**Drosophila grimshawi – Rheb**

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Figure 1: (A) Synteny of genomic neighborhood of Rheb in both *D. melanogaster* as well as *D. grimshawi*. (B) Gene Model in Apollo: A screenshot of the Apollo instance housing the gene model, containing student annotations, Dmel proteins, Gnomon annotations, transdecoder genes, RNA-Seq tracks and splice junctions; (C) Dot Plot of gene in *D. melanogaster* (x-axis) vs. the gene in *D. grimshawi* (y-axis); (D) Low sequence conservation near the start of the third coding exon, which is more obvious in other species, but still existent in *D. grimshawi*.

**Description**

**Introduction**

The Ras homolog enriched in brain (*Rheb*) encodes a Ras homolog (Karassek *et al.* 2010). Ras is family of genes that make proteins involved in cell signaling pathways that control cell growth and cell death (Banerjee and Resat 2016). The
gene model reported here (dgri_Rheb) was developed for the May 2011 assembly of D. grimshawi Agencourt
dgri_caf1/DgriCAF1 (GCA_000005155.1) to describe the ortholog to D. melanogaster Rheb (FBgn0041191) at the locus
previously annotated as XM_001989756.1. The general protocol and datasets for the genome browser tracks used to
establish this reported gene model are reported in Rele et al. 2020. Additional tools and resources used in generating and
confirming this model include HISAT (Kim et al. 2015), BEDTools (Quinlan et al. 2010), and the Sequence Read Archive

Synteny

The Rheb gene on chromosome 3R in D. melanogaster is surrounded by the genes CG12746, CG2931, CRMP, and
CG2926. Upon a tblastn search, the Rheb ortholog gene in D. grimshawi, on scaffold 14906, is surrounded by the genes
XM_001989754.1, XM_001989755.1, XM_001989575.1, and XM_001989576.1 (orthologous to Cenp-C, CLS, Nup93-2, and
CG2519) in D. melanogaster, Figure 1A). Though none of these flanking genes appear to be orthologous between the
two species, we determined this region to contain the ortholog for Rheb in D. grimshawi because this location had a
substantially better blastp hit to the Rheb protein sequence than to the second-best hit.

Gene Model

This gene model contains two isoforms of the Rheb protein in D. grimshawi, Rheb-PA and Rheb-PB (Figure 1B). Each of
these isoforms contains five identical coding exons. The model in D. melanogaster and D. grimshawi have the same
length and number of exons, and are similar in peptide sequence. However, there is a dissimilarity at the start of the third
exon; but the peptides replacing the ones in D. melanogaster have similar properties. The coordinates of the corrected
gene model can be found in NCBI at GenBank/BankIt using the accession BK014396 and archived in CaltechData
here.

Special Characters of Gene Model

Improper alignment at start of coding exon three: As shown in Figure 1D, there is a stretch of amino acids (Figure 1D)
that are not identical (black color), but similar (gray/white), between D. melanogaster and D. grimshawi. This pattern is
also evident in a few other species as compared to D. melanogaster (Figure 1D). Though this is more obvious in D.
kikkawai, D. serrata, D. obscura, D. pseudoobscura, D. persimilis, and D. miranda (Figure 1D) as compared to D.
grimshawi (Figure 1D), it nonetheless exists.

Changes in the splice donor site for coding exon four: Rheb-PA in D. grimshawi has a canonical GT splice donor site at
the end of coding exon four. In contrast, the end of coding exon four of Rheb-PA in D. melanogaster, and in most of the
other Drosophila species across the genus Sophophora, use a non-canonical GC splice donor site.

Extended data:
Fasta (.faa and .fna) and GFF files are archived and available on CaltechData:
D_grimshawi_Rheb_geneModel_gff_faa_fna.
This file contains
- Peptide Sequence of Rheb in D. grimshawi
- Nucleotide Sequence of Rheb in D. grimshawi
- GFF of Rheb in D. grimshawi

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