



Background

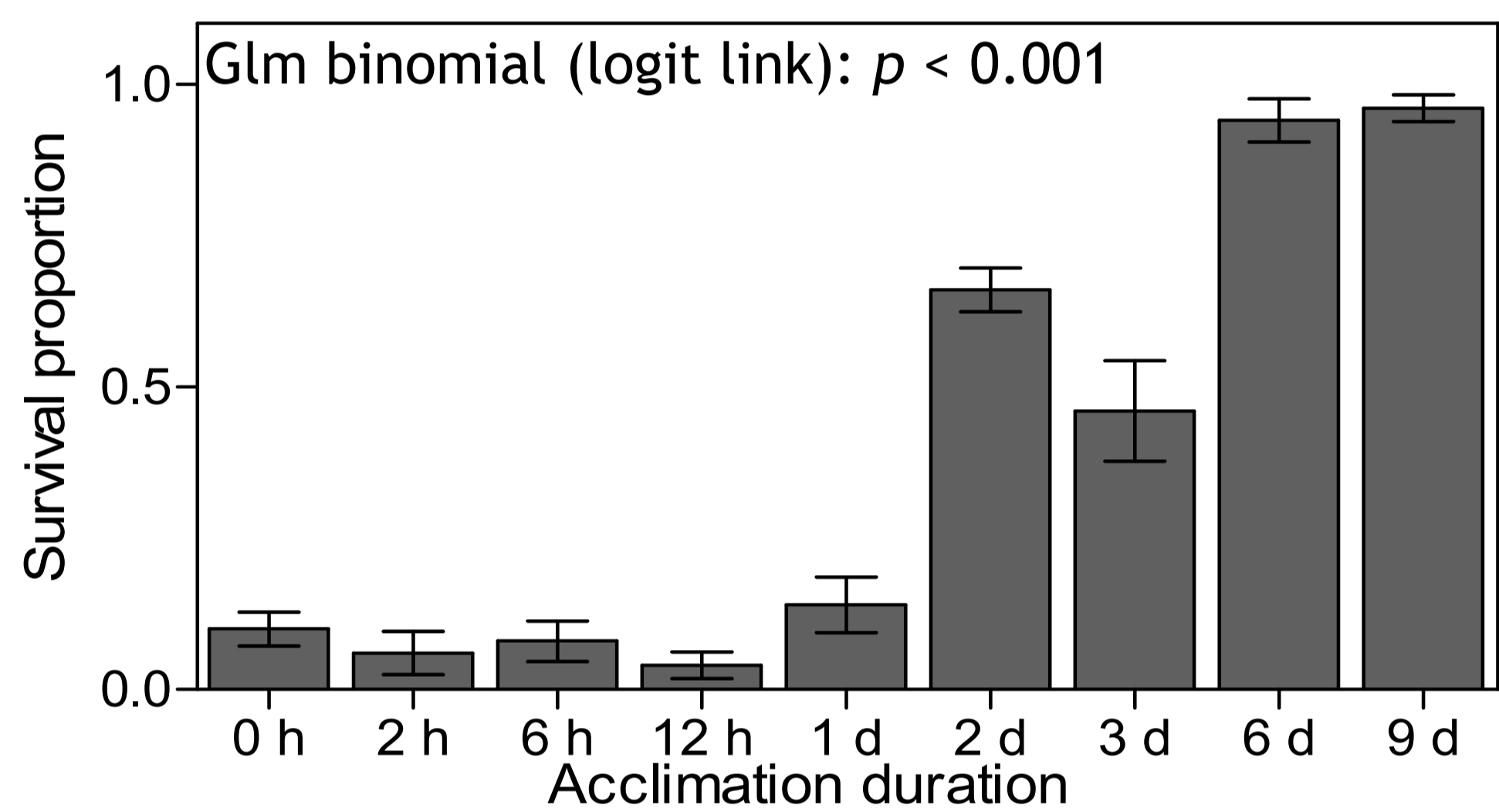
- D. suzukii* (invasive pest of red berries) is a chill susceptible fly. Yet, it survives harsh winter conditions, likely due to its highly plastic cold tolerance. Current knowledge about underlying mechanisms of cold acclimation in this species is scarce.
 - A recent study showed that developmental acclimation (long term: 50-60 days) lead to up-regulation of genes implied in ion transport, carbohydrate metabolism and glycolysis in this fly (Shearer et al. BMC Ecol, 2016)
- What about shorter-term acclimation?
 - ➔ Is there a “dose” of acclimation capable of maximizing cold tolerance in *D. suzukii*?
 - Which mechanisms are implied?



