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Transposable element '*roo*' attaches to nuclear matrix of the *Drosophila melanogaster*

Anitha Mamillapalli[1,2], Rashmi U. Pathak[1], Hita S. Garapati[1], and Rakesh K. Mishra[1d]

[1]Centre for Cellular and Molecular Biology, Uppal Road, Hyderabad-500 007, India
[2]Current Address: Department of Biotechnology, GITAM Institute of Science, GITAM University, Visakhapatnam-530 045, India

Abstract

The genome of eukaryotes is organized into structural units of chromatin loops. This higher order organization is supported by a nuclear skeleton called the nuclear matrix. The genomic DNA associated with the nuclear matrix is called the matrix associated region (MAR). Only a few genome-wide screens have been attempted, although many studies have characterized locus-specific MAR DNA sequences. In this study, a MAR DNA library was prepared from the *Drosophila melanogaster* Meigen (Diptera: Drosophilidae) genome. One of the sequences identified as a MAR was from a long terminal repeat region of '*roo*' retrotransposon (*roo* MAR). Sequence analysis of *roo* MAR showed its distribution across the *D. melanogaster* genome. *roo* MAR also showed high sequence similarity with a previously identified MAR in *Drosophila,* namely the '*gypsy*' retrotransposon. Analysis of the genes flanking *roo* MAR insertions in the *Drosophila* genome showed that genes were co-ordinately expressed. The results from the present study in *D. melanogaster* suggest this sequence plays an important role in genome organization and function. The findings point to an evolutionary role of retrotransposons in shaping the genomic architecture of eukaryotes.

Keywords: genome organization, MAR DNA, retrotransposon
Abbreviations: CTCF, CCCTC-binding factor; LTR, long terminal repeat; MAR, matrix associated region; NuMat, nuclear matrix
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Introduction

Chromatin in the eukaryotic nucleus is known to be organized into loop domains. Intranuclear space is compartmentalized into structural and functional domains (Spellman and Rubin 2002; Sexton et al. 2007; Kadauke et al. 2009; Cremer and Cremer 2010). The structural features of the nucleus are the nuclear membrane, nucleolus, and heterochromatic and euchromatic domains. The major functions involving chromatin, such as transcription, replication, repair, splicing, silencing, etc., are orchestrated in the non-chromatin space of the nucleus (Cook et al. 1999; Lanctot et al. 2007). The nuclear matrix (NuMat) has been proposed to play an important role in this structural and functional organization, as proteins related to the nuclear functions have been found to be physically associated with NuMat (Berezney and Wei 1998; Kallapagoudar et al. 2010).

Biochemically, NuMat is made of protein, RNA, and DNA. Protein and RNA constitute the bulk of NuMat, and only a small amount of DNA (~1%) is found to be associated with it (Berezney and Coffey 1977). The DNA sequences associated with NuMat are called matrix-associated or scaffold-attachment regions (MARs/SARs). The MARs bind to NuMat and provide an anchor for higher order chromatin organization. This association is dynamic and varies in a cell-specific manner (Fey and Penman 1988; Dworetzky et al. 1990; Cai et al. 2003; Varma and Mishra 2011).

Earlier studies indicated that the association of MARs with NuMat leads to the formation of 50–200 kb chromatin loops that can act as independent functional domains (Jackson et al. 1990; Cremer and Cremer 2001). MAR DNA sequences range between 300 and 1000 bp in length and are AT rich (Boulikas 1993). These sequences were shown to have special sequence motifs, such as A-box (AATAAAAA/CAA) and T-box (TTTTATTTTT), and were also shown to bind to topoisomerase II, boundary element associated factor, and CCCTC-binding factor (CTCF) (Gasser and Laemmli 1986; Dunn et al. 2003; Pathak et al. 2007; Phillips et al. 2009). Many times they also coincided with replication origin (Amati and Gasser 1988). Though MARs contain specialized sequences, no consensus sequence motif had been identified before our study. It is presumed that the MAR property is determined by the structural similarities more than by the sequence similarity (Yamamura and Nomura 2001).

Computational programs that screen for genome wide occurrence of MAR sequences are far from perfect but they have useful predictive value (Evans et al. 2007). In the present study, a MAR DNA library from *Drosophila melanogaster* Meigen (Diptera: Drosophilidae) embryos was prepared. The long terminal repeat region (LTR) of transposable element '*roo'* was found as one of the MARs. Earlier studies have shown that a 350-bp sequence at the 5'-UTR of the *gypsy* transposon also had a nuclear matrix binding property (Nabirochkin et al. 1998). The sequence alignment of *roo* MAR with the NuMat associated region of *gypsy* showed very high similarity. Interestingly, a significant proportion of genes present in the flanking region of *roo* transposon were found to be expressed in adult testes and ovaries. These findings point to the importance of transposable elements in genome organization and evolution.

Materials and Methods

Isolation of MAR DNA of 0–16 hours old *Drosophila melanogaster* embryos

Embryos (0–16 hrs old) were obtained from a laboratory population of *D. melanogaster* (Canton-S) maintained at 25° C. Embryos were collected and weighed. NuMat was prepared according to published protocol from 0.1 g of embryos (Mirkovitch et al. 1984) with modifications as mentioned in Pathak et al. (2007) (Figure 1). Briefly, nuclei were isolated in nuclear isolation buffer (15 mM Tris pH 7.4, 40 mM KCl, 1 mM EDTA, 0.1 mM EGTA, 0.1 mM PMSF, 0.25 mM spermidine, and 0.5% (v/v) Triton-X 100) with 0.25 M sucrose. The nuclear pellet was digested with digestion buffer (20 mM Tris pH 7.4, 20 mM KCl, 70 mM NaCl, 10 mM MgCl2, 0.125 mM spermidine, 1 mM PMSF, 0.5% Triton-X 100, 10 U/mL RNase In, and 40 U/µL DNase I) at 4° C for 1 hr to remove chromatin. Extraction was carried out sequentially with 0.4 M NaCl and then with 2.0 M NaCl, each for 5 min, in extraction buffer (10 mM Hepes pH7.5, 4 mM EDTA, 0.25 mM spermidine, 0.1 mM PMSF, 0.5% (v/v) Triton X-100). The final pellet after extraction was washed 2 times with wash buffer (5 mM Tris, 20 mM KCl, 1 mM EDTA, 0.25 mM spermidine, 0.1 mm PMSF), and DNA was isolated from the pellet using a DNeasy Blood and Tissue kit (Qiagen, www.qiagen.com).

Preparation of MAR DNA library

The isolated MAR DNA was made blunt end with DNA polymerase I, large (Klenow) fragment (New England Biolabs, www.neb.com) and ligated to pMOS blunt end vector (Amersham kit, GE Healthcare, www.gelifesciences.com) according to the manufacturer's instructions. Transformed colonies were screened on blue-white selection and checked for inserts by restriction enzyme digestions. DNA inserts in the plasmids were sequenced by the cycle sequencing method using the Big Dye terminator version 1.1 cycle sequencing kit (Applied Biosystems, www.appliedbiosystems.com) and an ABI Prism 310 Automated DNA sequencer (Applied Biosystems) with M13F and T7 primers.

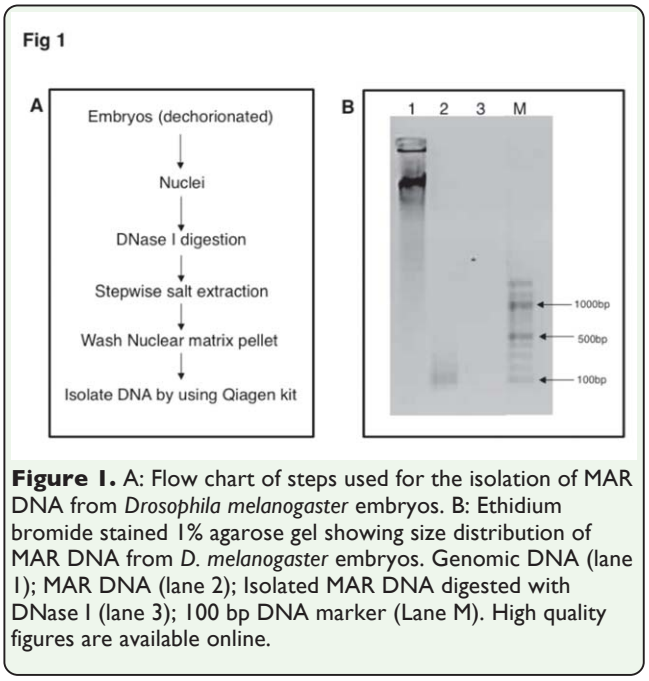

Figure 1. A: Flow chart of steps used for the isolation of MAR DNA from *Drosophila melanogaster* embryos. B: Ethidium bromide stained 1% agarose gel showing size distribution of MAR DNA from *D. melanogaster* embryos. Genomic DNA (lane 1); MAR DNA (lane 2); Isolated MAR DNA digested with DNase I (lane 3); 100 bp DNA marker (Lane M). High quality figures are available online.

Analysis of library sequences

The library sequences were analyzed for MAR potential by MAR-WIZ program (Singh 2000) under the default parameters setting. The results are given in Table 1.

The MAR sequences were also analyzed for binding sites of DNA-binding proteins, such as boundary element associated factor, GAGA factor, zeste-white 5, suppressor of hairy wing, and dCTCF, using a bioinformatic tool known as "chromatin domain boundary element search tool – cdBEST" (Srinivasan and Mishra 2012). These proteins are know to interact with chromatin domain boundaries, and most of them have also been shown to bind with MARs. The results of the analysis are presented in Supplementary Table 1.

