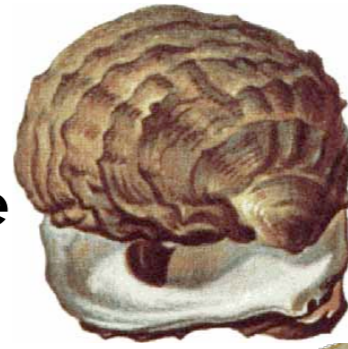


Short-read sequencing used for genomic characterization in aquacultured shellfish

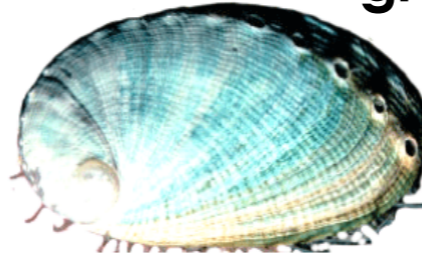
Steven Roberts
University of Washington
School of Aquatic and Fishery Sciences



disease resistance



growth



color

stress
tolerance



Traits

disease resistance

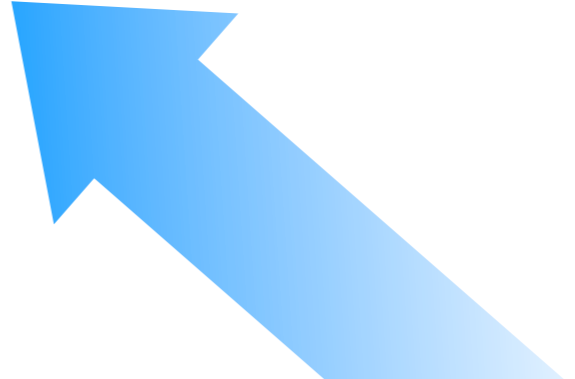
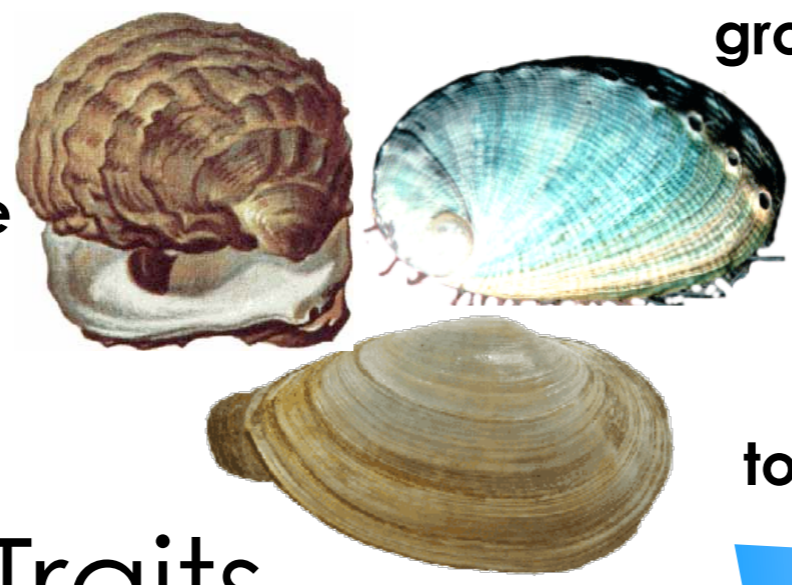
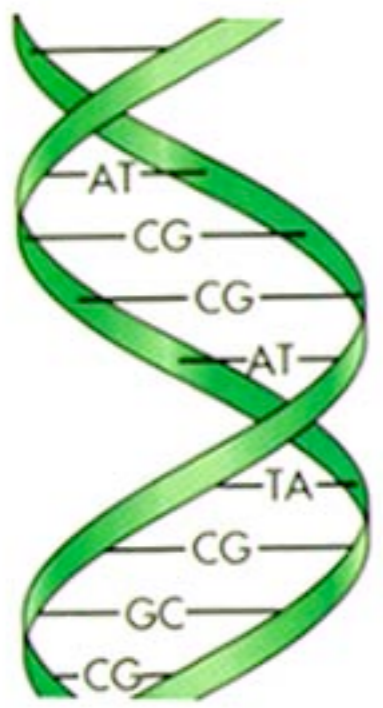
growth