Effect of acclimation

7 days old ♀ acclimated at 10°C:

- Survival to -5°C/100 min (similar effects on $C_{t_{min}}$ and CCRT)



➔ Cold tolerance ↗ with acclimation duration (94% survival after 6 days)

RNA sequencing

Illumina Hiseq 2500, pair end, 125 bp

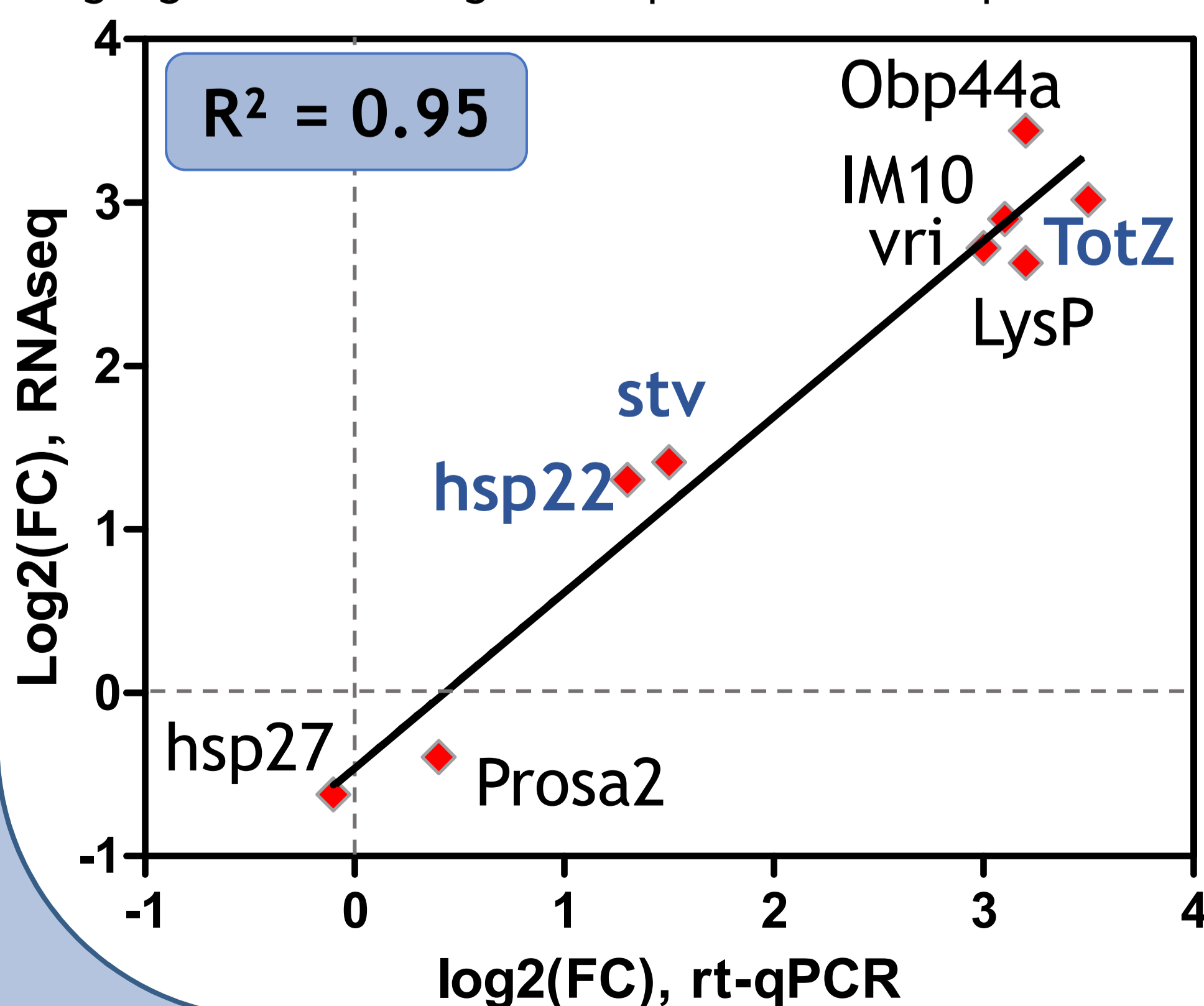
6 libraries: 3 Ctrl samples + 3 Acclimated samples (9 days)

