Pycnopodia helianthoides immune response to SSWD

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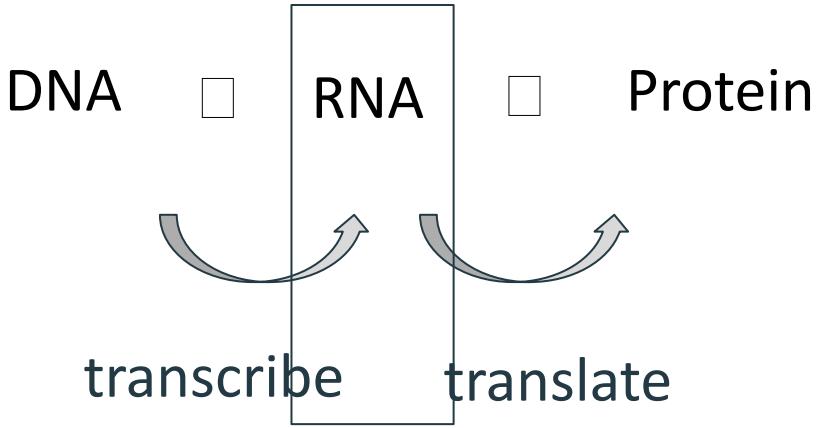
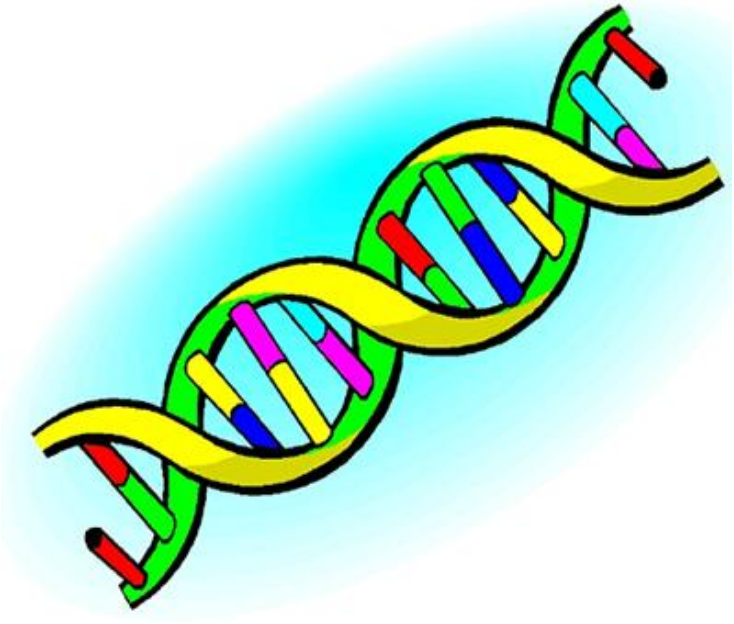
Studying Immune Response with Transcriptomics



Collection of mRNA sequence = transcriptome

Genes

- Unbiased
- Basic functionality in organism
- Differential expression
  - how conditions affect organism

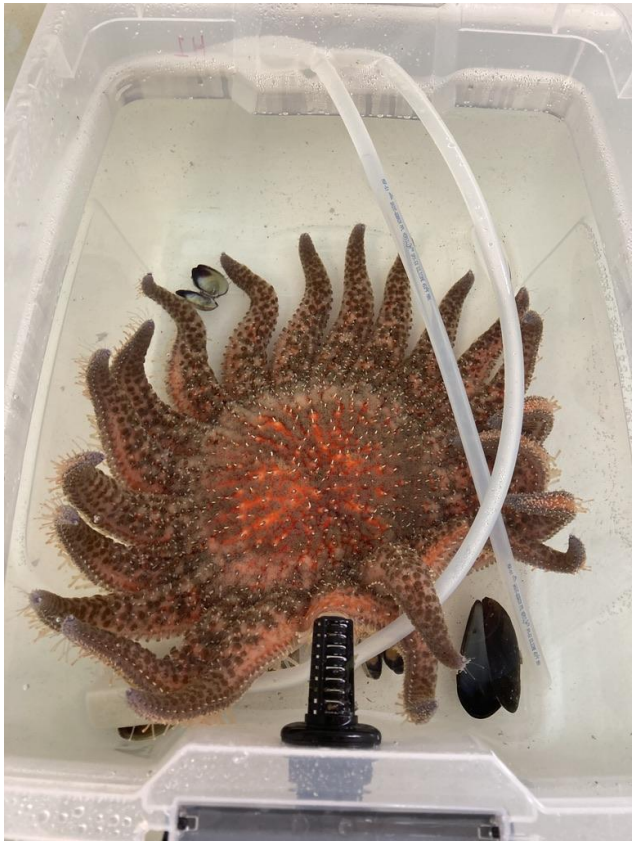


Why does it matter?

