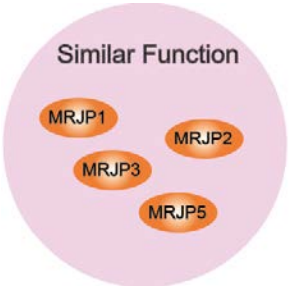
***Cite this as*:** Lingqi YU, Danfeng WANG, Xuanhao CHEN, Jiayu XIE, Dongjing WEN, Yi ZHANG, Lirong SHEN, Wenfeng CHEN, Zhenxing LIU, Yufeng YANG. Ectopic expression of structurally similar major royal jelly proteins reveals their distinct functions in *Drosophila*. *Journal of Zhejiang University-SCIENCE B*, 2026, 27(3):295-309. https://doi.org/10.1631/jzus.B2400624

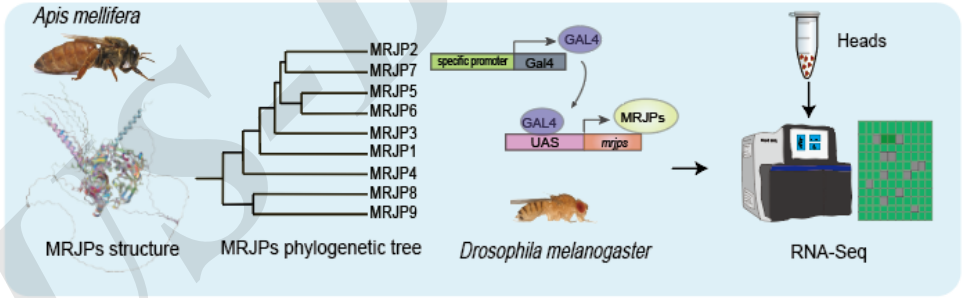
Ectopic expression of structurally similar major royal jelly proteins reveals their distinct functions in *Drosophila*

Key words: *Drosophila melanogaster*; Major royal jelly protein (MRJP); Ectopic expression

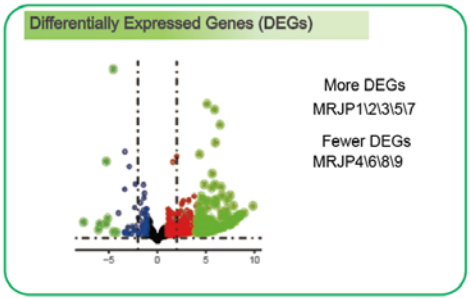
Research Summary

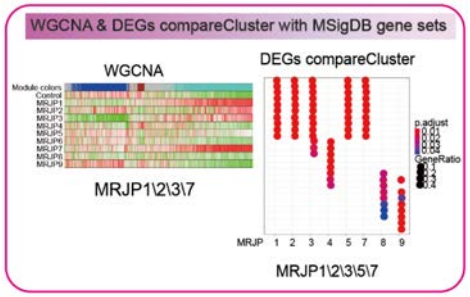
This study expressed structurally similar MRJPs 1-9 in *Drosophila* neurons, revealing that MRJP1/2/3/5 activate proliferation pathways and increase body size, while others show minimal effects, demonstrating their functional diversity.

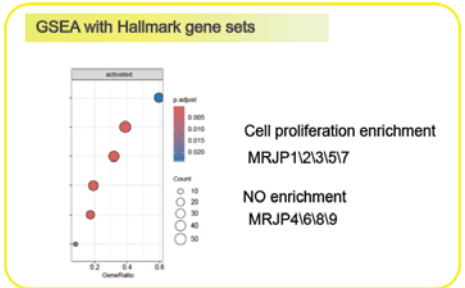


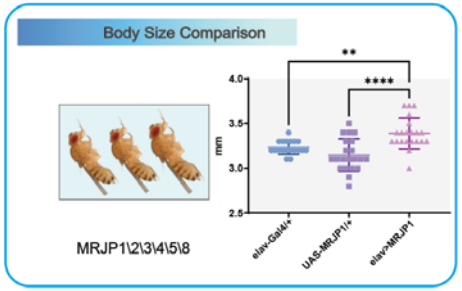


- **Comparative analysis of protein structures**
- **Construction and expression analysis of transgenic *Drosophila***
- **DEGs of different MRJPs overexpression *Drosophila***
- **Gene set enrichment comparison analysis**
- **Body size of *Drosophila* following neuronal overexpression of different MRJPs**