- Mapping: **Tophat2** (Reference genome)
- Diff. expression: **Cufflinks / CuffDiff**

% Mapping	70.5
Nb genes	13 000
Diff. expressed	2200
Down regulated	1000
Up regulated	1200

Validation of results using qPCR

Highlighted in blue: genes implied in cold response

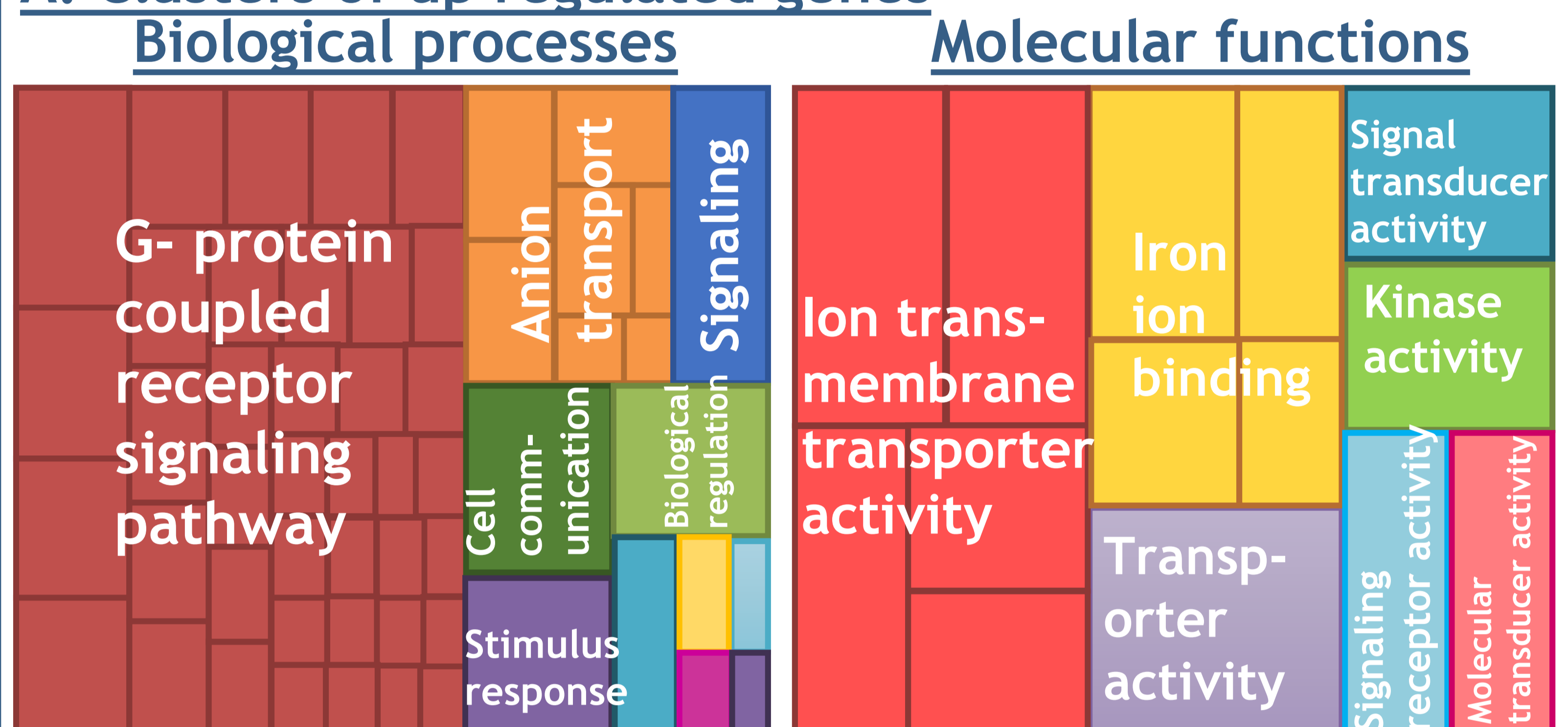


➔ qPCR and RNAseq results highly correlated
➔ Several genes implied in cold hardness up-regulated