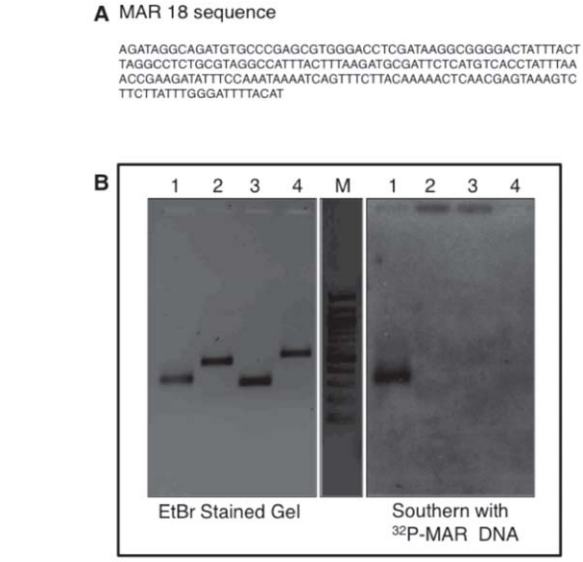

Figure 2. A: Sequence of MAR18 (*roo* transposon) clone found in MAR of *Drosophila melanogaster*. B: Southern blot analysis of PCR amplified *roo* LTR and control regions. Left panel shows the resolution of PCR amplicons on a 1.2% agarose gel. *roo* LTR (lane 1), Wnt4 control (lane 2), Arc control (lane 3), Wnt6 control (lane 4), 100 bp ladder (lane M). The right panel shows Southern hybridization of the gel with ^{32}P-labelled MAR DNA. High quality figures are available online.

Analysis of MAR18 (*roo* MAR) sequence

The library sequences were aligned with the *Drosophila* genome using NCBI-BLAST program (http://www.ncbi.nlm.nih.gov/). Of these, the MAR18 sequence was found to correspond to the LTR of *roo* transposon. Before proceeding further with any analysis, we first wanted to validate that the LTR of *roo* was actually associated with NuMat. To do this, an *in viv*o MAR assay was performed. Primers were designed to PCR amplify a region that enclosed the MAR18 sequence in the LTR of *roo* element (forward primer: 5'CCGCCTCCTAAAATAGTCCC3'; reverse primer: 5'CCTTACCTTTGGTAGGGGGA3'; amplicon size: 299 bp). As controls, primers were designed that amplified sequences of the *D. melanogaster* genome from an exon (in arc gene: forward primer: 5'GGAGAGGATTCAGGGTCACA3'; reverse primer: 5'GTTAGGGGAGGAGGAGCAAC3'; amplicon size: 280 bp), an intron (in Wnt6 gene: forward primer: 5'GAGAGACGGGTTTCGTGAAC3'; reverse primer: 5'CTTACCAATCGACCTGCGTT3'; amplicon size: 514 bp), or an intergenic region (5' of Wnt4 gene: forward primer: 5'GATCTAGGCCGCATGGTAAA3'; reverse primer: 5'CGAGAGCTGAACCGAAAATC3'; amplicon size: 497 bp). These control fragments were from regions close to *roo* insertions. The amplicons were resolved on a 1.2% TAE-agarose gel and transferred onto Nylon NY+ membrane in 20X SSC by capillary transfer. MAR DNA (obtained as mentioned above from *D. melanogaster* embryos) was labelled with ^{32}P-dATP by the random primer labelling method. Hybridization was carried out at 60° C in 0.5 M sodium phosphate/7% SDS for 16 hr. The blot was washed stringently and exposed to a phosphor-imager screen for 4 hr. The results are presented in Figure 2.

After validating that the *roo* LTR sequence was indeed retained in NuMat, *in silico* analysis of the transposon insertion sites in the *Drosophila* genome was performed. The NCBI-BLAST results were observed in a whole genome view. The 190 bp sequence was analyzed by MAR-WIZ to find out the sequences with high MAR potential. The *roo* MAR sequence was aligned to the previously identified MAR in *gypsy* transposon using CLUSTAL-W program (www.clustal.org). The results are presented in Figure 3.

Analysis of genes that flank *roo* insertion sites in the *Drosophila* genome

The sequence locations of the *roo* transposon insertions in the whole genome of *D. melano-*

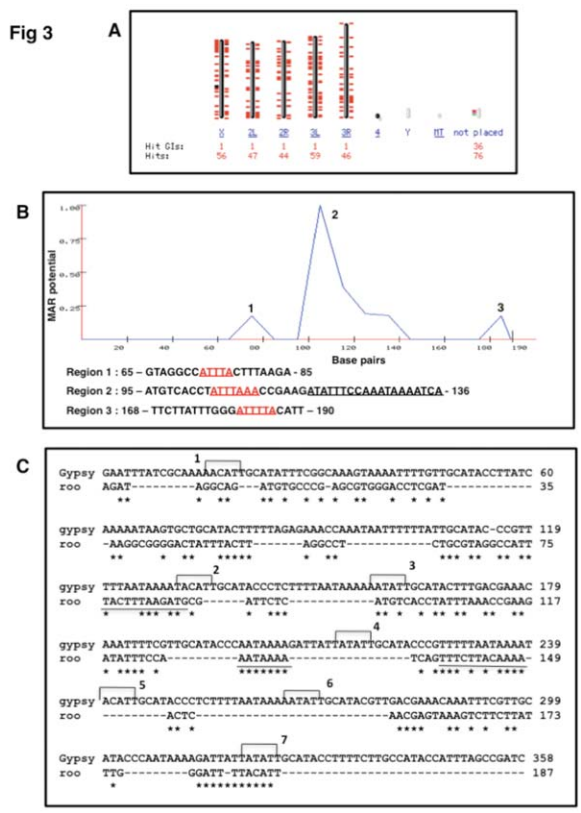

Figure 3. Analysis of *roo* MAR sequence. A: Genome view of distribution of *roo* MAR sequence in *Drosophila melanogaster*. B: Analysis of *roo* MAR with MAR-WIZ program. The regions with matrix association potential are shown as peaks in the graph. The matrix potential is shown on the Y-axis, and DNA in base pairs is shown on the X-axis. Sequences corresponding to the peaks are given below. Sequences relevant for MAR association are underlined. C: Sequence alignment of the *roo* MAR with the matrix-associated region of the *gypsy* transposable element using ClustalW program. On the *gypsy* sequence, topoisomerase II cleavage sites are marked with brackets and labelled 1–7. Sequences following ATC rule and an A-box are underlined. High quality figures are available online.

gaster were taken from FlyBase (www.flybase.org). The coordinates of the flanking genes were obtained from the release 5.45 of *D. melanogaster* available in FlyBase. The nearest genes associated with the *roo* transposons (upstream, downstream, and those containing them) were extracted using an in-house written PERL script. For each of the associated genes, FlyAtlas anatomical expression data were obtained from FlyBase. The results are presented in Supplementary Tables 2 and 3 and Figure 4.

Results

Isolation of MAR DNA from *D. melanogaster* embryos

NuMat was prepared from 0–16 hr old *D. melanogaster* embryos using standard protocol (Figure 1A). Standard nuclear isolation protocols use hypertonic salt extraction to remove digested DNA. Alternative protocols using low salt extraction have been developed with the argument that physiological levels of salt may better preserve the ultrasturcture. However, a survey of literature shows that both methods reveal similar ultrastructural features (reviewed in Nickerson 2001). We used the high salt extraction method, modified so that the salt extraction was performed slowly in a step-wise manner (from low to high salt) in the presence of mild detergent. This ensured that the extraction process is gentle and avoids artifacts. From the NuMat pellet, MAR DNA was isolated. The size of MAR DNA ranged between 100 and 500 bp. Upon digestion of the isolated MAR DNA with DNase I, it was confirmed that the isolated

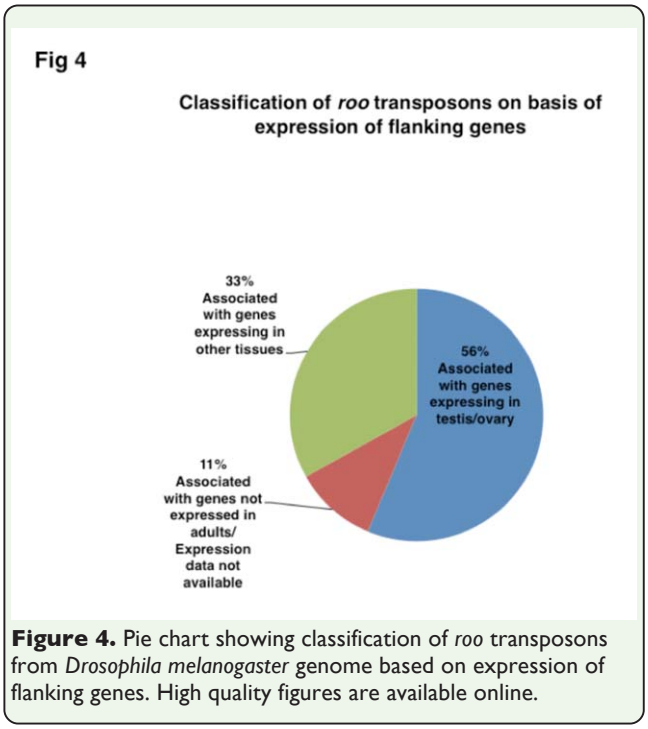

Figure 4. Pie chart showing classification of *roo* transposons from *Drosophila melanogaster* genome based on expression of flanking genes. High quality figures are available online.

fragments were DNA and not RNA (Figure 1B). The MAR DNA library was made according to the protocol described in the Methods. Despite repeated efforts, cloning did not give many colonies, probably because the MAR DNA were AT rich sequences with secondary structures. Such sequences are not tolerated well by the bacteria and hence are difficult to clone (Godiska et al. 2010; Leach and Lindsay 1986). The obtained MAR DNA clones were checked for inserts by restriction digestion. The size of the inserts ranged from 100 to 500 bp, correlating well with the size of the MAR DNA used for ligation. The clones were sequenced, and all the sequences obtained were found to be unique (Table 1).

