



**A functional genomics approach to assessing
ecosystem health and resilience in keystone
bioindicator species**

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Mytilus species



Image redrawn from Springer & Crespi 2007, doi 10.1111/j.1558-5646.2007.00073.x

Project background



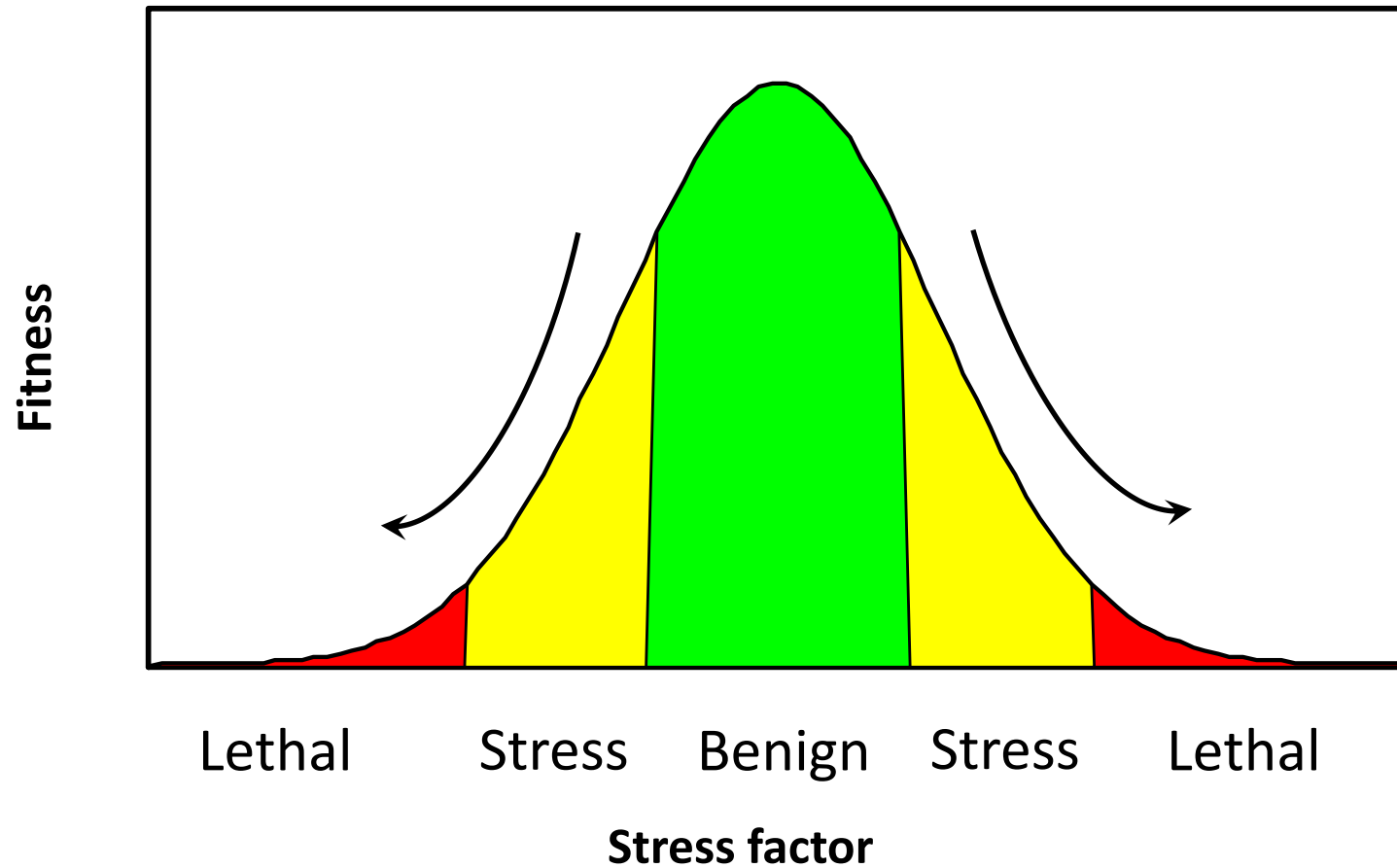
Taylor Shellfish



John Rowley

Good market opportunities, mortality events

Cause and effect



Redrawn from Sørensen JG and Loeschcke V (2007). *J. Biosci.* 32(3):447-456.

Myt-OME bioinformatics

35,157 Expressed Sequence Tags (ESTs)