color

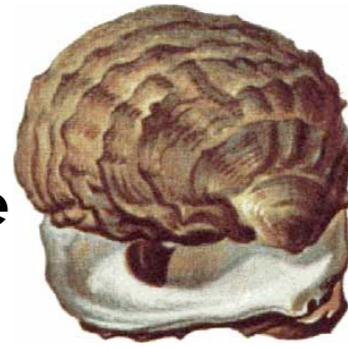
stress tolerance

Traits

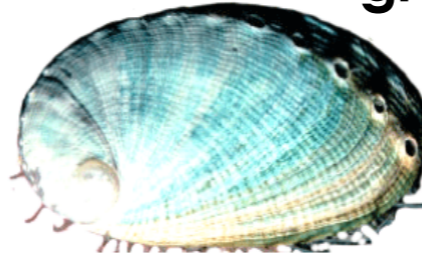
Transcriptome



disease resistance



growth



color

Traits



Epigenetics



Outline

Disease tolerance [*Mercenaria mercenaria*]

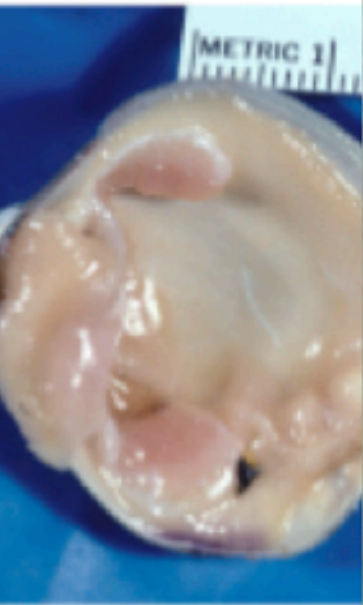
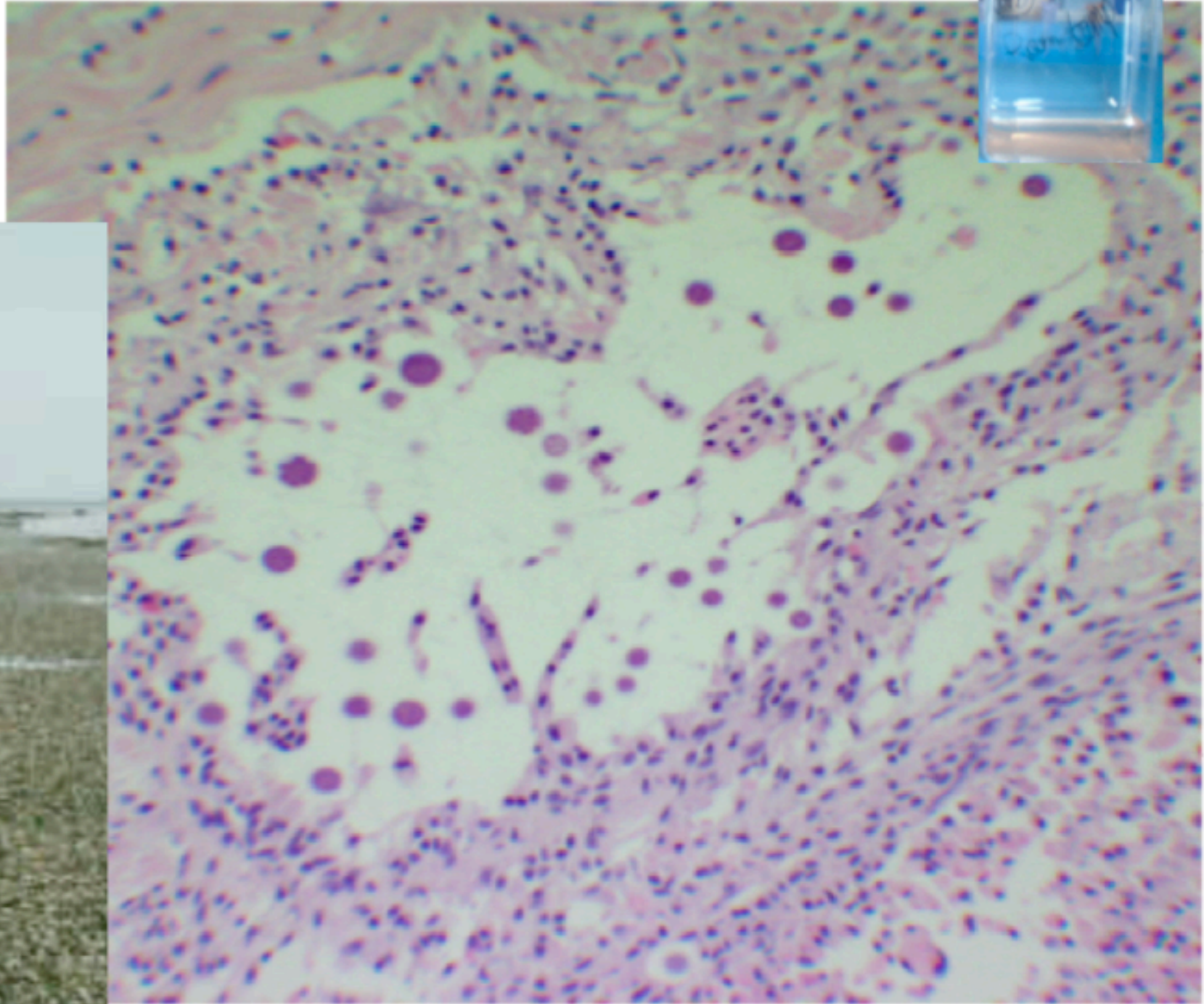
Environmental response [*Ruditapes philippinarum*]