Analysis of the MAR DNA clones with MAR-WIZ and cdBEST programs

All the MAR clones were analyzed for the NuMat binding properties by *in silico* analysis. As no single property is attributed to NuMat association, we checked for AT%, origin of replication sites, topoisomerase II cleavage sites, AT richness (regularly spaced AT repeats), ATC rule (a stretch of 20 or more nucleotides of A, T, or C) ,and MAR score (all the individual parameters were considered, and those that had a potential higher than the threshold were given) with MAR-WIZ program (Singh 2000). Sixteen of the 35 sequences showed AT% of more than 60% (Table 1). Origin of replication sites were found in all the MAR sequences except 3. Two-thirds of the sequences showed AT richness. Sixteen sequences showed topoisomerase II sites. ATC rule was also followed by many of the clones, and most importantly all the clones showed maximum threshold for matrix association. All the sequences satisfied more than one rule of NuMat association. This analysis clearly indicated that the obtained sequences have potential to associate with NuMat, and the library represents a subset of the whole genome of MAR DNA sequences from *D. melanogaster* embryos.

The binding motifs of a few DNA binding proteins, such as boundary element associated factor, GAGA factor, zeste-white 5, dCTCF, and suppressor of hairy wing, were also checked for in the cloned sequences, as these proteins are reported to bind to chromatin domain boundaries as well as MAR sequences. Several boundaries have been shown to associate with NuMat, so whether any of the sequences had a potential for boundary activity was also checked. To check this, the cdBEST program (Srinivasan and Mishra 2012) was used. The program can be used for identification of recognition sequences of boundary interacting proteins as well as for identifying potential boundaries. The results (Supplementary Table 1) show that none of the MAR sequences cloned were predicted to be a potential boundary. Of the boundary/MAR interacting proteins, the boundary element associated factor binding site was present in 10 sequences (~29%), the GAGA factor binding site was present in 10 sequences (~29%), and the zeste-white 5 binding site was present in 4 (~10%) of the sequences. Although this data set is small, it indicates that all MAR sequences may not neccesarily act as boundaries and vice-versa. Further, MAR and boundary property, if present on the same sequence, may be separable and not overlapping.

LTR sequence from *roo* transposon is enriched in NuMat

One of the clones from the library, labeled as MAR18, corresponded to an 190 bp sequence in the LTR of *roo* retrotransposon (Figure 2A). The complete *roo* retrotransposon element is 8.7 Kb, with a terminal repeat of 429 bp (Kaminker et al. 2002). The association of

roo MAR with NuMat was validated by the *in vivo* MAR assay by Southern blotting. Primers were designed to amplify the LTR region of *roo* encompassing the MAR18 sequence. As controls, exonic, intronic, and intergenic regions close to *roo* insertion sites in the *Drosophila* genome were used. A signal in the *roo* MAR lane indicates the presence of complimentary sequences in the labelled MAR pool used as a probe. The absence of signals in the other lanes indicates that those sequences were not present in MAR *in situ* (Figure 2B). This experiment confirmed that the *roo* LTR element is associated with the NuMat *in vivo*.

In silico analysis of *roo* MAR sequence

Upon BLAST analysis, *roo* MAR was shown to be present 250 times in the genome (56, 47, 44, 59, and 46 times on X, 2L, 2R, 3L, and 3R chromosomes respectively) (Figure 3A). *roo* MAR sequences were found both at intergenic and intronic regions but never in an exon. Sometimes it was present more than once within the same intronic or intergenic region. The sequence of *roo* MAR when analyzed using MAR-WIZ showed a region of maximum matrix association that extended from 95 bp to 135 bp of the LTR (Figure 3B). This region had an origin of replication sequence (ATTTA), a curved DNA sequence (TTTAAA), an A-box (AAATAAAA), and a region that conformed with ATC rule (underlined in the sequence). The other 2 regions with lower MAR potential also harbored origin of replication sequences and were AT rich. The sequence was further checked for its similarity with an already known MAR DNA sequence in *Drosophila gypsy* retrotransposon. Alignment showed overall 40–50% sequence similarity. In the *gypsy* MAR sequence, topoisomerase II recognition sites are labelled as 1 to 7, and regions showing ATC rule are underlined (Figure 3C) (Nabirochkin et al. 1998). The topoisomerase II recognition sequence numbered "7," and the regions following ATC rule, showed high sequence conservation among *gypsy* and *roo* MAR. Furthermore, an A-box was present in both sequences. Thus, the 2 sequences were similar in regions important for MAR association.

Analysis of *roo*-flanking genes in the *Drosophila* genome

FlyBase showed 193 insertions of *roo* in the whole genome of which 151 were in the sequenced region. Of the 151 places where *roo* transposon was inserted, 85 sites had a gene in the vicinity of those expressed in testes and ovaries (Supplementary Tables 2, 3), a significant 56% of the 151 sequenced *roo* insertions. Of the rest, expression data for genes around 11% of the *roo* insertions were either not available or the genes were not expressed in adult tissue. The remaining 33% insertions had associated genes expressed in other tissues (Figure 4). This analysis indicated a potential role for *roo* transposon in genome organization and regulated expression of distant genes via NuMat association.

Discussion

The genome in eukaryotes needs MAR regions to demarcate chromatin into domains and to regulate gene expression (Heng et al. 2004; Razin et al. 2007). Many MARs have been characterized and are found to lie in genic as well as intergenic regions of the genome. MARs have been shown to topologically constrain DNA into loops. This plays an important role in compact packaging of the chromatin (Mirkovitch et al. 1984). As they are DNA sequences with special properties, several *in silico* programs attempt to predict these sequences on a genome-wide scale. MARs can target a DNA locus to a desired location for a specific function (Yusufzai and

Felsenfeld 2004). For example, in *Drosophila*, the *scs'* boundary sequence that demarcates *hsp70* heat shock locus behaves as a MAR. It binds to the boundary element associated factor and localizes to the NuMat (Pathak et al. 2007). A similar example is *gypsy* retrotransposon, which is known to behave as an insulator. *Gypsy* DNA, along with its binding proteins, is located in the NuMat, and the intervening DNA between 2 *gypsy* insertions was found to be arranged in a loop (Byrd and Corces 2003). Mutation in the *gypsy* binding protein leads to disruption of the loop. In the context of spatial organization, such MAR-associated localization could simply reflect changes in transcriptional status or changes in organization of chromatin structure.

In the present study, it was found that an abundant retrotransposon *roo* had a region that can bind to the NuMat. Transposon *roo* has been shown to be transcribed in a development and tissue-specific manner, and elements within the retrotransposon have been shown to act as *cis*-regulatory elements (Bronner et al. 1995). The transposon is distributed throughout the genome on all chromosomes. The genes flanking the transposon insertion site appeared to be coordinately regulated, as a sizable fraction of them were expressed in testes or ovaries. It would be ideal for the cell to have a few sequences and multiply them many times to organize the genome instead of having different sequences for different regions. These repeat sequences could provide the mechanism to identify coordinately regulated genes and cluster them in appropriate regions for regulated expression. Transposons like *roo*, by virtue of NuMat association, can act as a tool to direct the spatial organization of the genome and regulate expression. As they are mobile elements, they can lead to the creation of new domains by moving along the genome and helping in evolution. The findings of our study strengthen the idea of the role of mobile genetic elements in genome organization and gene regulation (Kazazian 2004; Tomilin 2008).

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Table 1. Characteristics of MAR DNA library sequences (Based on MAR-WIZ). Indvidual scores for origin of replication (ORI), Topoisomerase II (TopoII) sites, AT richness, and ATC rule are given for forward and reverse strands in F/R format.