- Average read of 750 bases
- Paracel Transcript clustering

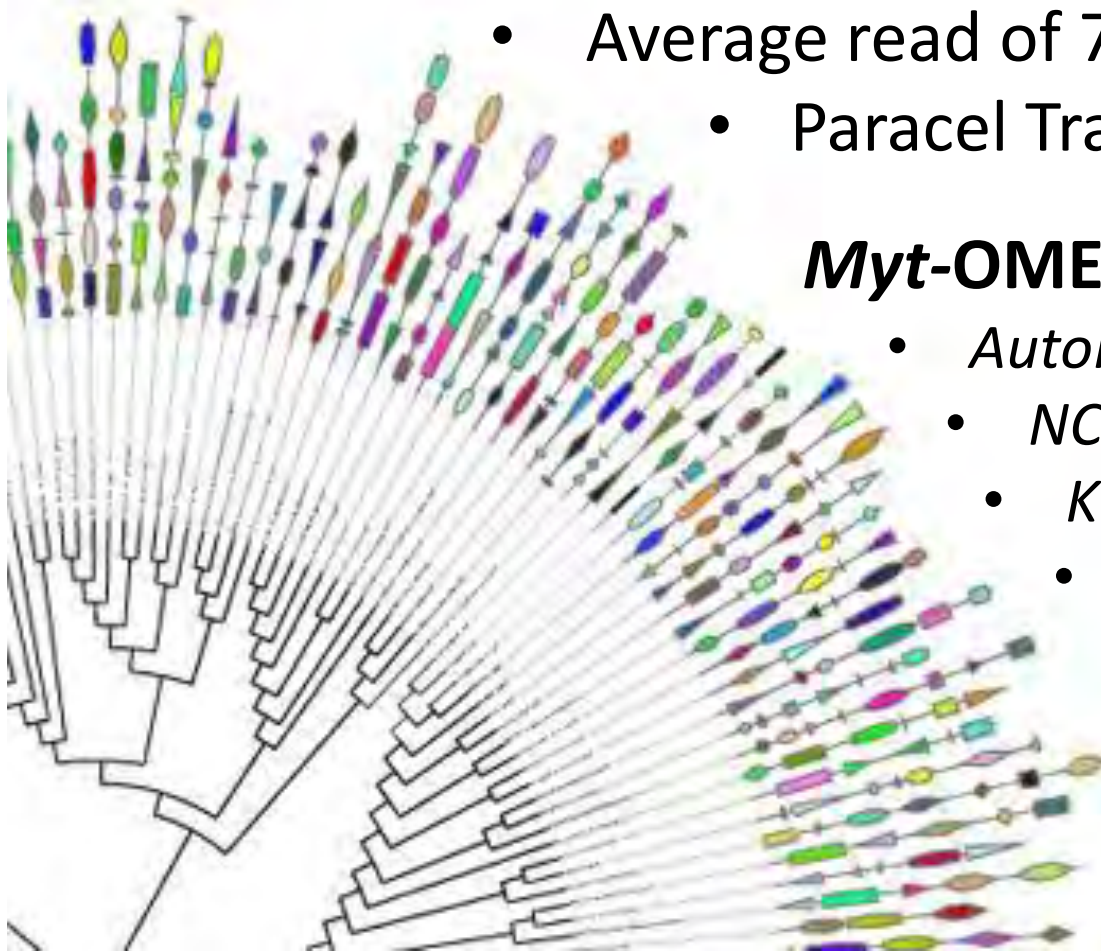
Myt-OME sequence annotation

- *AutoFact*
- *NCBI*
- *KEGG, Pfam, LSU, SSU*
- *mollusca_pro and mytibase*

NCBI GenBank non-project sequences

- *Annotation by AutoFact*

csc.uvic.ca





Myt-OME: Sequence Record

Home
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Sequence Search
Annotation
Summaries