Epigenetics [*Crassostrea gigas*]

Disease tolerance

QPX and *Mercenaria mercenaria*

Disease tolerance

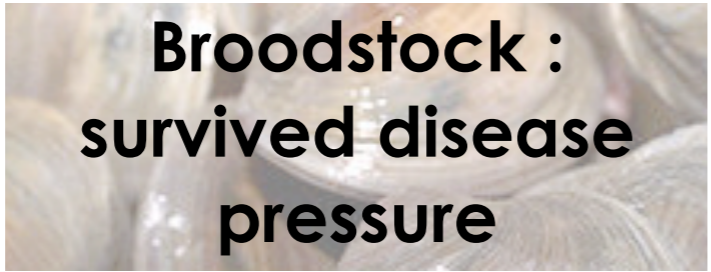


Disease tolerance

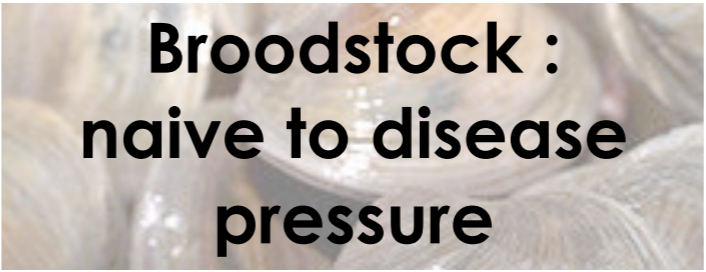


Map
Traffic