MAR Seq. No	Seq length	AT%	ORI pattern	TOPO II	AT richness	ATC rule	MAR Score 1
MAR1	277	54.6	3/2	0	2/2	0	+
MAR2	141	54.4	0/2	0	0	0	+
MAR3	62	60.3	0/0	0	2/3	0	+
MAR4	177	69.6	4/4	0	15/16	0	+
MAR5	74	64.5	1/2	0	5/3	0	+
MAR6	224	74.6	6/6	1/0	14/14	20/7	+
MAR7	72	65.9	1/2	0/1	6/4	0/7	+
MAR8	158	42.4	0	1/0	0	0	+
MAR9	128	49	1/1	1/0	0	0	+
MAR10	306	50.3	1/1	0	0	0	+
MAR11	82	64.2	1/2	0	6/3	0	+
MAR12	278	57.7	4/3	0	5/5	1/0	+
MAR13	73	62.6	1/2	0	5/3	0	+
MAR14	165	69	3/3	0	16/18	0	+
MAR15	301	49.5	1/0	0	0	0	+
MAR16	301	50.2	1/0	0	0	0	+
MAR17	123	62.9	1/0	0	1/3	0/3	+
MAR18	190	59.3	4/1	0	2/1	0	+
MAR19	100	46.9	-	-	-	-	-
MAR20	116	65.5	1/2	0	0	0	+
MAR21	329	63.2	5/6	2/0	9/0	5/4	+
MAR22	235	48.6	6/6	0	14/14	7/20	+
MAR23	242	65.3	5/4	3/0	3/1	2/16	+
MAR24	323	61.3	4/3	1/0	5/5	2/0	+
MAR25	395	48.4	3/4	1/0	0	2/0	+
MAR26	117	66.6	3/2	0	1/3	0/6	+
MAR27	148	69.6	2/3	0	4/2	6/0	+
MAR28	281	59.4	2/4	0/1	0	10/0	+
MAR29	297	59.5	4/3	0/1	6/5	8/0	+
MAR30	125	52	1/0	1/0	0	0	+
MAR31	77	49.6	0/1	1/0	0	0	+
MAR32	580	51.4	4/7	1/1	0	2/0	+
MAR33	179	58.1	2/1	0	4/1	0	+
MAR34	559	53.8	7/8	1/0	15/16	2/0	+
MAR35	364	63.3	7/5	39815	14/14	39913	+

Supplementary Table 1. Binding sites for various boundary/MAR interacting proteins in the MAR DNA library sequences (Based on cdBEST).

MAR. Seq No	Sequence length	BEAF	GAGA factor	Zw5	dCTCF	Su(Hw)
MAR1	277	0	0	0	0	0
MAR2	141	0	0	0	0	0
MAR3	62	0	1	0	0	0
MAR4	177	0	0	0	0	0
MAR5	74	0	1	0	0	0
MAR6	224	0	0	0	0	0
MAR7	72	0	1	0	0	0
MAR8	158	0	0	0	0	0
MAR9	128	2	0	0	0	0
MAR10	306	2	0	0	0	0
MAR11	82	0	1	0	0	0
MAR12	278	1	0	1	0	0
MAR13	73	0	1	0	0	0
MAR14	165	0	0	0	0	0
MAR15	301	2	0	0	0	0
MAR16	301	2	0	0	0	0
MAR17	123	0	0	0	0	0
MAR18	190	1	0	0	0	0
MAR19	100	0	0	0	0	0
MAR20	116	0	0	0	0	0
MAR21	329	0	0	0	0	0
MAR22	235	0	0	0	0	0
MAR23	242	0	1	0	0	0
MAR24	323	0	0	0	0	0
MAR25	395	0	1	0	0	0
MAR26	117	1	0	0	0	0
MAR27	148	0	1	0	0	0
MAR28	281	1	0	0	0	0
MAR29	297	1	0	1	0	0
MAR30	125	0	0	0	0	0
MAR31	77	0	0	0	0	0
MAR32	580	0	2	0	0	0
MAR33	179	1	0	1	0	0
MAR34	559	0	1	2	0	0
MAR35	364	0	0	0	0	0

Supplementary Table 2.

S. No	Symbol	Chr Arm	Sequence location	Associated gene orientation	Associated gene name	Summary of FlyAtlas Anatomical Expression Data
1	roo{}l(2)gl[52]	2L	13563-15062	upstream	CG11023	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	Ir21a	No expression detected in any larval or adult organs/tissues.
				Within	l(2)gl	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval hindgut, larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval central nervous system, adult crop, adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, adult carcass.
2	roo{}281	2L	686974-695955	upstream	CG2839	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG2839.
				downstream	Hsp60B	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				Within	ds	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system.
3	roo{}283	2L	976935-984512	upstream	CG4341	Expression at high levels in the following post-embryonic organs or tissues: adult brain. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system.
				downstream	IA-2	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult heart. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult crop, larval/adult midgut, adult male accessory gland, adult carcass.
4	roo{}284	2L	996780-1005816	upstream	CG4341	Expression at high levels in the following post-embryonic organs or tissues: adult brain. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system.
				downstream	IA-2	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult heart. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult crop, larval/adult midgut, adult male accessory gland, adult carcass.
5	roo{}2620	2L	2100430-2109522	upstream	CG12674	Expression at moderate levels in the following post-embryonic organs or tissues: adult male reproductive system.
				downstream	CG4259	Expression at high levels in the following post-embryonic organs or tissues: adult heart, adult fat body, adult spermathecae. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult carcass.
				Within	dpr3	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult male accessory gland.
6	roo{}drm[3]	2L	3545808-3545809	upstream	Chc-13	No expression detected in any larval or adult organs/tissues.
				downstream	CR43822	
				Within	drm	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult hindgut, adult heart.
7	roo{}311	2L	5827763-5836712	upstream	CG31644	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				downstream	CG8965	Expression at high levels in the following post-embryonic organs or tissues: adult spermathecae. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult Malpighian tubules, adult salivary gland.
				Within	TrissinR	Little or no expression detected in any larval or adult organs/tissues.
8	roo{}5613	2L	6426911-6431563	upstream	l(2)k11101	
				downstream	CG9527	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult fat body. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass.
9	roo{}315	2L	6431564-6436013	upstream	l(2)k11101	
				downstream	CG9527	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult fat body. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass.
10	roo{}1706	2L	6436014-6445112	upstream	l(2)k11101	
				downstream	retm	Expression at high levels in the following post-embryonic organs or tissues: adult fat body, inseminated spermatheca. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult crop, larval/adult hindgut, adult heart, larval fat body, larval salivary gland, adult female reproductive system, adult carcass.
				partial overlap	CG9527	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult fat body. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass.
11	roo{}319	2L	7343381-7350438	upstream	wg	Expression at moderate levels in the following post-embryonic organs or tissues: larval hindgut, adult salivary gland.
				downstream	Wnt10	No expression detected in any larval or adult organs/tissues.
				Within	Wnt6	Little or no expression detected in any larval or adult organs/tissues.
12	roo{}grk[2]	2L	8431781-8431781	upstream	Akap200	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval/adult midgut, larval hindgut, larval Malpighian tubules, adult heart, larval/adult fat body, larval salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult Malpighian tubules, adult salivary gland.
				downstream	D12	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				Within	grk	Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult heart, adult ovary, larval/adult carcass.

Supplementary Table 2. Continued.

13	roo{}grk[3]	2L	8431781-8431781	upstream	Akap200	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval/adult midgut, larval hindgut, larval Malpighian tubules, adult heart, larval/adult fat body, larval salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult Malpighian tubules, adult salivary gland.
				downstream	D12	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				Within	grk	Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult heart, adult ovary, larval/adult carcass.
14	roo{}grk[4]	2L	8431781-8431781	upstream	Akap200	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval/adult midgut, larval hindgut, larval Malpighian tubules, adult heart, larval/adult fat body, larval salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult Malpighian tubules, adult salivary gland.
				downstream	D12	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				Within	grk	Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult heart, adult ovary, larval/adult carcass.
15	roo{}mus201[S]	2L	8441909-8441909	upstream	D12	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				downstream	CG31897	Little or no expression detected in any larval or adult organs/tissues.
				Within	Chrac-14	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval trachea
				Within	mus201	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval trachea.
16	roo{}326	2L	8452476-8461588	upstream	U26	Little or no expression detected in any larval or adult organs/tissues.
				downstream	fu2	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				Within	fu12	Expression at high levels in the following post-embryonic organs or tissues: adult midgut, virgin spermatheca, adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, larval midgut, adult hindgut, adult Malpighian tubules, adult fat body, adult female reproductive system, adult carcass.
17	roo{}330	2L	9000335-9007786	upstream	Try29F	Expression at high levels in the following post-embryonic organs or tissues: adult midgut. Expression at moderate levels in the following post-embryonic organs or tissues: larval midgut, adult hindgut.
				downstream	CG9568	Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules.
18	roo{}339	2L	10946999-10956155	upstream	CG14072	Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG33129	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, adult crop, larval/adult fat body, larval salivary gland, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval/adult carcass.
				Within	dpr2	
19	roo{}366	2L	13853140-13862231	upstream	CG7968	Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, adult Malpighian tubules.
				downstream	Smg5	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				Within	ecnG1A	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, adult female reproductive system, larval/adult carcass.
20	roo{}371	2L	14642626-14651730	upstream	Adh	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval salivary gland, adult testis.
				upstream	Adhr	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval salivary gland, adult testis.
				downstream	CG15282	Expression at high levels in the following post-embryonic organs or tissues: larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval hindgut, larval trachea.
				Within	osp	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval hindgut, larval Malpighian tubules, larval/adult fat body, larval trachea, adult female reproductive system, larval/adult carcass.

Supplementary Table 2. Continued.

