGCGAATTAGAG
CCAGAAGGTCGACAACCGTGTGCGACAGTAGAAAGTATTGCCATATACCAAATAATCGCAACAAAC
GACCTGTCGAATCACGCAAACAAACAGCTTGTCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
TCTTT

Table S1: RNA-seq samples used for the analyses in Figure 1B-D.

	Human	N. crassa	D. Melanogaster
1	Brodmann.1909.area.24	1 X2..sucrose	1 Periphery_Wk3_ALF_ZT00
2	Brodmann.1909.area.9	2 X1..misanthus	2 Periphery_Wk3_ALF_ZT06
3	C1.segment.of.cervical.spinal.cor	3 X1..Amylopectin	3 Periphery_Wk3_ALF_ZT12
4	EBV.transformed.lymphocyte	4 X1..amylose	4 Periphery_Wk3_ALF_ZT18
5	adrenal.gland	5 X1..Arabinan	5 Periphery_Wk3_TRF_ZT00
6	amygdala	6 X1..avicel	6 Periphery_Wk3_TRF_ZT06
7	aorta	7 X1..corn.stover	7 Periphery_Wk3_TRF_ZT12
8	atrium.auricular.region	8 X1..eastern.cottonwood	8 Periphery_Wk3_TRF_ZT18
9	blood	9 X1..Energy.cane	9 Periphery_Wk5_ALF_ZT00
10	breast	10 X1..galactan	10 Periphery_Wk5_ALF_ZT03
11	caudate.nucleus	11 X1..Galactomannan	11 Periphery_Wk5_ALF_ZT06
12	cerebellar.hemisphere	12 X1..Loblolly.Pine	12 Periphery_Wk5_ALF_ZT09
13	cerebellum	13 X1..MLG	13 Periphery_Wk5_ALF_ZT12
14	cerebral.cortex	14 X1..Pectin.Esterified	14 Periphery_Wk5_ALF_ZT15
15	coronary.artery	15 X1..Pectin	15 Periphery_Wk5_ALF_ZT18
16	cortex.of.kidney	16 X1..Rhamnogalacturonan	16 Periphery_Wk5_ALF_ZT21
17	ectocervix	17 X1..sherbourne.willow	17 Periphery_Wk5_TRF_ZT00
18	endocervix	18 X1..Switchgrass	18 Periphery_Wk5_TRF_ZT03
19	esophagogastric.junction	19 X1..Wing.nut	19 Periphery_Wk5_TRF_ZT06
20	esophagus.mucosa	20 X1..Xylan	20 Periphery_Wk5_TRF_ZT09
21	esophagus.muscularis.mucosa	21 X1..Xyloglucan	21 Periphery_Wk5_TRF_ZT12
22	fallopian.tube	22 X2mM.arabinose	22 Periphery_Wk5_TRF_ZT15
23	greater.omentum	23 X2mM.cellbiose	23 Periphery_Wk5_TRF_ZT18
24	heart.left.ventricle	24 X2mM.fructose	24 Periphery_Wk5_TRF_ZT21
25	hippocampus.proper	25 X2mM.fucose	25 Periphery_Wk7_ALF_ZT00
26	hypothalamus	26 X2mM.galactose	26 Periphery_Wk7_ALF_ZT06
27	liver	27 X2mM.galacturonic.acid	27 Periphery_Wk7_ALF_ZT12
28	lower.leg.skin	28 X2mM.glucuronic.acid	28 Periphery_Wk7_ALF_ZT18
29	lung	29 X2mM.glycerol	29 Periphery_Wk7_TRF_ZT00
30	minor.salivary.gland	30 X2mM.maltose	30 Periphery_Wk7_TRF_ZT06
31	nucleus.accumbens	31 X2mM.mannitol	31 Periphery_Wk7_TRF_ZT12
32	ovary	32 X2mM.mannose	32 Periphery_Wk7_TRF_ZT18
33	pancreas	33 X2mM.rhamnose	33 Head_Wk3_ALF_ZT00
34	pituitary.gland	34 X2mM.ribose	34 Head_Wk3_ALF_ZT06
35	prostate.gland	35 X2mM.sorbose	35 Head_Wk3_ALF_ZT12
36	putamen	36 X2mM.trehalose	36 Head_Wk3_ALF_ZT18
37	sigmoid.colon	37 X2mM.xylose	37 Head_Wk3_TRF_ZT00
38	skeletal.muscle.tissue	38 citrus.peel	38 Head_Wk3_TRF_ZT06
39	small.intestine.Peyer.s.patch	39 Starvation	39 Head_Wk3_TRF_ZT12
40	spleen	40 X0.4..NaNO3	40 Head_Wk3_TRF_ZT18
41	stomach	41 X0.25mM.Methionine..low.sulfur.	41 Head_Wk5_ALF_ZT00
42	subcutaneous.adipose.tissue	42 X1..Abies.alba.sapwood	42 Head_Wk5_ALF_ZT03
43	substantia.nigra	43 X1..BSA	43 Head_Wk5_ALF_ZT06
44	suprapubic.skin	44 X1..cedrus.libani.kearn.or.heartwo	44 Head_Wk5_ALF_ZT09
45	testis	45 X1..Cedrus.libani.split.wood	45 Head_Wk5_ALF_ZT12
46	thyroid.gland	46 X1..Glucomannan	46 Head_Wk5_ALF_ZT15
47	tibial.artery	47 X1..inulin	47 Head_Wk5_ALF_ZT18
48	tibial.nerve	48 X1..lignin	48 Head_Wk5_ALF_ZT21
49	transformed.skin.fibroblast	49 X1..picea.abies.heartwood	49 Head_Wk5_TRF_ZT00
50	transverse.colon	50 X1..Picea.abies.sapwood	50 Head_Wk5_TRF_ZT03
51	urinary.bladder	51 X1..Polygalacturonic.acid	51 Head_Wk5_TRF_ZT06
52	uterus	52 X1..Quercas.robur.sapwood	52 Head_Wk5_TRF_ZT09
53	vagina	53 X1..robina.pseudoararia.heartwoo	53 Head_Wk5_TRF_ZT12
		54 X1..robina.pseudoararia.sapwood	54 Head_Wk5_TRF_ZT15
		55 X2mM.mannobiose	55 Head_Wk5_TRF_ZT18
		56 X3.4mM.arginine	56 Head_Wk5_TRF_ZT21
		57 X4.3mM.proline	57 Head_Wk7_ALF_ZT00
		58 X5mM glutamate	58 Head_Wk7_ALF_ZT06
		59 X5mM glutamine	59 Head_Wk7_ALF_ZT12
		60 X5mM.Methionine..high.sulfur.	60 Head_Wk7_ALF_ZT18
		61 X10.1mM.alanine	61 Head_Wk7_TRF_ZT00
		62 X20mM.glycine	62 Head_Wk7_TRF_ZT06