- Disease resilience genes
- Identify resistant populations in wild
- Precision breeding, CRISPR

Pycnopodia helianthoides (Sunflower Star)

- Baja California, Mexico → Alaska, US
- Predator
  - Urchins



Sea Star Wasting Disease

- 2013/2014 mass die-offs
- *P. helianthoides* lost most of any species
  - 5.75 billion stars
- Unknown cause

Objective:

- Understand stress/immune response of stars
  - Transcriptomics

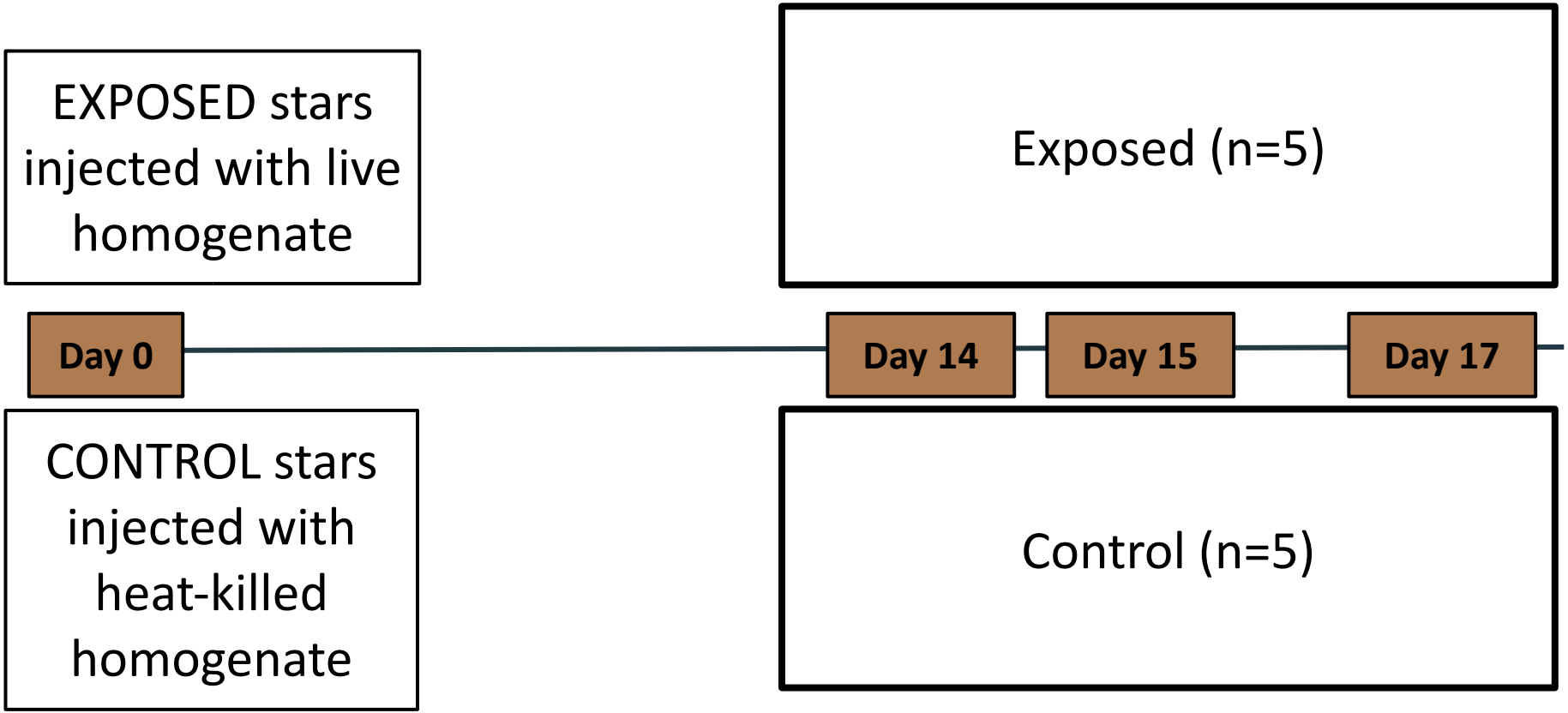