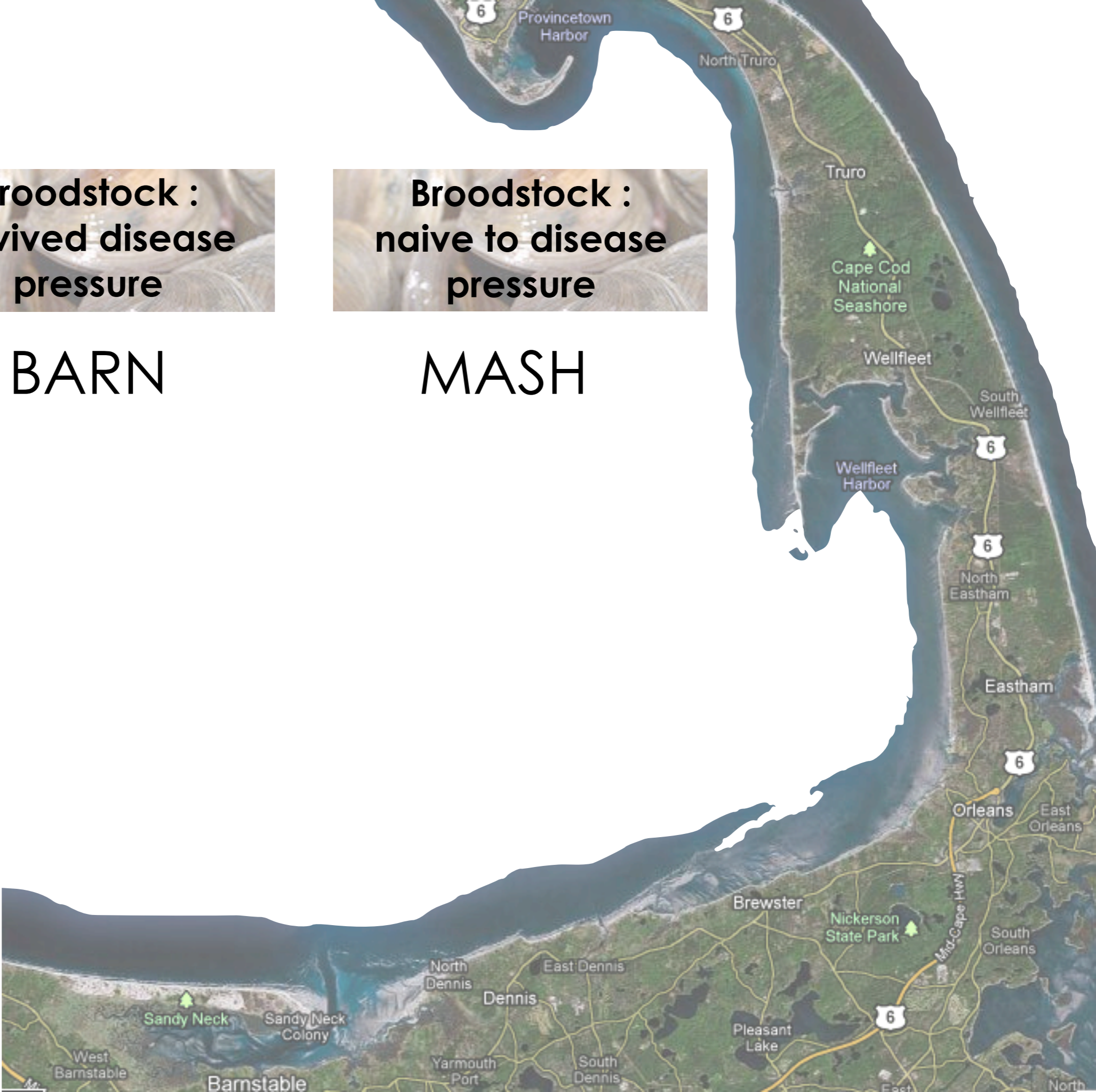
Roxanna Smolowitz



BARN



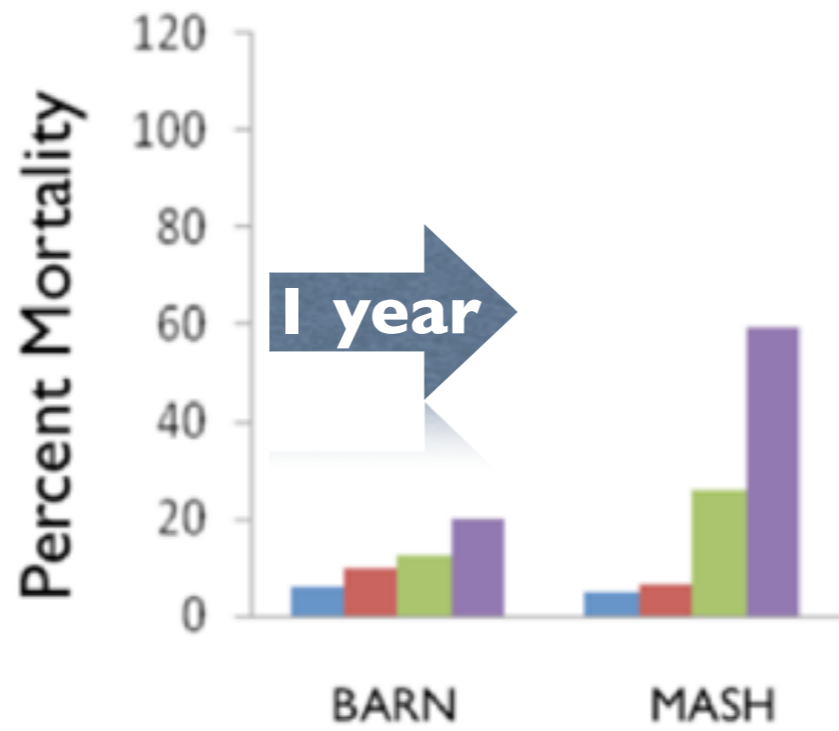