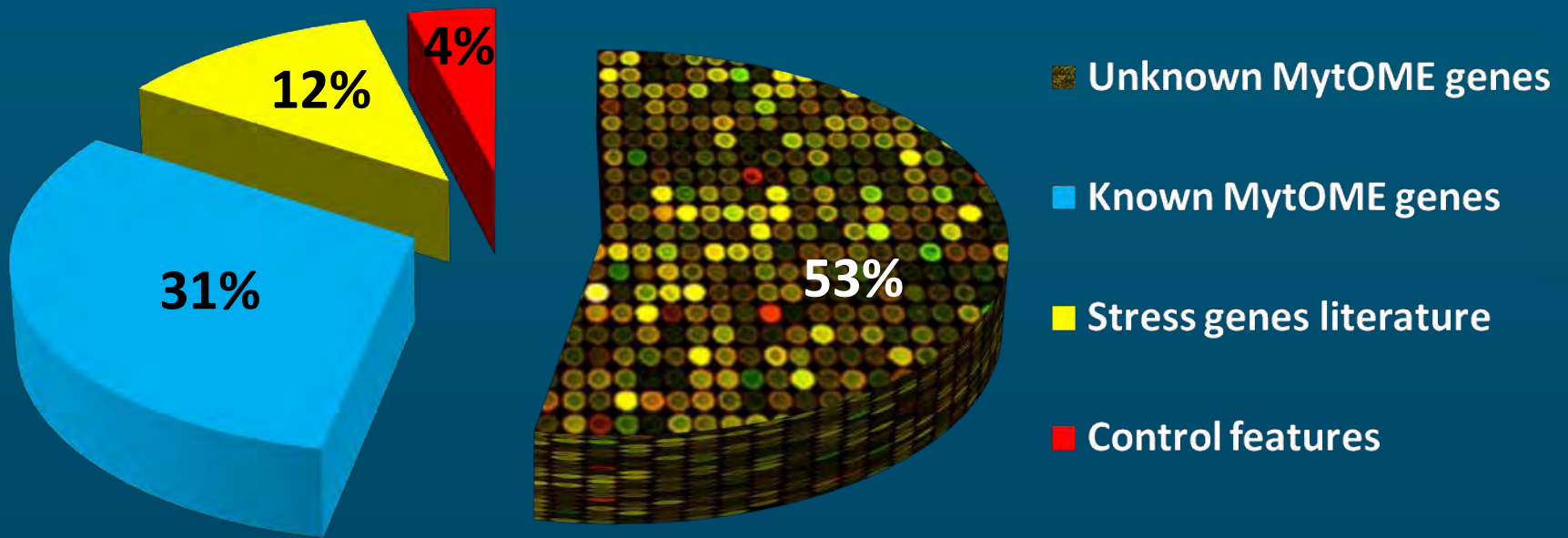
Name gallo1.2071.C1
Library
Date Added 2010-09-23
Date Sequenced
Contig? Yes
Orientation unknown
Size (nt) 642
%GC 39.25
Comments
FASTA

```
TACAGGCCATTACGGCCGGGGACAGTTATATAATGTATTTGGATTGAGAGGAGGCCAA
ADGTAGCCAGCTAGAGATAGTTTCAACAACGTTAACCCCTGCTACGTGATATAAGCTATCG
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CCGATTTTAGAAAAAGCTTTGACTGAGAAAAATGTTAGAAAAAGAAAGGCAAGCAGAAAGCA
GCTGGCGGTGCATTACTACCAATTAGCCTCTACCCAGGAATGACAGTGTCAAGCACCTGTT
TTTCTTACATTGGTAGCGACCTATGGGATCATGCTGTCAATAAGTTATGCCATTAGATCA
AGAAGGGACAGGGACATTCCTCTGTGCCAATAACAGAGGATGGTGTAGACGAAAGATGT