Summer 2021

CONTROL:
Heat-killed homogenate from a sick star
N = 5

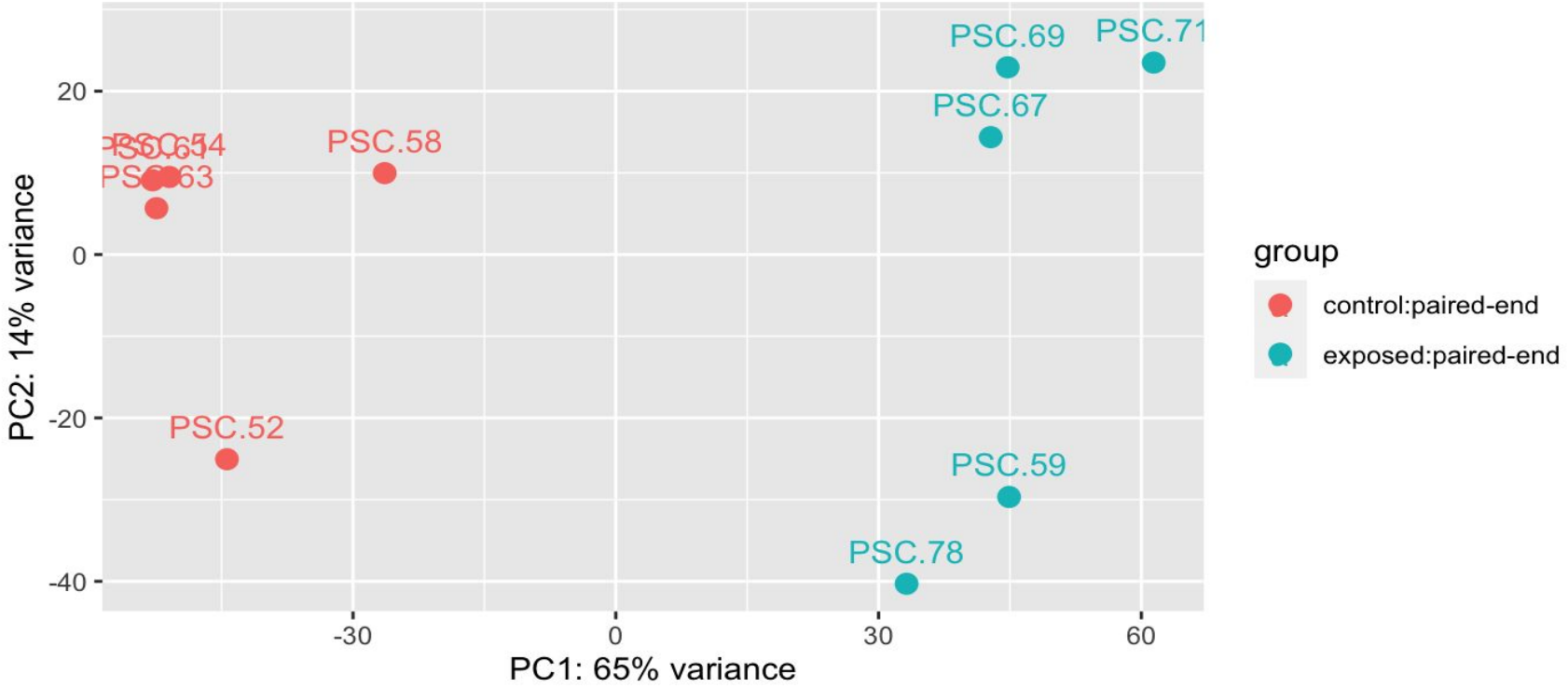
EXPOSED:
Live homogenate from a sick star

N = 5

Experimental timeline



PCA of RNAseq Samples



DEGs - what are they?

- Genes that are differentially expressed between two groups
  - Tells how treatment impacts gene expression/physiology

TOTAL GENES → **29476**

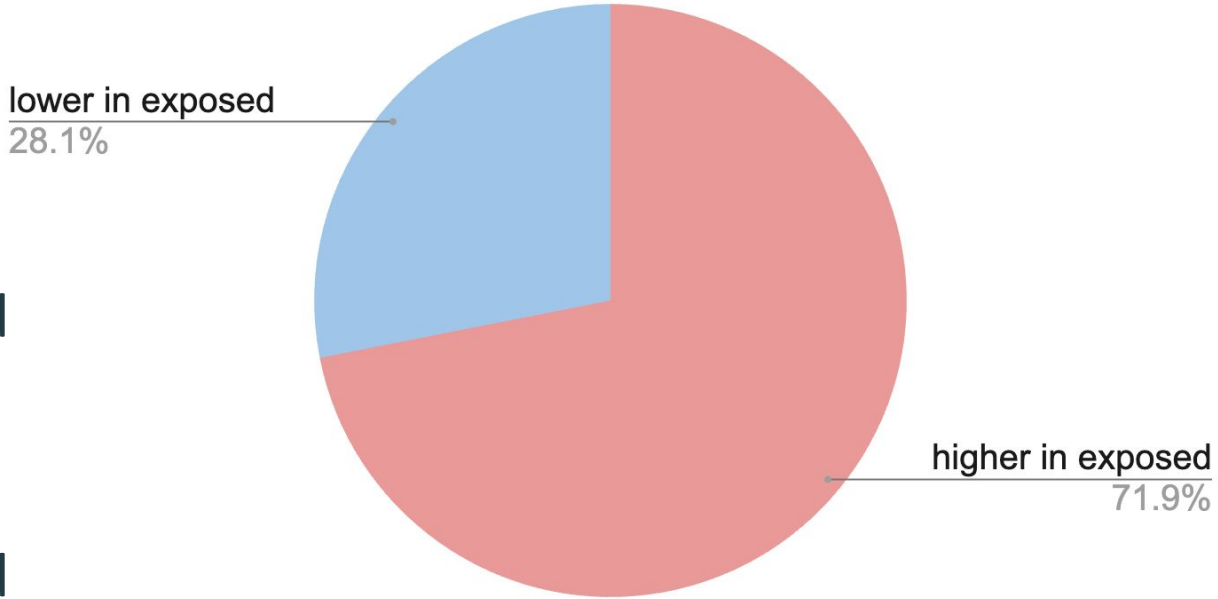
How many DEGs did we find?