21	roo{}Mhc[4]	2L	16775241-16775241	upstream	CG13278	Little or no expression detected in any larval or adult organs/tissues.
				downstream	Cyt-b5-r	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval Malpighian tubules, adult heart, larval/adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system, larval midgut, larval/adult hindgut, adult Malpighian tubules.
				Within	Mhc	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult crop, larval/adult midgut, larval/adult hindgut, adult heart, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system, larval/adult Malpighian tubules, adult fat body, adult ovary, adult testis.
22	roo{}402	2L	18051931-18061019	upstream	elfless	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	Arr1	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult brain. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	rdo	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system.
23	roo{}1676	2L	19652628-19674003	upstream	CG10366	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult crop, larval/adult salivary gland, adult ovary, adult testis, larval carcass.
				downstream	scw	No expression detected in any larval or adult organs/tissues.
				Within	Lar	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system, adult ovary.
24	roo{}419	2L	19703592-19712669	upstream	scw	No expression detected in any larval or adult organs/tissues.
				downstream	CG10462	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval central nervous system, adult crop, larval hindgut, larval/adult Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				Within	Lar	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system, adult ovary.
25	roo{}spir[I83]	2L	20345966-20345968	upstream	CR43606	
				downstream	La	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult heart, adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass.
				Within	spir	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, larval/adult midgut, adult hindgut, larval Malpighian tubules, adult ovary.
26	roo{}495	2L	21403091-21403521	upstream	nrv3	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: adult midgut, adult heart, larval trachea, adult carcass.
				downstream	His-Psi:CR31616	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of His-Psi:CR31616.
27	roo{}4147	2L	21441096-21450230	upstream	His3:CG33812	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of His3:CG33812.
				downstream	His1:CG33813	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of His1:CG33813.
28	roo{}501	2L	21560793-21570223	upstream	His-Psi:CR31614	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of His-Psi:CR31614.
				downstream	Lamp1	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
29	roo{}508	2L	21597085-21604770	upstream	CR42546	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CR42546.
				downstream	CG2201	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: adult eye, larval Malpighian tubules, larval fat body, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, adult heart, adult fat body, adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, adult carcass.
30	roo{}521	2L	21981738-21990843	upstream	CG11634	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG31693	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				Within	CG2528	Expression at high levels in the following post-embryonic organs or tissues: adult testis.

Supplementary Table 2. Continued.

31	roo{}3250	2R	438509-438937	upstream	RpL38	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				downstream	p120ctn	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval hindgut, larval fat body, larval trachea, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, larval/adult midgut, adult hindgut, larval/adult Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, adult spermathecae, adult male reproductive system, larval/adult carcass.
				Within	Stlk	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval/adult carcass.
32	roo{}1668	2R	2181670-2208433	upstream	Pld	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, larval/adult salivary gland, larval trachea, adult ovary, larval carcass.
				downstream	jing	Little or no expression detected in any larval or adult organs/tissues.
33	roo{}764	2R	3097401-3105090	upstream	CG30384	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	Or43a	Little or no expression detected in any larval or adult organs/tissues.
				Within	pk	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system.
34	roo{}775	2R	4218422-4218850	upstream	mir-280	
				downstream	CG11635	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				Within	pdm3	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: larval/adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult thoracico-abdominal ganglion, adult testis.
35	roo{}784	2R	5100254-5100681	upstream	VhaAC45	
				downstream	lilg	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval central nervous system.
36	roo{}785	2R	5239785-5248875	upstream	CG13739	No expression detected in any larval or adult organs/tissues.
				downstream	CG12158	Expression at high levels in the following post-embryonic organs or tissues: adult head. Expression at moderate levels in the following post-embryonic organs or tissues: adult carcass.
37	roo{}1670	2R	5367637-5378109	upstream	Camta	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary.
				downstream	Wnt2	Little or no expression detected in any larval or adult organs/tissues.
38	roo{}1601	2R	5755405-5755777	upstream	Ntmt	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult crop, adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult ovary, adult male reproductive system, larval/adult carcass.
				downstream	CG18446	Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				Within	CG1516	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	cbx	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
39	roo{}1602	2R	5756668-5756803	upstream	Ntmt	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult crop, adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult ovary, adult male reproductive system, larval/adult carcass.
				downstream	CG18446	Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				Within	CG1516	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	cbx	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.

Supplementary Table 2. Continued.

40	roo{}793	2R	5758595-5759028	upstream	CG1516	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG12744	Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body, adult ovary.
				Within	cbx	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				partial overlap	CG18446	Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
41	roo{}796	2R	6064440-6073548	upstream	CG12214	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, adult midgut, adult hindgut, larval Malpighian tubules, adult heart, adult salivary gland, adult testis, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval midgut, larval hindgut, adult Malpighian tubules, larval/adult fat body, larval trachea, adult female reproductive system, adult male accessory gland.
				downstream	CG34221	No expression detected in any larval or adult organs/tissues.
				Within	KCNQ	Expression at high levels in the following post-embryonic organs or tissues: larval hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain, larval/adult midgut, adult hindgut, larval/adult Malpighian tubules, adult male accessory gland, larval carcass.
42	roo{}806	2R	6897375-6906490	upstream	Spn47C	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult carcass.
				downstream	CG43188	
				Within	luna	Little or no expression detected in any larval or adult organs/tissues.
43	roo{}813	2R	8368697-8370442	upstream	CG8550	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult fat body.
				downstream	CG34234	Little or no expression detected in any larval or adult organs/tissues.
				Within	Dh44-R2	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system, adult crop, adult midgut, larval/adult hindgut, larval/adult Malpighian tubules.
44	roo{}815	2R	8595076-8603383	upstream	wuc	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	mos	Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary.
				Within	CG42663	Little or no expression detected in any larval or adult organs/tissues.
45	roo{}816	2R	8676855-8685159	upstream	CG12374	Expression at high levels in the following post-embryonic organs or tissues: adult midgut.
				downstream	CG17580	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	sca	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system.
46	roo{}1707	2R	9980995-9997087	upstream	CG42288	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	mir-989	
				Within	Prosap	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult hindgut, adult heart, larval trachea, adult female reproductive system, larval carcass.
47	roo{}828	2R	10351851-10363947	upstream	Oaz	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system.
				downstream	L	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, adult crop, larval midgut, larval/adult hindgut, adult fat body, adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult midgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval salivary gland, larval carcass.
48	roo{}850	2R	13706421-13715342	upstream	CG5036	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval midgut, adult testis.
				downstream	olf186-F	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval midgut, larval/adult hindgut, larval Malpighian tubules, adult heart, larval/adult fat body, larval salivary gland, adult female reproductive system, adult male accessory gland, larval/adult carcass.
				Within	grh	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at high levels in the following post-embryonic organs or tissues: larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, adult crop, larval trachea, adult carcass.
49	roo{}1769	2R	14249643-14258754	upstream	sbb	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval trachea, inseminated spermatheca. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult crop, larval/adult hindgut, larval Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, adult female reproductive system, larval/adult carcass.
				downstream	CG42736	

Supplementary Table 2. Continued.

50	roo{}854	2R	14478428-14487521	upstream	Rgk2	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG42697	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG42697.
				Within	GEFmeso	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult midgut.
51	roo{}862	2R	16256072-16265176	upstream	CG11192	Expression at moderate levels in the following post-embryonic organs or tissues: adult hindgut.
				downstream	CG12484	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system.
52	roo{}866	2R	17625838-17634939	upstream	LBR	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				downstream	Grx-1	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
53	roo{}867	2R	17640644-17641071	upstream	LBR	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary.
				downstream	Grx-1	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
54	roo{}868	2R	17697085-17705266	upstream	CR9281	Expression at high levels in the following post-embryonic organs or tissues: larval fat body, adult testis.
				downstream	CG13492	Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, adult hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: larval hindgut.
55	roo{}883	2R	20241007-20249310	upstream	slbo	Expression at high levels in the following post-embryonic organs or tissues: larval Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: larval midgut.
				downstream	tRNA:N5:60C	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of tRNA:N5:60C.
				Within	bs	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval/adult midgut, larval Malpighian tubules, larval fat body, larval/adult salivary gland, adult ovary, larval carcass.
56	roo{}1598	2R	21029229-21036865	upstream	CG43106	
				downstream	CG34038	No expression detected in any larval or adult organs/tissues.
57	roo{}1665	2R	21036866-21046860	upstream	CG43106	
				downstream	CG34038	No expression detected in any larval or adult organs/tissues.
58	roo{}896	3L	110267-119375	upstream	CG12483	Little or no expression detected in any larval or adult organs/tissues.
				downstream	Pdk1	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult crop, larval Malpighian tubules, adult heart, adult fat body. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, larval fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
59	roo{}898	3L	789969-790396	upstream	tRNA:CR32481	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of tRNA:CR32481.
				downstream	CG13898	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
60	roo{}903	3L	1154185-1163277	upstream	bab1	Expression at moderate levels in the following post-embryonic organs or tissues: adult brain.
				downstream	CG13912	Expression at high levels in the following post-embryonic organs or tissues: adult heart.
				Within	bab2	Many larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult Malpighian tubules, adult heart, adult salivary gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval/adult midgut, larval hindgut, larval Malpighian tubules, adult fat body, larval/adult carcass.
61	roo{}911	3L	2447560-2456657	upstream	CG13800	Expression at moderate levels in the following post-embryonic organs or tissues: larval Malpighian tubules.
				downstream	CG33232	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at high levels in the following post-embryonic organs or tissues: adult crop. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				Within	CG42669	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult midgut, adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval central nervous system, adult crop, larval midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
62	roo{}927	3L	5034214-5043307	upstream	CG12027	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				downstream	CR43884	
				Within	Con	Expression at high levels in the following post-embryonic organs or tissues: adult brain. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system.
63	roo{}scny[roo]	3L	5767137-5767137	upstream	Ppat-Dpck	Expression at high levels in the following post-embryonic organs or tissues: larval Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult crop, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, adult heart, larval/adult fat body, adult female reproductive system, adult carcass.
				downstream	vito	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult female reproductive system, adult male accessory gland.
				Within	scny	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
64	roo{}936	3L	6214070-6223163	upstream	pncr008:3L	Expression at high levels in the following post-embryonic organs or tissues: larval/adult hindgut.
				downstream	CG13299	Expression at high levels in the following post-embryonic organs or tissues: adult ovary.
65	roo{}1708	3L	6398814-6425219	upstream	CG13300	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG10147	Little or no expression detected in any larval or adult organs/tissues.
				Within	CG42747	

Supplementary Table 2. Continued.