63 Bird.s.medium..NH4.only.	63 Head_Wk7_TRF_ZT12
64 Fries.medium..low.phosphate..0.0!	64 Head_Wk7_TRF_ZT18
65 Fries.medium	65 Heart_Wk5_ALF_ZT00
66 no.nitrogen	66 Heart_Wk5_ALF_ZT06
67 no.phosphate	67 Heart_Wk5_ALF_ZT12
68 no.sulfur	68 Heart_Wk5_ALF_ZT18
69 X2mM.sodium.acetate	69 Heart_Wk5_TRF_ZT00
70 X2mM.lactose	70 Heart_Wk5_TRF_ZT06
71 X2mM.sorbitol	71 Heart_Wk5_TRF_ZT12
	72 Heart_Wk5_TRF_ZT18

Table S3: The primer sequences used for the template amplification used for making probes for Northern blot analysis.

5xMyc-luciferase 5' end (5'- TGATATCATCGATTAAAGCA -3', 5'- TGCTAATACGACTCACTATAGGGAGCATGTCGCCAAGCTCTCCAT -3')

eYFP 5' end (5'- ATGGTGAGCAAGGGCGAGGAGCTG -3', 5'- TGCTAATACGACTCACTATAGGGAGCCTCGCCGGACACGCTGAAC -3')

YFP 3'UTR (5'- TCTTGTGAAGGAACCTTAC -3', 5'- TGCTAATACGACTCACTATAGGGAGTTCATCAGTCCATAGGTTG -3')

Ars2 3'UTR (5'- TATCGGTTACCATGATTGG -3', 5'- TGCTAATACGACTCACTATAGGGAGTCGCACTTATTCCTGTG -3')

Mtr4 3'UTR (5'- CGACTGGAGGAGCTTCTGCG -3', 5'- TGCTAATACGACTCACTATAGGGAGATTACAAAGGTTAGGG -3')

ZCHC8 3'UTR (5'- GCTCGTGCCTTGAAGGCG -3', 5'- TGCTAATACGACTCACTATAGGGAGTCCAGCCAAGCAGGCGGATA -3')

Rrp40 3'UTR (5'- GAGCTGGTCTGCGTCAACTC -3', 5'- TGCTAATACGACTCACTATAGGGAGTAAGGGTAGTACTATCTTC -3')

Hsp70 5'end (5'- ATGCCTGCTATTGGAATCGATCTG -3', 5'- TGCTAATACGACTCACTATAGGGAGCCGATCAGTCGCTTGGCGTCAAAC -3')

U6 (5'- CGGCAGAACATATACTAAAATTGG -3', 5'- TAATACGACTCACTATAGGGAGTGGAACGCTTCACGATTTGCG -3')

gapdh (5'- AGTCCACCGGAGTGTCACC -3', 5'- TGCTAATACGACTCACTATAGGGAGAGAAGTCGGTGGAGACCACC -3')

Gal4 (5'- ATGAAGCTACTGTCTTCTATCG -3', 5'- TGCTAATACGACTCACTATAGGGAGTGCCCTAGTCAGCGGAGACC -3')

hph (5'- ATGAAAAAGCCTGAACTCACCG -3', 5'- TGCTAATACGACTCACTATAGGGAGTTGTAGAAACCATCGGCGCAGC -3').