29476 total genes

3651 differentially expressed

2625 higher expression in exposed stars

1026 lower expression in exposed stars



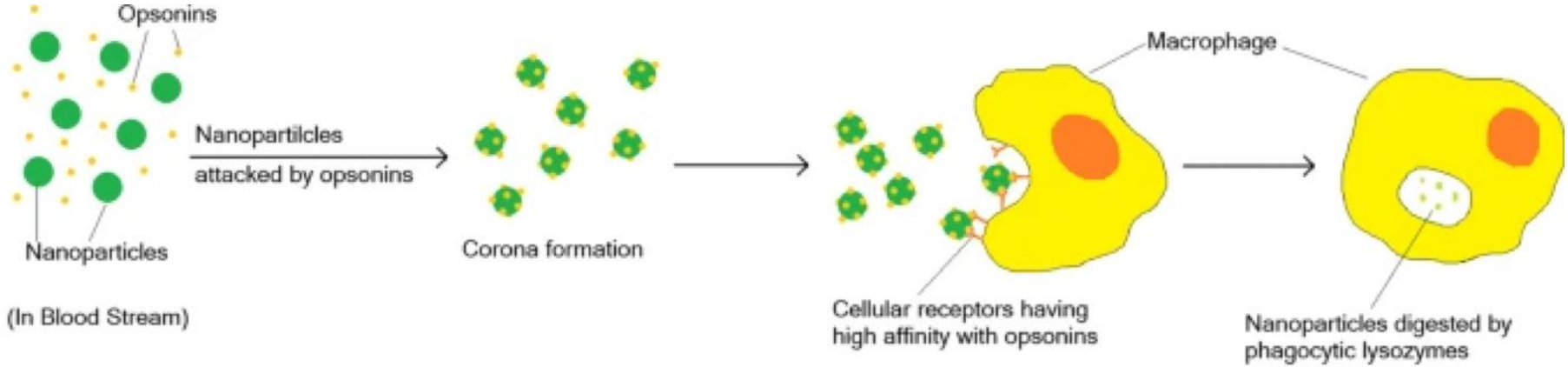
treatment
treatment
control
exposed
2
1
0
-1
-2
PSC.58
PSC.63
PSC.61
PSC.52
PSC.54
PSC.59
PSC.69
PSC.67
PSC.78
PSC.71

Enrichment

178 significantly enriched biological processes

Enriched Responses in Exposed Stars

Biological Process	Gene
positive regulation of opsonization	complement factor properdin (**CFP**)



Wani, T.U., Raza, S.N. & Khan, N.A. Nanoparticle opsonization: forces involved and protection by long chain polymers. *Polym. Bull.* **77**, 3865–3889 (2020). https://doi.org/10.1007/s00289-019-02924-7

Enriched Responses in Exposed Stars

Biological Process	Gene
positive regulation of opsonization	complement factor properdin (**CFP**)
defense response to Gram-negative bacterium	lysozyme 3 (LOC111100849)
innate immune response	Scavenger receptor cysteine-rich domain superfamily protein (**SRCR1**)
inflammatory response	Complement C3 (**C3**)
response to cytokine	interleukin 6 cytokine family signal transducer (**IL6ST**)
defense response to virus	FAS-associated death domain protein (**FADD**)

What else can genes help us understand?

- Help narrow search for causative agent
- Differences between populations, species

What's coming up next

- Align these and upcoming data to *P. helianthoides* genome
- RNAseq data last summer 2022 experiments
  - Control vs Exposed and juveniles and adult stars
- Summer 2023
  - Multi-species → compare immune response across species: *Pycnopodia helianthoides*, *Pisaster ochraceus*, and *Dermasterias imbricata*

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Thank you!
Questions?

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