66	roo{}944	3L	6880673-6888106	upstream	vvl	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at moderate levels in the following post-embryonic organs or tissues: adult heart, adult fat body, larval trachea, adult carcass.
				downstream	Prat2	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult heart, larval/adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye.
67	roo{}Hn[r3]	3L	7755577-7755580	upstream	CG32373	Expression at moderate levels in the following post-embryonic organs or tissues: larval midgut, larval hindgut, larval carcass.
				downstream	Clk	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult crop, adult hindgut, adult heart, adult salivary gland, adult testis.
				Within	Hn	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult heart, larval/adult fat body, adult spermathecae, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult hindgut, adult testis.
68	roo{}952	3L	7909983-7919096	upstream	CG32368	Expression at high levels in the following post-embryonic organs or tissues: adult midgut. Expression at moderate levels in the following post-embryonic organs or tissues: larval midgut, larval/adult hindgut, adult Malpighian tubules, inseminated spermatheca.
				downstream	syd	Expression at moderate levels in the following post-embryonic organs or tissues: adult brain, adult male accessory gland.
69	roo{}958	3L	8474928-8484028	upstream	Gug	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, larval/adult carcass.
				downstream	ZC3H3	Expression at moderate levels in the following post-embryonic organs or tissues: adult brain.
				Within	CG43163	
70	roo{}965	3L	9263773-9271469	upstream	CG4477	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	PGRP-LA	Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult central nervous system, adult crop, larval/adult midgut, larval hindgut, adult heart, larval/adult salivary gland, larval trachea, adult spermathecae.
				Within	Glu-RIB	
71	roo{}969	3L	9494856-9495283	upstream	CG32037	No expression detected in any larval or adult organs/tissues.
				downstream	CG3408	Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: larval hindgut, larval Malpighian tubules, larval fat body, larval salivary gland, larval trachea, adult ovary, larval carcass.
				Within	path	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, larval central nervous system, adult midgut, adult Malpighian tubules, adult heart, adult fat body, larval salivary gland, adult female reproductive system, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult central nervous system, adult crop, larval midgut, larval/adult hindgut, larval fat body, adult salivary gland, adult male accessory gland, larval carcass.
72	roo{}974	3L	9922823-9931543	upstream	nudE	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: adult crop, larval hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval/adult midgut, adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
				downstream	CG6685	Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary.
				Within	CG34356	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system.
73	roo{}982	3L	11492212-11501312	upstream	chrb	Expression at high levels in the following post-embryonic organs or tissues: adult heart. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system, adult crop, adult hindgut, inseminated spermatheca
				downstream	CG33500	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG33500.
74	roo{}989	3L	13518312-13526049	upstream	CG10710	Little or no expression detected in any larval or adult organs/tissues.
				downstream	miR-289	
				Within	bru-3	
75	roo{}1653	3L	13797701-13807238	upstream	bru-3	
				downstream	CG43184	
76	roo{}992	3L	13804335-13806808	upstream	bru-3	
				downstream	CG43184	
77	roo{}995	3L	14289138-14289565	upstream	CG7906	Expression at high levels in the following post-embryonic organs or tissues: larval hindgut, larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye.
				downstream	CG13482	Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval/adult hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult Malpighian tubules, adult heart.
				Within	fz	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval trachea, adult ovary.
78	roo{}1010	3L	15922352-15931440	upstream	sff	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system.
				downstream	GXIVsPLA2	Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult Malpighian tubules, adult heart, larval/adult salivary gland, larval trachea, adult ovary, larval/adult carcass.
				Within	Pka-C3	Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult crop, adult hindgut, larval Malpighian tubules, adult testis, larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult brain, larval hindgut, adult Malpighian tubules, adult heart, inseminated spermatheca, adult male accessory gland, adult carcass.

Supplementary Table 2. Continued.

79	roo{}1018	3L	16938883-16947977	upstream	Cpr73D	Expression at moderate levels in the following post-embryonic organs or tissues: adult salivary gland, adult carcass.
				downstream	Nc73EF	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary, adult male reproductive system.
				partial overlap	Obp73a	No expression detected in any larval or adult organs/tissues.
80	roo{}1020	3L	17078160-17087250	upstream	CG7724	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult crop, adult Malpighian tubules, adult salivary gland, adult carcass.
				downstream	CR43433	
				Within	Rbp6	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult central nervous system.
81	roo{}1034	3L	18040863-18049861	upstream	CG42393	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG42393.
				downstream	CG34252	Expression at high levels in the following post-embryonic organs or tissues: adult ovary.
				Within	Eip75B	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval midgut, larval hindgut, larval Malpighian tubules, larval/adult fat body, larval/adult salivary gland, larval trachea, adult ovary, larval/adult carcass.
82	roo{}1039	3L	18521783-18530885	upstream	CG32198	Expression at high levels in the following post-embryonic organs or tissues: larval/adult salivary gland.
				downstream	star1	Little or no expression detected in any larval or adult organs/tissues.
83	roo{}1043	3L	18765564-18774186	upstream	Aut1	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval Malpighian tubules, adult heart, larval fat body, virgin spermatheca. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult hindgut, adult Malpighian tubules, adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
				downstream	CG14073	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult crop, larval Malpighian tubules, larval fat body, larval salivary gland, larval trachea, adult female reproductive system, adult testis, larval carcass.
				Within	ftz-f1	Expression at high levels in the following post-embryonic organs or tissues: adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult brain.
84	roo{}1055	3L	19841657-19850786	upstream	kto	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult testis.
				downstream	Rab8	
				Within	Papss	Expression at high levels in the following post-embryonic organs or tissues: larval fat body, larval salivary gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult central nervous system, adult midgut, adult Malpighian tubules, adult fat body, adult salivary gland, adult female reproductive system, adult carcass.
85	roo{}1059	3L	20106813-20116011	upstream	CG14187	Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary.
				downstream	CG7365	Expression at high levels in the following post-embryonic organs or tissues: larval/adult hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye.
86	roo{}1076	3L	21299303-21308403	upstream	CG7632	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, adult hindgut, adult Malpighian tubules, adult heart, adult fat body, adult ovary, adult carcass.
				downstream	Rab26	Little or no expression detected in any larval or adult organs/tissues.
				Within	Pc	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult ovary.
87	roo{}1582	3L	21951869-21952236	upstream	CG7458	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG7458.
				downstream	CR34262	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CR34262.
88	roo{}1583	3L	21954331-21954698	upstream	CR34262	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CR34262.
				downstream	CS-2	Expression at moderate levels in the following post-embryonic organs or tissues: adult midgut, larval/adult hindgut, larval/adult Malpighian tubules.
89	roo{}3796	3L	23191794-23191887	upstream	CG34031	No expression detected in any larval or adult organs/tissues.
				downstream	nAcRalpha-80B	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system.
90	roo{}5834	3L	23592989-23593409	upstream	CG32230	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				downstream	CG17454	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval/adult carcass.
				Within	AGO3	Expression at high levels in the following post-embryonic organs or tissues: adult ovary.
91	roo{}2355	3L	23648593-23649016	upstream	CG32230	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				downstream	CG17454	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval/adult carcass.
				Within	AGO3	Expression at high levels in the following post-embryonic organs or tissues: adult ovary.

Supplementary Table 2. Continued.

92	roo{}1189	3R	192535-200859	upstream	hkb	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system.
				downstream	CG11739	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult heart, larval/adult fat body, adult spermathecae, adult testis, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, larval trachea, adult ovary, larval carcass.
				partial overlap	CG1090	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system.
93	roo{}dsx[D]	3R	3761198-3761198	upstream	lds	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary, adult testis.
				downstream	CD98hc	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, adult female reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval Malpighian tubules, larval trachea, adult male reproductive system.
				Within	dsx	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult fat body, adult spermathecae. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult crop, adult hindgut, adult Malpighian tubules, adult heart, larval fat body, adult salivary gland, adult carcass.
94	roo{}1265	3R	4228785-4237892	upstream	CG31462	No expression detected in any larval or adult organs/tissues.
				downstream	Obp85a	No expression detected in any larval or adult organs/tissues.
				Within	CG43462	
95	roo{}1267	3R	4427544-4436638	upstream	Cenp-C	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary, adult testis.
				downstream	Or85c	No expression detected in any larval or adult organs/tissues.
				Within	CG42796	
96	roo{}1290	3R	7205013-7214109	upstream	KP78b	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult testis.
				upstream	KP78a	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult testis.
				downstream	mRpL40	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system, adult midgut, larval/adult hindgut, larval/adult salivary gland, adult ovary, larval/adult carcass.
				Within	pros	Expression at high levels in the following post-embryonic organs or tissues: larval/adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult heart.
97	roo{}1348	3R	8690339-8690766	upstream	CG10126	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult thoracico-abdominal ganglion, adult crop, adult hindgut, larval/adult Malpighian tubules, larval/adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult midgut, larval hindgut, adult heart, larval fat body, adult carcass.
				downstream	d-cup	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
98	roo{}1359	3R	10020205-10029296	upstream	CG3199	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG9649	Expression at high levels in the following post-embryonic organs or tissues: adult crop, adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult heart.
				Within	DopR	Expression at moderate levels in the following post-embryonic organs or tissues: adult brain.
99	roo{}1378	3R	13464089-13464522	upstream	tRNA:CR31573	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of tRNA:CR31573.
				downstream	CG43175	
100	roo{}1379	3R	13588940-13589367	upstream	TyrR	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG43102	
101	roo{}1388	3R	15267283-15276380	upstream	CG3517	Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: larval fat body.
				downstream	Dys	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult crop, larval midgut, larval/adult hindgut, larval Malpighian tubules, larval salivary gland, adult spermathecae. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult midgut, adult Malpighian tubules, adult heart, larval/adult fat body, adult salivary gland, larval trachea, adult ovary, adult male accessory gland, larval/adult carcass.
				Within	CG31221	Expression at high levels in the following post-embryonic organs or tissues: larval/adult central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult head.
102	roo{}1392	3R	15982468-15991579	upstream	CR42836	
				downstream	CG5023	Expression at high levels in the following post-embryonic organs or tissues: adult crop, larval/adult hindgut, adult heart, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult midgut, larval trachea.
103	roo{}1395	3R	16156776-16157203	upstream	Sirt2	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, adult ovary, adult male accessory gland, adult carcass.
				downstream	Ir92a	No expression detected in any larval or adult organs/tissues.
104	roo{}1405	3R	18065269-18074270	upstream	Gld2	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	mir-1010	
				Within	SKIP	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of SKIP.