CAAAAGCCACGAGGTGGTAGACTGGTATCATAGTGACATTTGTGGATCGTACAATTGCTGT
CGTCCATATTAATGGGATCAAAATGTATTGACTTGTATCGATCTTCTTTTTCCGTCATTTT
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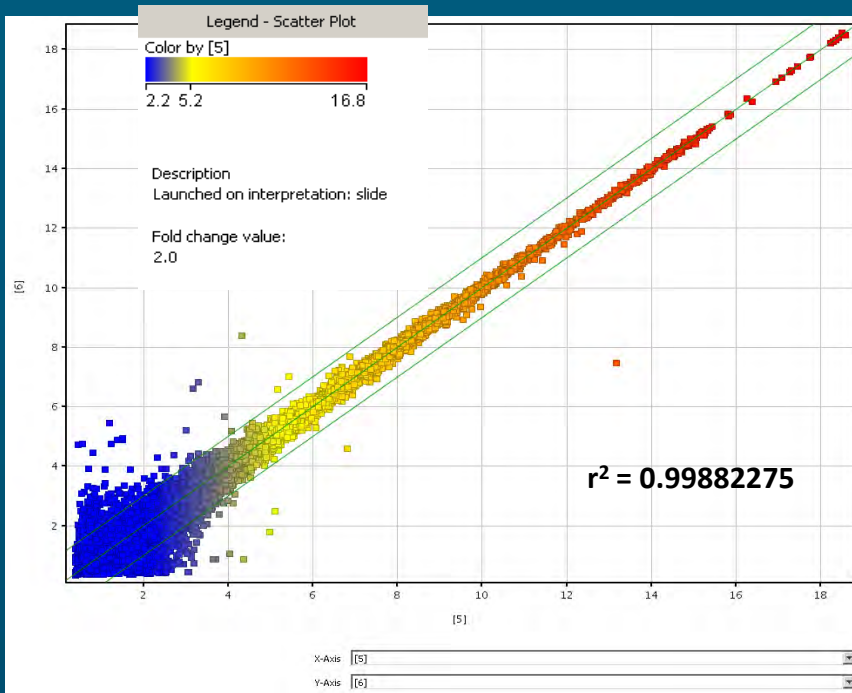
AutoFACT Results

Source	Accession	Description	Bits	eValue	Sequence Identity	Locus	EC number	Function	Pathway
AutoFACT	gallo1.2071.C1	Big defensin n=1 Tax=Branchiostoma belcheri ReplD=BDEF_BRABE	239	1e-18	42% (51/121)				
uniref90	Q86QN6	Big defensin n=1 Tax=Branchiostoma belcheri ReplD=BDEF_BRABE	239	1e-18	42% (51/121)				
nr	Q86QN6	RecName: Full=Big defensin; AltName: Full=Defensin; Flags: Precursor gb AAO18674.1 defensin [Branchiostoma belcheri tsingtauense]	239	2e-18	42% (51/121)				