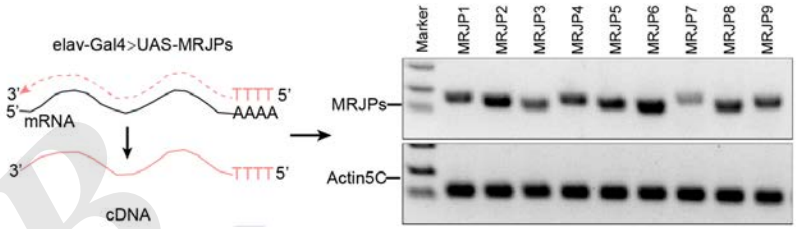




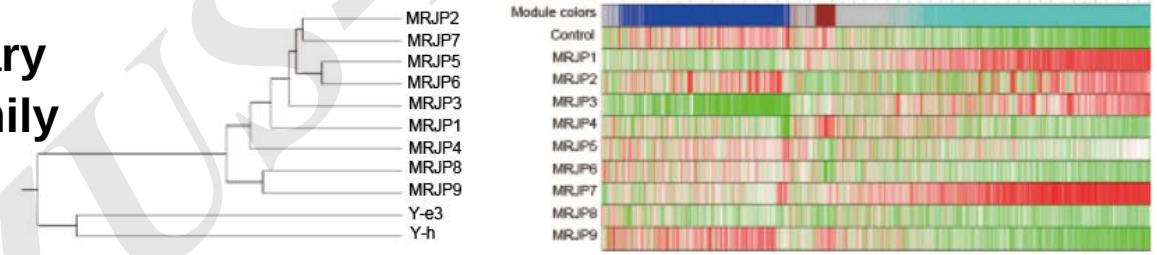


Innovation points

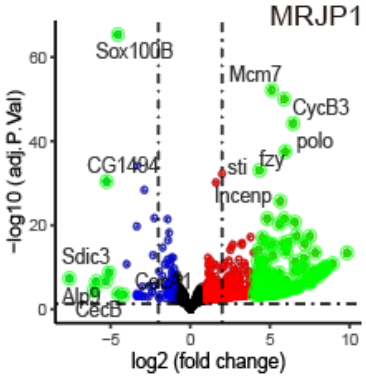
- **Constructed** nine ***Drosophila*** **models for ectopic expression of distinct MRJPs.**

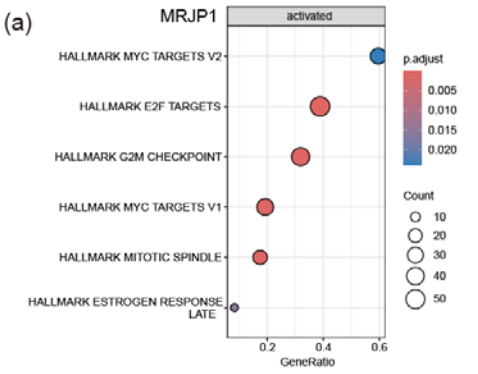


- **Confirmed** **the evolutionary relationships among MRJP family members.**



- **Revealed** **distinct gene expression profiles and signaling pathway disruptions caused by overexpression of specific MRJPs.**





Innovation points

A series of comprehensive figures and tables were generated to elucidate the potential functional variations of MRJPs in the brain.

Figure 1 | Comparative analysis of protein sequences and tertiary structures of different MRJPs.

Figure 2 | Construction and expression analysis of transgenic *Drosophila* with different UAS-MRJPs.

Figure 3 | Differentially expressed genes following the overexpression of different MRJPs in neurons of *Drosophila* heads

Figure 4 | Co-expression network analysis and gene enrichment comparison analysis of head transcriptomes in different MRJP overexpression and control groups.

Figure 5 | Gene set enrichment analysis of Hallmark gene sets in different MRJP overexpression groups.

Figure 6 | Changes in the body size of *Drosophila* following neuronal overexpression of different MRJPs.

Innovation points

A series of comprehensive figures and tables were generated to elucidate the potential functional variations of MRJPs in the brain.

Figure S1 | Comparative analysis of genomic structures for different MRJPs.

Figure S2 | Comparison of the tertiary structure of monomeric MRJP1 predicted by AlphaFold3 with the reported tertiary structure of multimeric MRJP1.

Figure S3 | Principal component analysis of transcriptomic data comparing overexpression of different MRJPs in the brain to the control group.

Figure S4 | Changes in body size of *Drosophila* following whole-body overexpression of different MRJPs.

Figure S5 | Changes in body size of *Drosophila* following fat body overexpression of different MRJPs

Table S1 | Primers used for genes amplication

Table S2 | Gene and protein sequences of MRJPs