Supplementary Table 2. Continued.

105	roo{}1410	3R	19510474-19510901	upstream	CG16710	No expression detected in any larval or adult organs/tissues.
				downstream	SPE	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult crop, adult hindgut, adult heart, larval/adult fat body, adult spermathecae.
				Within	CG18754	Little or no expression detected in any larval or adult organs/tissues.
106	roo{}1411	3R	19661181-19670273	upstream	snRNA:U1:95Cb	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of snRNA:U1:95Cb.
				downstream	snRNA:U1:95Ca	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of snRNA:U1:95Ca.
				Within	CG34355	Little or no expression detected in any larval or adult organs/tissues.
107	roo{}1421	3R	21551606-21560707	upstream	CLS	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: larval fat body, adult testis. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
				downstream	LpR1	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult central nervous system, adult midgut, adult heart, adult fat body, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, larval midgut, larval trachea, adult ovary, larval carcass.
				Within	LpR2	Expression at high levels in the following post-embryonic organs or tissues: adult heart, adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, larval/adult hindgut.
108	roo{}alpha4GT2[1]	3R	21658468-21667591	upstream	Mst57Da	Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG14545	Expression at high levels in the following post-embryonic organs or tissues: adult ovary.
				Within	alpha4GT2	Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland.
109	roo{}1425	3R	22202102-22211203	upstream	CG33970	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult crop, adult hindgut, adult salivary gland, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult midgut, larval hindgut, larval trachea, adult testis, larval carcass.
				downstream	CG14239	Little or no expression detected in any larval or adult organs/tissues.
110	roo{}1426	3R	22336279-22345281	upstream	CG5455	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval midgut, adult hindgut, adult heart, adult fat body, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult midgut, larval/adult Malpighian tubules, adult salivary gland, larval trachea, adult spermathecae, adult male reproductive system, larval carcass.
				downstream	scrib	
				Within	CG6490	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG6490.
111	roo{}1429	3R	22636330-22636757	upstream	snoRNA:Me28S-U1554	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of snoRNA:Me28S-U1554.
				downstream	Lerp	Many larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut, larval hindgut, larval/adult Malpighian tubules, adult spermathecae. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, adult hindgut, larval/adult salivary gland, adult ovary, adult male accessory gland.
				Within	Tl	
112	roo{}1430	3R	22833182-22842258	upstream	CG6295	Expression at high levels in the following post-embryonic organs or tissues: larval/adult midgut.
				downstream	CG17192	Expression at high levels in the following post-embryonic organs or tissues: adult midgut.
				Within	NepYr	Expression at moderate levels in the following post-embryonic organs or tissues: adult hindgut.
113	roo{}1701	3R	23346935-23356085	upstream	CG13972	No expression detected in any larval or adult organs/tissues.
				downstream	Gr98b	No expression detected in any larval or adult organs/tissues.
				Within	CG12885	Little or no expression detected in any larval or adult organs/tissues.
114	roo{}1434	3R	23349297-23355043	upstream	CG13972	No expression detected in any larval or adult organs/tissues.
				downstream	Gr98b	No expression detected in any larval or adult organs/tissues.
				Within	CG12885	Little or no expression detected in any larval or adult organs/tissues.
115	roo{}1445	3R	24584063-24589621	upstream	CG14061	Expression at high levels in the following post-embryonic organs or tissues: adult male accessory gland.
				downstream	CG34295	Expression at moderate levels in the following post-embryonic organs or tissues: adult male accessory gland.
116	roo{}1455	3R	25707797-25716895	upstream	CG34133	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at moderate levels in the following post-embryonic organs or tissues: adult salivary gland, adult ovary, adult testis.
				downstream	CG15517	No expression detected in any larval or adult organs/tissues.
				Within	CG31038	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at high levels in the following post-embryonic organs or tissues: adult eye, larval trachea. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult crop, larval/adult hindgut, adult Malpighian tubules, adult heart, adult salivary gland, adult spermathecae, adult male accessory gland, larval/adult carcass.
117	roo{}1458	3R	26143103-26150636	upstream	CG34300	Little or no expression detected in any larval or adult organs/tissues.
				downstream	Fer1HCH	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				Within	hdc	Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system. Expression at moderate levels in the following post-embryonic organs or tissues: adult central nervous system, larval trachea, adult ovary, adult male reproductive system, larval carcass.

Supplementary Table 2. Continued.

118	roo{}1460	3R	26221995-26230202	upstream	Fer2LCH	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				downstream	CG2217	Expression at high levels in the following post-embryonic organs or tissues: adult central nervous system, larval salivary gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult heart, adult fat body, adult spermathecae.
				downstream	CG42740	
119	roo{}4733	X	57196-64391	upstream	CR43863	
				downstream	tyn	Expression at high levels in the following post-embryonic organs or tissues: larval hindgut.
120	roo{}7	X	721690-729423	upstream	Sec22	High or moderate levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult crop, larval midgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male accessory gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval/adult central nervous system, adult midgut, larval/adult hindgut, adult ovary, adult testis, larval/adult carcass.
				downstream	CG14635	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	CG43867	
121	roo{}13	X	957844-966579	upstream	CG14629	Many larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult midgut, larval Malpighian tubules, adult heart, larval/adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult brain, larval/adult hindgut, adult Malpighian tubules, larval trachea, larval carcass.
				downstream	CG3655	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult crop, adult salivary gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval midgut, larval/adult hindgut, larval/adult Malpighian tubules.
122	roo{}20	X	1631199-1640305	upstream	CG3795	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG42666	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	Adar	Little or no expression detected in any larval or adult organs/tissues.
				partial overlap	Scgdelta	Little or no expression detected in any larval or adult organs/tissues.
123	roo{}25	X	2293926-2302220	upstream	PsGEF	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG12496	Little or no expression detected in any larval or adult organs/tissues.
124	roo{}w[bf]	X	2685708-2685712	upstream	CG32795	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, larval/adult carcass.
				downstream	CG12498	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	kirre	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain, adult heart, larval trachea.
				Within	w	Expression at high levels in the following post-embryonic organs or tissues: larval/adult Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval fat body.
125	roo{}w[sp1]	X	2691741-2691745	upstream	w	Expression at high levels in the following post-embryonic organs or tissues: larval/adult Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval fat body.
				downstream	CG12498	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				Within	kirre	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain, adult heart, larval trachea.
126	roo{}28	X	2717876-2726365	upstream	CG12498	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG14416	No expression detected in any larval or adult organs/tissues.
				Within	kirre	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain, adult heart, larval trachea.
127	roo{}34	X	3112591-3121684	upstream	CG3939	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval/adult Malpighian tubules, larval fat body, larval salivary gland, larval trachea. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult heart, adult fat body, adult salivary gland, adult female reproductive system, adult male reproductive system, larval/adult carcass.
				downstream	CG14265	Expression at high levels in the following post-embryonic organs or tissues: larval salivary gland.
				Within	dnc	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval/adult central nervous system, adult Malpighian tubules, adult heart, adult salivary gland, larval trachea, larval/adult carcass.
128	roo{}37	X	3387180-3396280	upstream	CG10803	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, larval trachea, adult female reproductive system, adult testis.
				downstream	CG32791	Little or no expression detected in any larval or adult organs/tissues.
				Within	Gas8	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
129	roo{}39	X	3491639-3496347	upstream	CG2875	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				downstream	Ilp7	Expression at moderate levels in the following post-embryonic organs or tissues: adult thoracico-abdominal ganglion.
				Within	AlstR	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain.

Supplementary Table 2. Continued.