cog		No hits found	0						

Myt-OME microarray

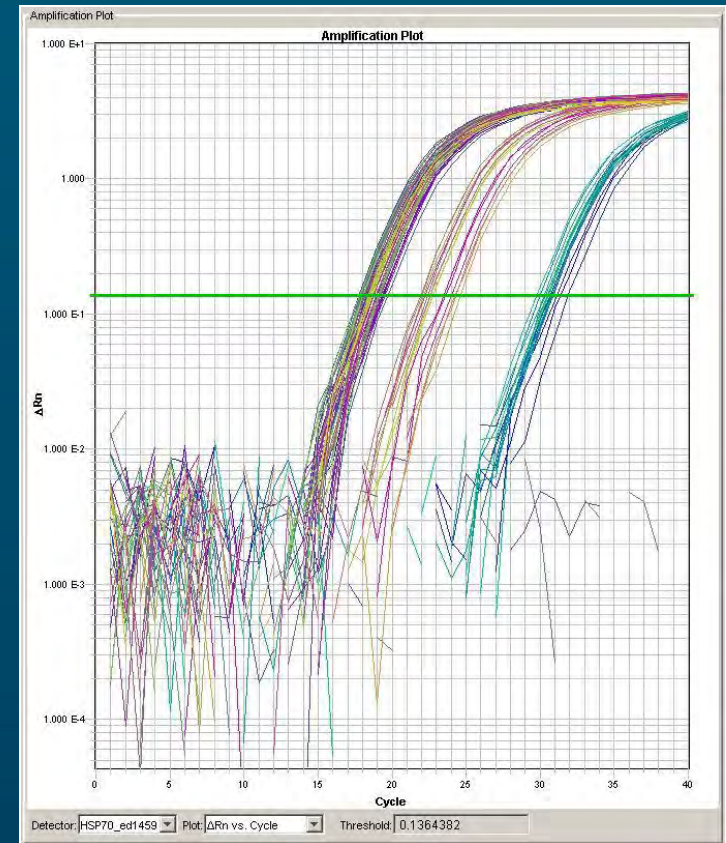


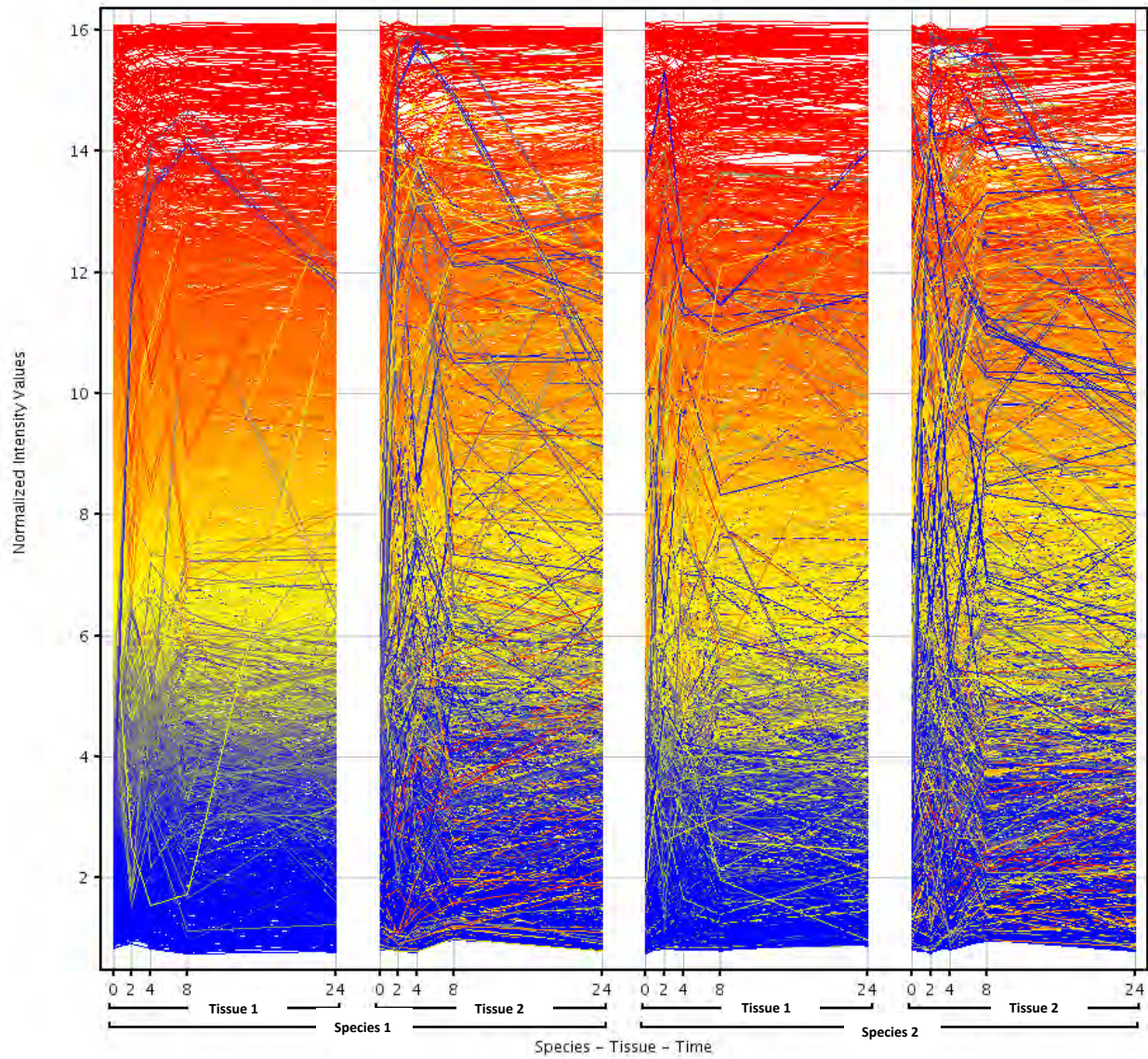
AMADID number and eArray to facilitate collaboration / modifications



Tool performance – *highly consistent*

- Real-time qPCR
- Genes of interest and housekeeping genes
- Strong correlations with microarray data



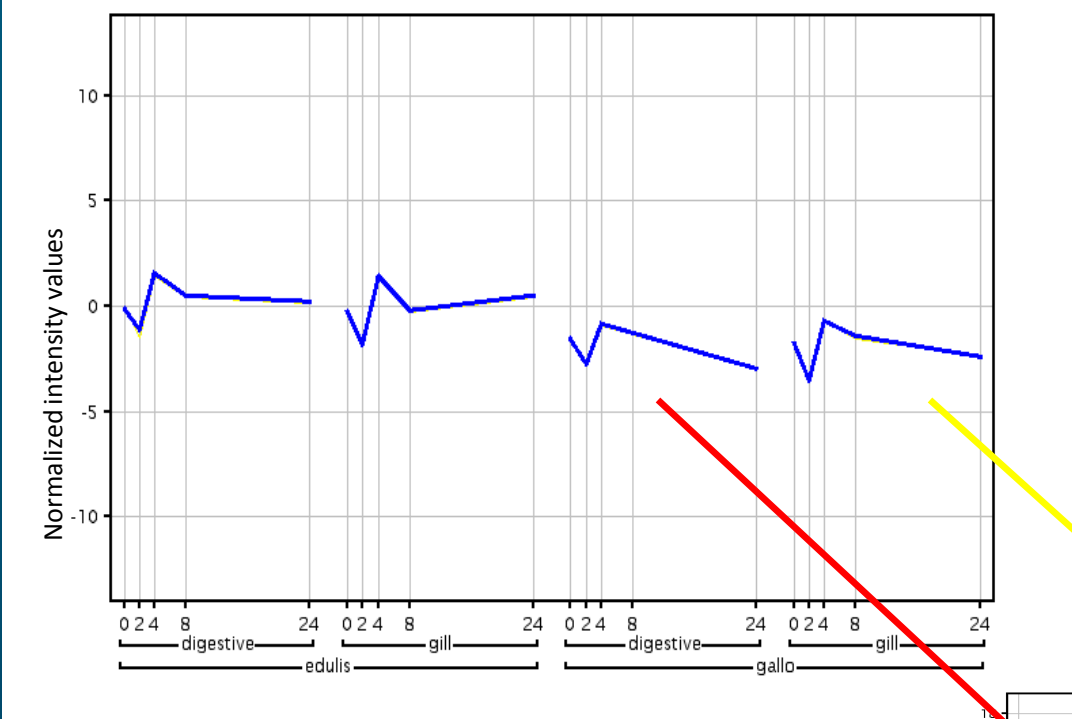


high



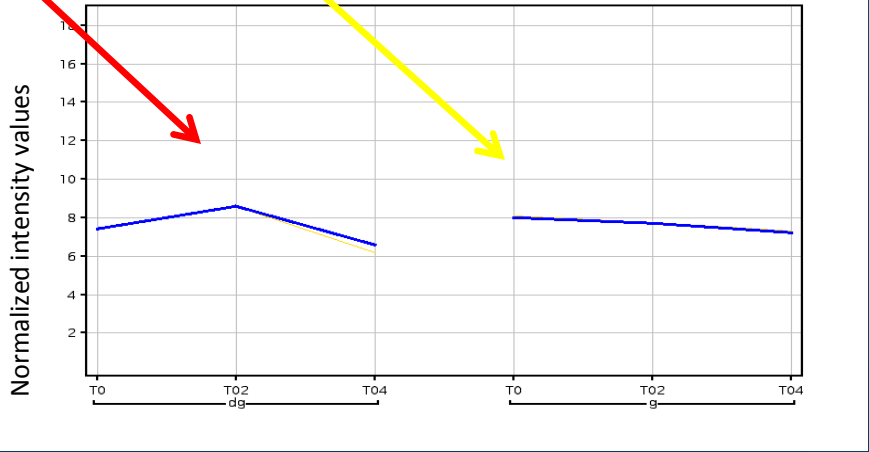
low

Differential stress responses

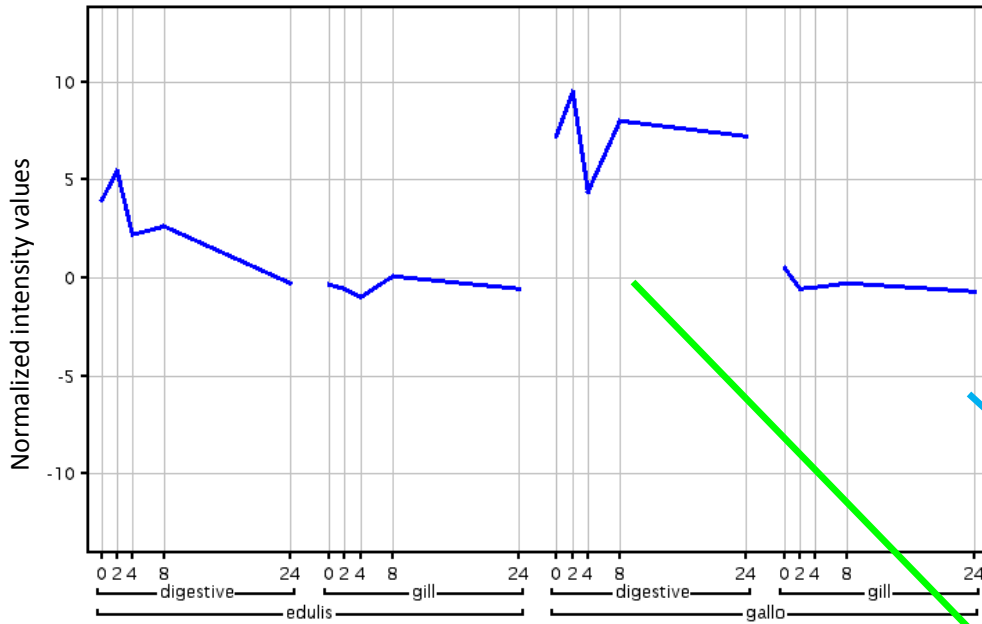


Thermal shock

Physical stress