Gene ontology term enrichment

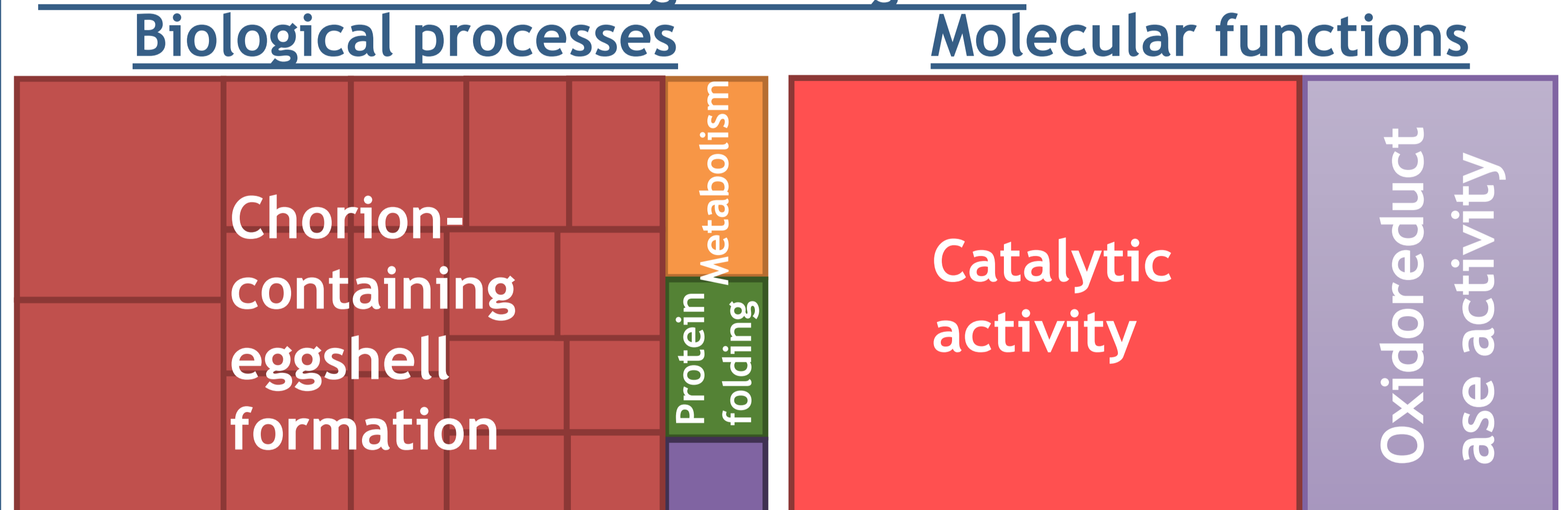
REVIGO

A: Clusters of up regulated genes



➔ Linked with membrane activity and ionic homeostasis

B: Clusters of down regulated genes



↘ reproductive process of acclimated females.

Caption: Treemap overviews of A: up and B: down regulated genes based on Gene Ontology. Each box represent a GO term. Relative sizes of the boxes correspond to $-\log_{10}(p\text{-value})$ of the respective GO term. Related terms are visualized with the same color. Process or function in which they are involved is indicated in white.

Take-home message

- Short term acclimation: ↗ from 10 to 100% survival
- Disturbance of ion homeostasis and membrane function: major mechanisms implied in chill-injuries (Overgaard and MacMillan, Annu. Rev. Physiol. 2017)
- ➔ Here: clusters of up regulated genes related to ion transport and membrane activity in cold-hardy flies

➔ *D. suzukii* plasticity of cold tolerance relies on mechanisms capable of counteracting chilling deleterious effects