130	roo{}38	X	3495975-3496220	upstream	CG2875	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				downstream	Ilp7	Expression at moderate levels in the following post-embryonic organs or tissues: adult thoracico-abdominal ganglion.
				Within	AlstR	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain.
131	roo{}41	X	3500362-3501109	upstream	CG2875	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				downstream	Ilp7	Expression at moderate levels in the following post-embryonic organs or tissues: adult thoracico-abdominal ganglion.
				Within	AlstR	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain.
132	roo{}1631	X	3500377-3506897	upstream	CG2875	Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				downstream	Ilp7	Expression at moderate levels in the following post-embryonic organs or tissues: adult thoracico-abdominal ganglion.
				Within	AlstR	Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult brain.
133	roo{}53	X	4683601-4684794	upstream	CG6978	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG2861	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
134	roo{}1649	X	4884132-4891287	upstream	SIP3	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG12680	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
135	roo{}57	X	4885090-4889813	upstream	SIP3	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG12680	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
136	roo{}78	X	7019334-7028434	upstream	fz1	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult midgut, larval hindgut, larval Malpighian tubules, larval/adult salivary gland, larval trachea, adult ovary, adult male accessory gland, larval carcass.
				downstream	CG9650	Little or no expression detected in any larval or adult organs/tissues.
137	roo{}89	X	8842847-8850298	upstream	CG43255	
				downstream	mir-4964	
				Within	rdgA	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at high levels in the following post-embryonic organs or tissues: adult eye.
138	roo{}lz[L]	X	9181085-9181085	upstream	c11.1	Many larval and adult organs/tissues expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval Malpighian tubules. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
				downstream	c12.1	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval Malpighian tubules, larval/adult fat body, larval/adult salivary gland, larval trachea, adult ovary, adult male accessory gland, larval carcass.
				Within	lz	Little or no expression detected in any larval or adult organs/tissues.
139	roo{}96	X	10161391-10170482	upstream	CG12643	Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, larval/adult midgut, larval fat body, larval trachea. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval hindgut, larval Malpighian tubules, adult heart, adult fat body, larval salivary gland, adult spermathecae, larval carcass.
				downstream	CG2909	Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult midgut, larval Malpighian tubules, adult fat body.
				partial overlap	alpha-Man-I	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, larval salivary gland, adult ovary, adult male accessory gland.
140	roo{}100	X	10580139-10585217	upstream	CG12637	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG32676	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval salivary gland. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, larval central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval/adult carcass.
				Within	X11Lbeta	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression in all larval and adult organs/tissues ranges from low to undetected. Expression at high levels in the following post-embryonic organs or tissues: adult brain. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system.
141	roo{}v[36f]	X	10819187-10819187	upstream	CG11203	Little or no expression detected in any larval or adult organs/tissues.
				downstream	CG2145	Many larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult thoracico-abdominal ganglion, larval/adult hindgut, adult heart, larval/adult fat body, larval trachea, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult central nervous system, adult Malpighian tubules, larval salivary gland, larval carcass.
				Within	v	Expression at high levels in the following post-embryonic organs or tissues: larval/adult fat body, adult spermathecae, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult heart.
142	roo{}111	X	11637655-11644743	upstream	CR43385	
				downstream	m	Expression at moderate levels in the following post-embryonic organs or tissues: adult crop.
143	roo{}123	X	13999111-14008203	upstream	tRNA:S774:12Ef	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of tRNA:S774:12Ef.
				downstream	tRNA:S7:12Eg	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of tRNA:S7:12Eg.

Supplementary Table 2. Continued.

144	roo{}132	X	14830948-14840146	upstream	Flo-2	
				downstream	CG9030	Expression at high levels in the following post-embryonic organs or tissues: adult testis.
				Within	pdgy	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval trachea, adult male reproductive system, larval/adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: larval central nervous system, adult fat body, larval/adult salivary gland, adult female reproductive system.
145	roo{}142	X	16116866-16125157	upstream	disco	Expression at moderate levels in the following post-embryonic organs or tissues: adult head, larval central nervous system.
				downstream	snRNA:U5:14B	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of snRNA:U5:14B.
146	roo{}143	X	16234756-16243854	upstream	Dsp1	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, adult ovary. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult spermathecae, adult male accessory gland, larval/adult carcass.
				downstream	sl	Nearly all larval and adult tissues/organs expressed at moderate levels. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male accessory gland, larval carcass.
147	roo{}162	X	18851158-18859762	upstream	CG7378	Expression at high levels in the following post-embryonic organs or tissues: adult eye, adult crop, adult carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult central nervous system, larval/adult hindgut, adult heart, larval carcass.
				downstream	Diedel3	No FlyAtlas data available because no Affy2 ProbeSet aligns to an exon of CG34329.
				Within	CG43759	
148	roo{}186	X	20707808-20715352	upstream	CG15450	Expression at moderate levels in the following post-embryonic organs or tissues: adult testis.
				downstream	CG43193	
				Within	shakB	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at moderate levels in the following post-embryonic organs or tissues: adult eye, adult central nervous system, adult heart.
149	roo{}193	X	20932946-20933373	upstream	CG1518	Nearly all larval and adult organs/tissues expressed at moderate or high levels. Expression at high levels in the following post-embryonic organs or tissues: larval central nervous system, larval salivary gland, larval trachea, adult ovary, adult male accessory gland, larval carcass. Expression at moderate levels in the following post-embryonic organs or tissues: adult head, adult eye, adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, adult Malpighian tubules, adult heart, larval/adult fat body, adult salivary gland, adult spermathecae, adult carcass.
				downstream	CG32512	Expression at high levels in the following post-embryonic organs or tissues: larval hindgut. Expression at moderate levels in the following post-embryonic organs or tissues: larval/adult midgut, adult heart, larval/adult fat body, larval trachea, adult ovary, adult male reproductive system, adult carcass.
				Within	bves	Expression at moderate levels in the following post-embryonic organs or tissues: adult ovary.
150	roo{}1716	X	21394786-21424793	upstream	CG32822	
				downstream	CG14476	High levels of expression observed in all larval and adult organs/tissues. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system, adult crop, larval/adult midgut, larval/adult hindgut, larval/adult Malpighian tubules, adult heart, larval/adult fat body, larval/adult salivary gland, larval trachea, adult female reproductive system, adult male reproductive system, larval/adult carcass.
151	roo{}4286	X	22398199-22405374	upstream	CG40485	Two or more Affy2 ProbeSets identify exons of this gene. This is a summary of the tissue expression peaks exhibited in at least one of these ProbeSets. Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye.
				downstream	FucTC	Expression at moderate levels in the following post-embryonic organs or tissues: adult midgut.
				Within	stnB	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system.
				Within	stnA	Expression at high levels in the following post-embryonic organs or tissues: adult head, adult eye, larval/adult central nervous system.

Supplementary Table 3.

roo associated with genes expressed in testis/ovary	*roo* associated with genes expressed in other tissues	*roo* associated with genes not expressed in adult tissue/expression data not available
roo{}l(2)gl[52]	roo{}283	roo{}4147
roo{}281	roo{}284	roo{}1598
roo{}311	roo{}2620	roo{}1665
roo{}grk[2]	roo{}drm[3]	roo{}1708
roo{}grk[3]	roo{}5613	roo{}989
roo{}grk[4]	roo{}315	roo{}1653
roo{}mus201[S]	roo{}1706	roo{}992
roo{}326	roo{}319	roo{}1582
roo{}339	roo{}330	roo{}1265
roo{}371	roo{}366	roo{}1378
roo{}Mhc[4]	roo{}495	roo{}1379
roo{}402	roo{}501	roo{}1411
roo{}1676	roo{}784	roo{}1701
roo{}419	roo{}785	roo{}1434
roo{}spir[I83]	roo{}813	roo{}25
roo{}508	roo{}828	roo{}123
roo{}521	roo{}1769	
roo{}3250	roo{}854	
roo{}1668	roo{}862	
roo{}764	roo{}896	
roo{}775	roo{}903	
roo{}1670	roo{}scny[roo]	
roo{}1601	roo{}944	
roo{}1602	roo{}952	
roo{}793	roo{}958	
roo{}796	roo{}982	
roo{}806	roo{}1020	
roo{}815	roo{}1039	
roo{}816	roo{}1583	
roo{}1707	roo{}3796	
roo{}850	roo{}1392	
roo{}866	roo{}1410	
roo{}867	roo{}1426	
roo{}868	roo{}1430	
roo{}883	roo{}1445	
roo{}898	roo{}1460	
roo{}911	roo{}4733	
roo{}927	roo{}13	
roo{}936	roo{}34	
roo{}Hn[r3]	roo{}39	
roo{}965	roo{}38	
roo{}969	roo{}41	
roo{}974	roo{}1631	
roo{}995	roo{}89	

Supplementary Table 3. Continued.

roo{}1010	roo{}v[36f]	
roo{}1018	roo{}111	
roo{}1034	roo{}142	
roo{}1043	roo{}162	
roo{}1055	roo{}1716	
roo{}1059	roo{}4286	
roo{}1076		
roo{}5834		
roo{}2355		
roo{}1189		
roo{}dsx[D]		
roo{}1267		
roo{}1290		
roo{}1348		
roo{}1359		
roo{}1388		
roo{}1395		
roo{}1405		
roo{}1421		
roo{}alpha4GT2[1]		
roo{}1425		
roo{}1429		
roo{}1455		
roo{}1458		
roo{}7		
roo{}20		
roo{}w[bf]		
roo{}w[sp1]		
roo{}28		
roo{}37		
roo{}53		
roo{}1649		
roo{}57		
roo{}78		
roo{}lz[L]		
roo{}96		
roo{}100		
roo{}132		
roo{}143		
roo{}186		
roo{}193		