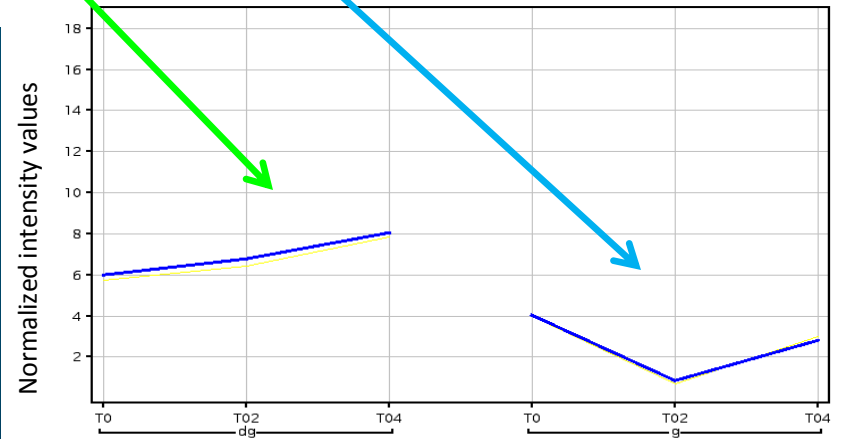


Differential tissue responses

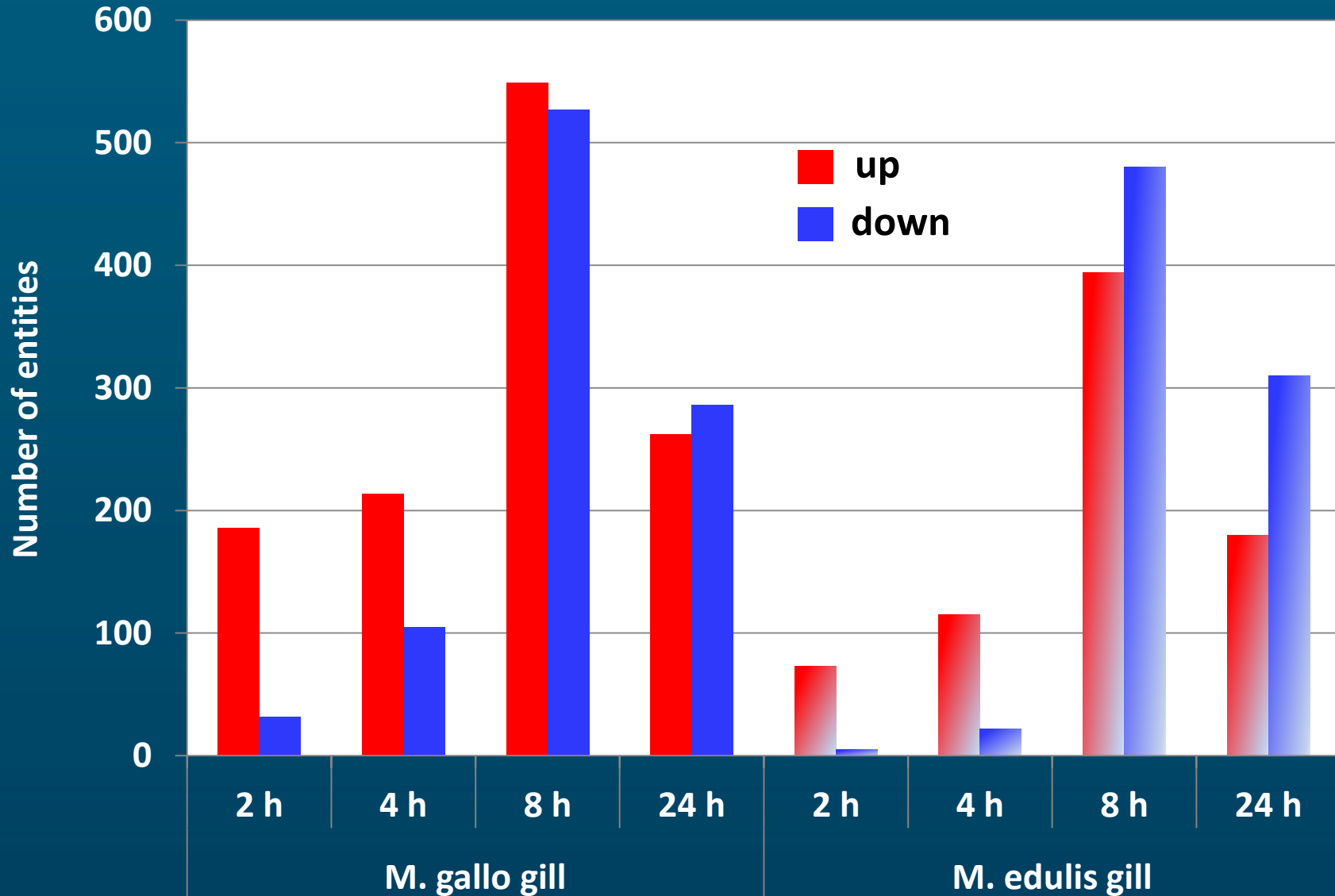


Thermal shock

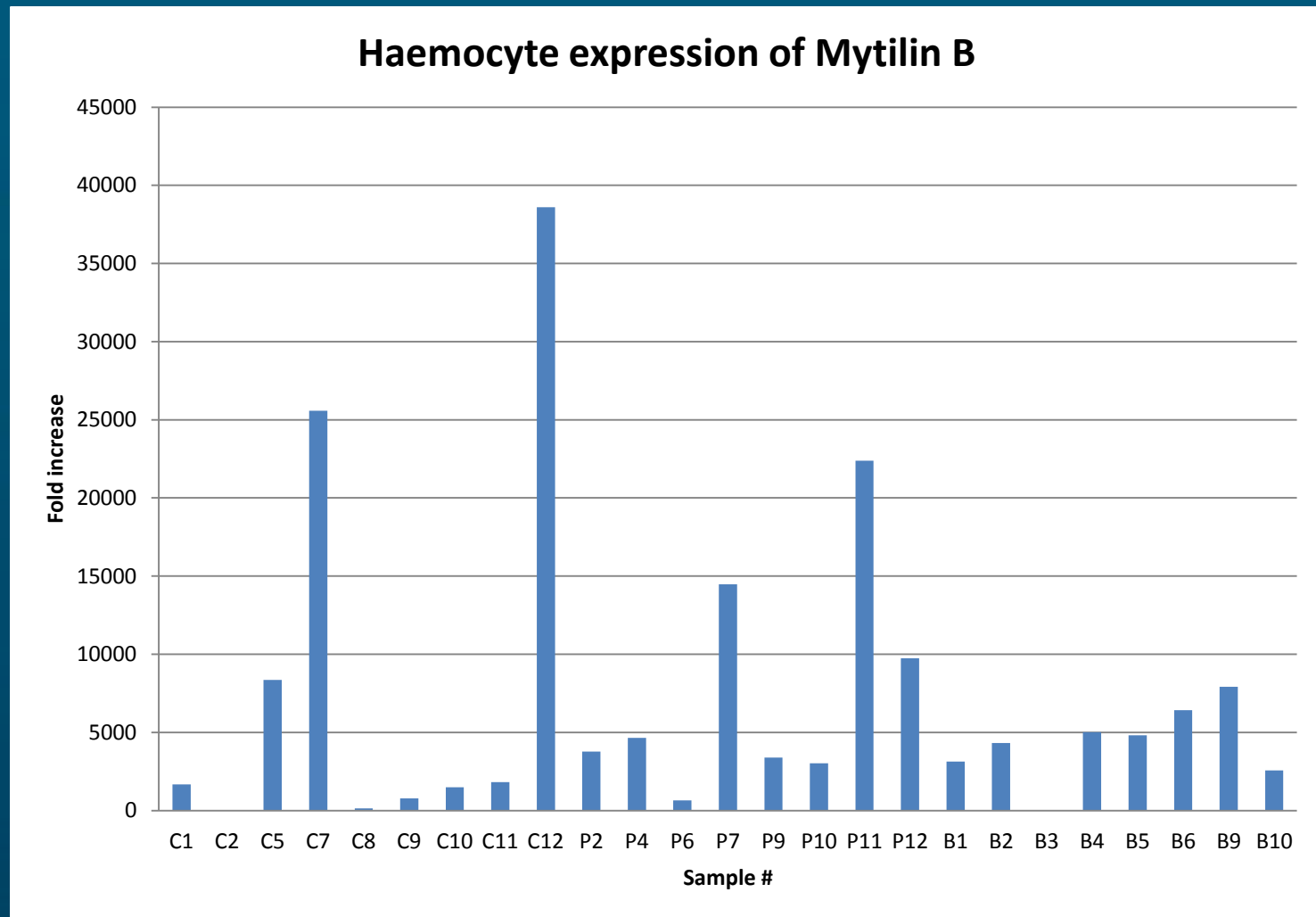
Physical stress



Differential species expression

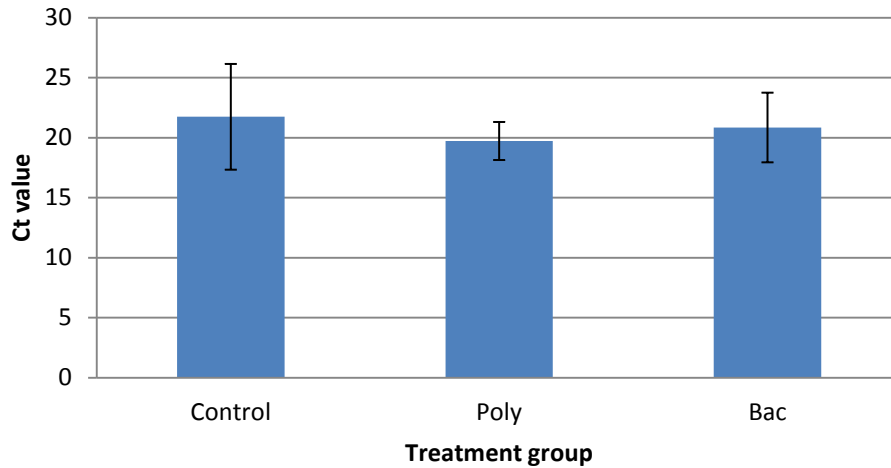


Individual variability

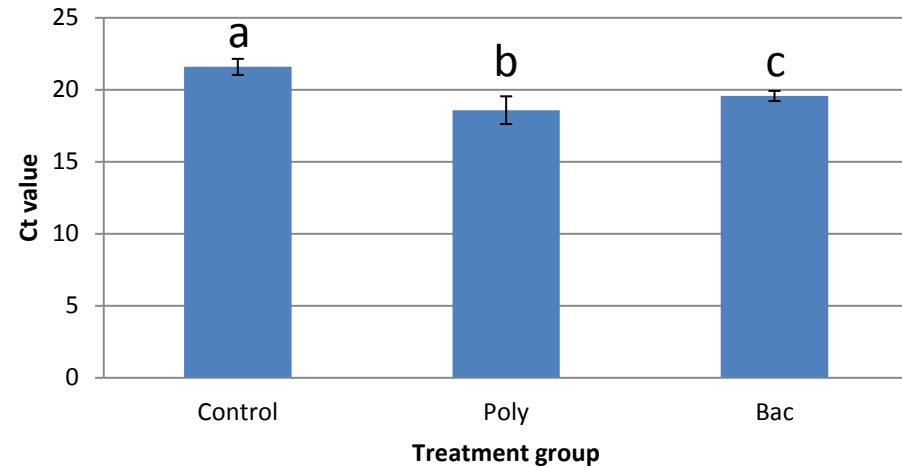


Important consideration
of sample pooling and
significance reporting

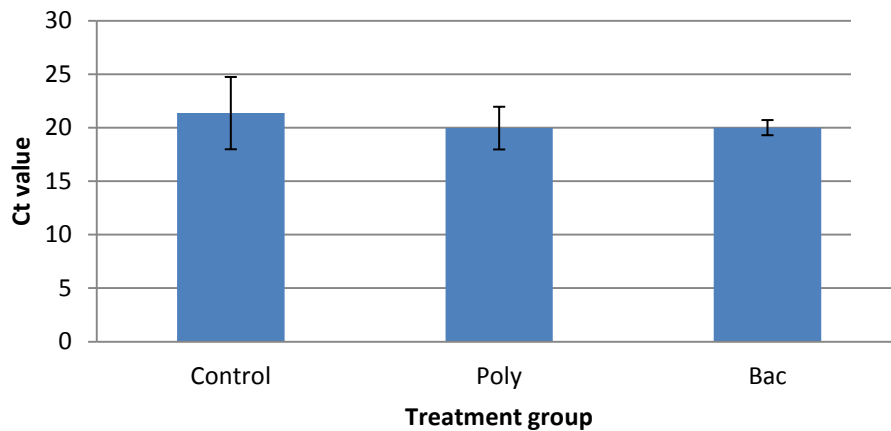
Mytilin B expression in hemocytes - all samples



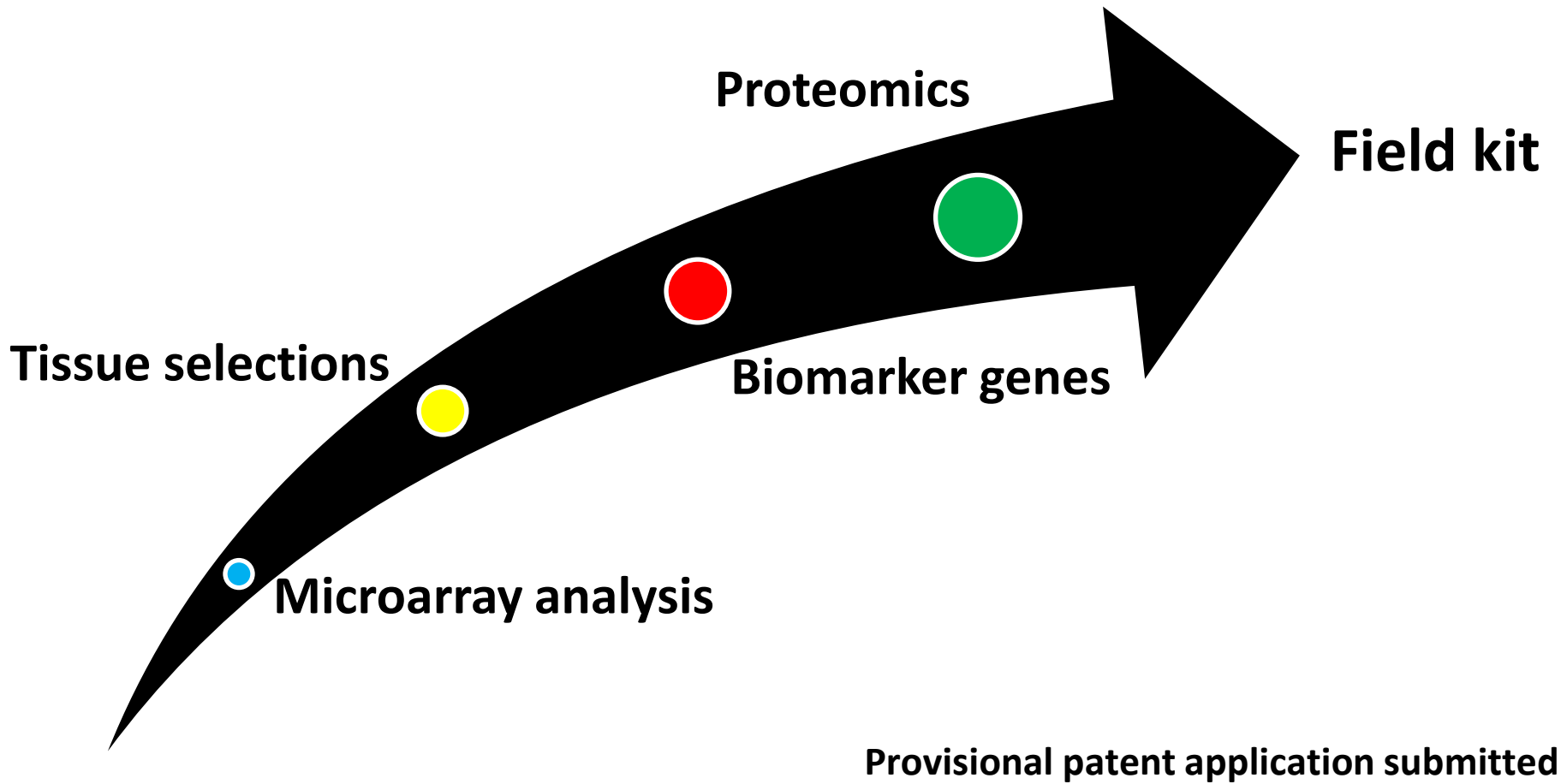
Mytilin B expression in haemocytes - selected samples



Mytilin B expression in haemocytes - randomly selected sample



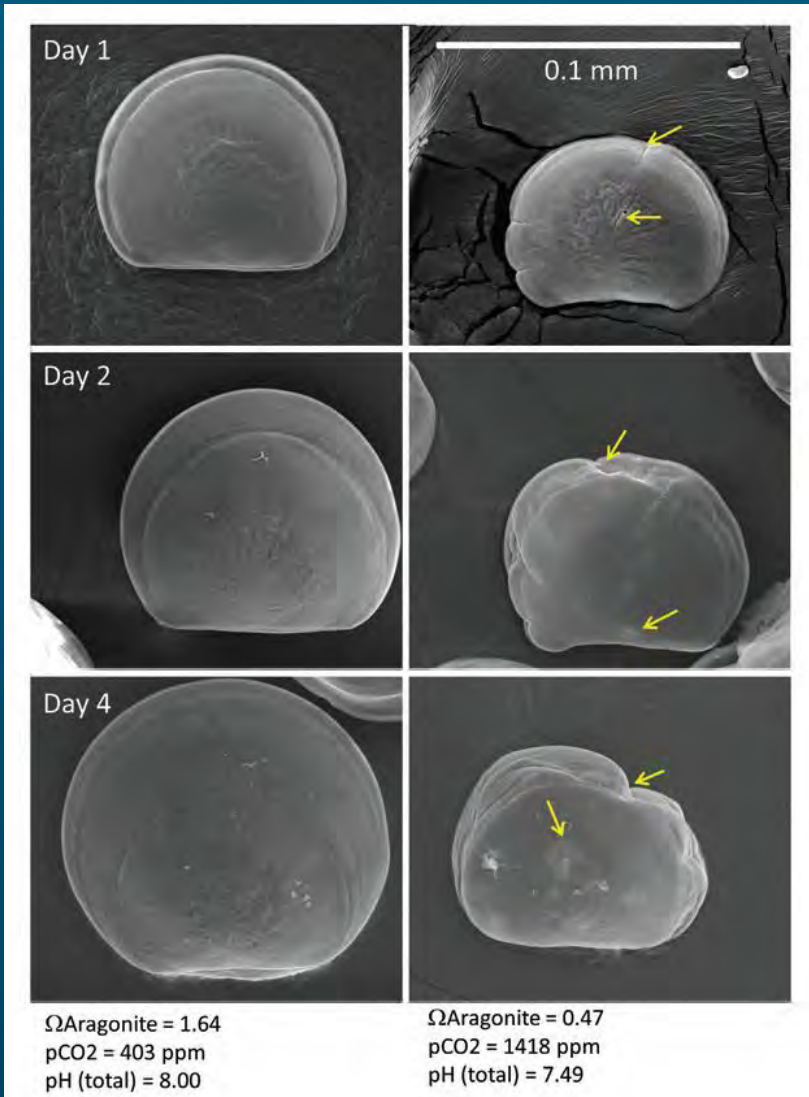
Ultimate goals



Finding and using the biomarkers.....

Ocean acidification

- Decrease in pH of the oceans, caused by uptake of anthropogenic CO₂ from the atmosphere
- Organisms using calcium carbonate (aragonite or calcite) most susceptible
- **Shellfish larvae and juveniles vulnerable**
- **Species differences?**
Broodstock development
- Increased land activities exacerbating effects



Brunner / Waldbusser. Taken from Washington State Blue Ribbon Panel on Ocean Acidification, Nov 2012

Wastewater management

'Compounds of concern' includes

endocrine disruptors,
pharmaceutical and personal
care products, microplastics,
heavy metals and polycyclic
aromatic hydrocarbons.

New methods of determining
biological impacts

Diagnostic tool for field and lab

Improvement in civil engineering
processes



Monitoring

- Upland impacts
- Seasonal population sizes



theguardian.com



http://www.kitimatlngfacility.com/Project/project_site.aspx

- New industrial developments
- Toxicogenomics
- Broader ecology questions

Thank you

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Project team also includes: Angeline de Bruyns, Alynn Shanks