MASH





BARN

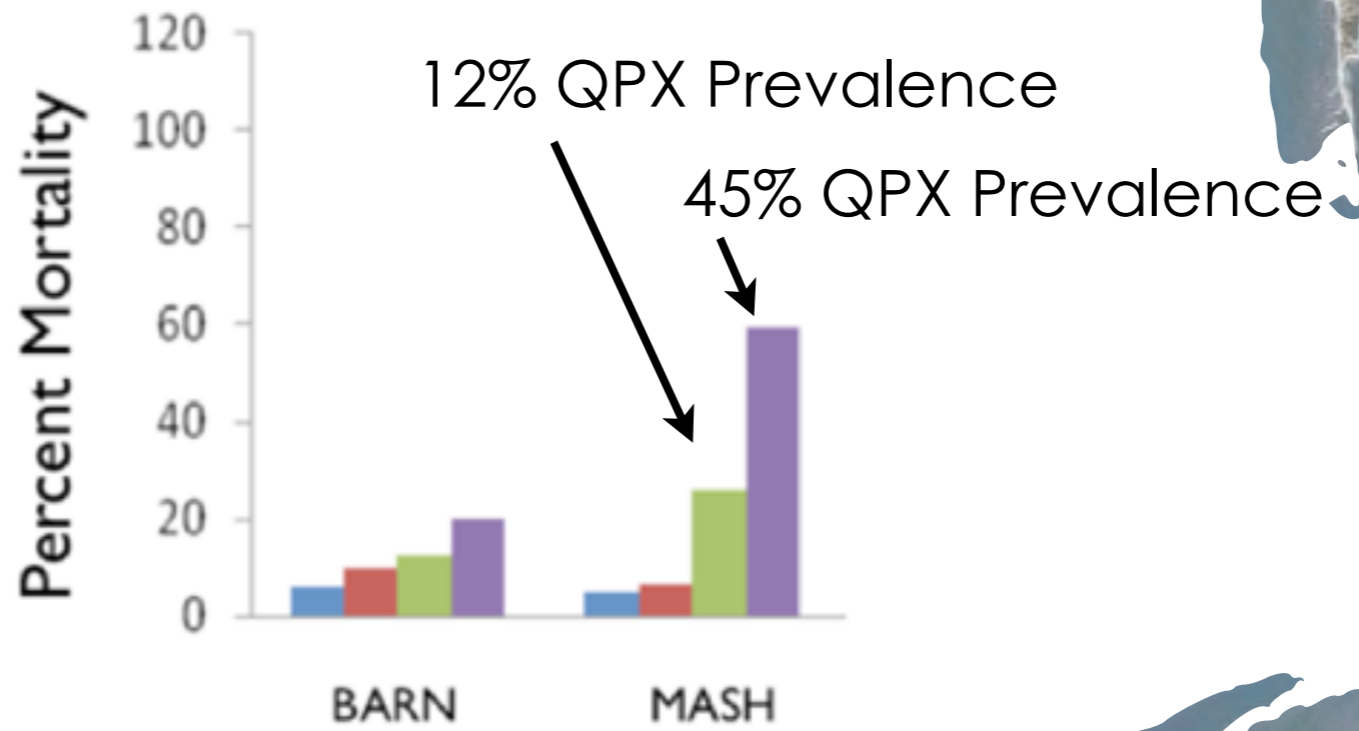
MASH





BARN

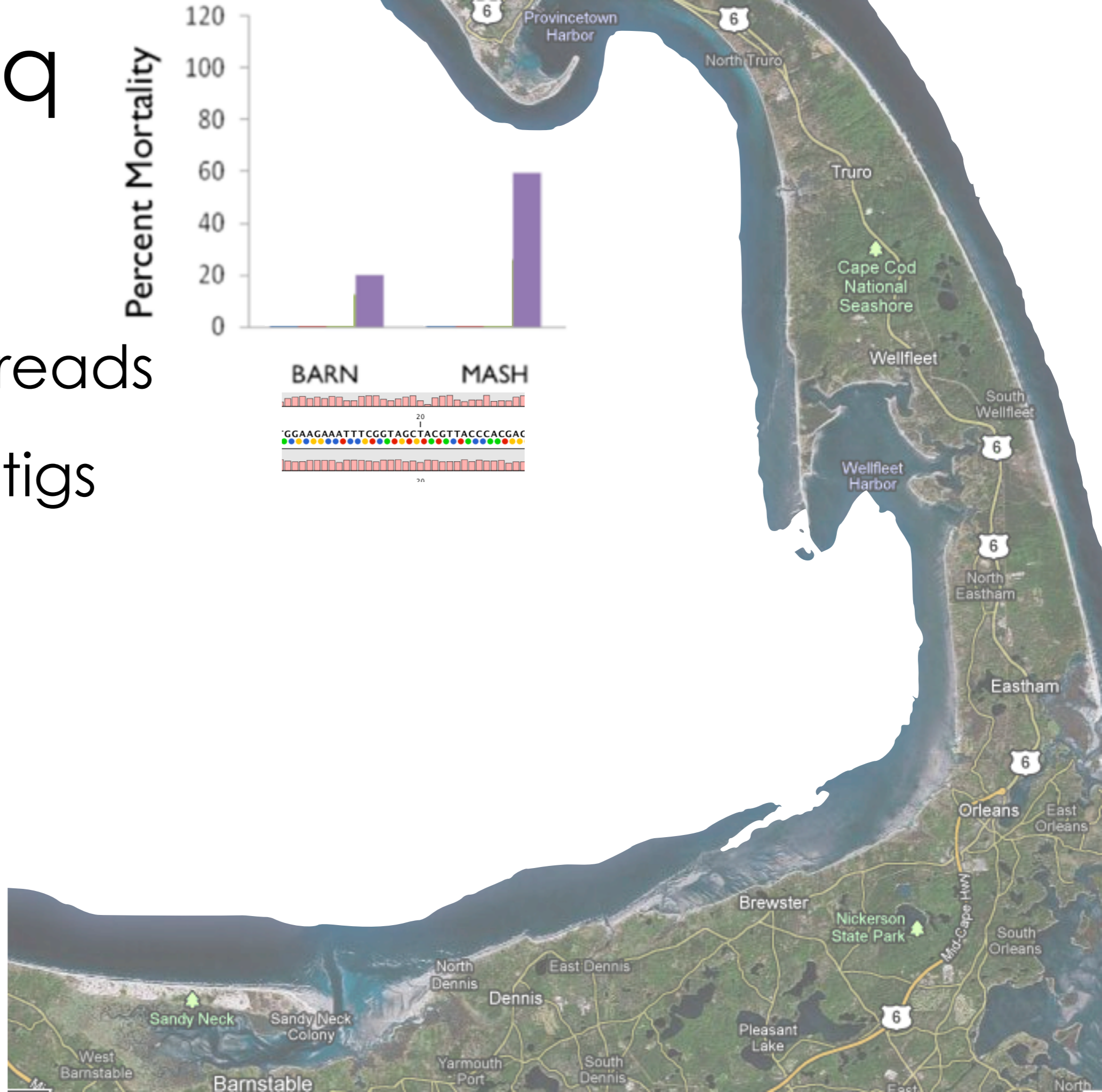
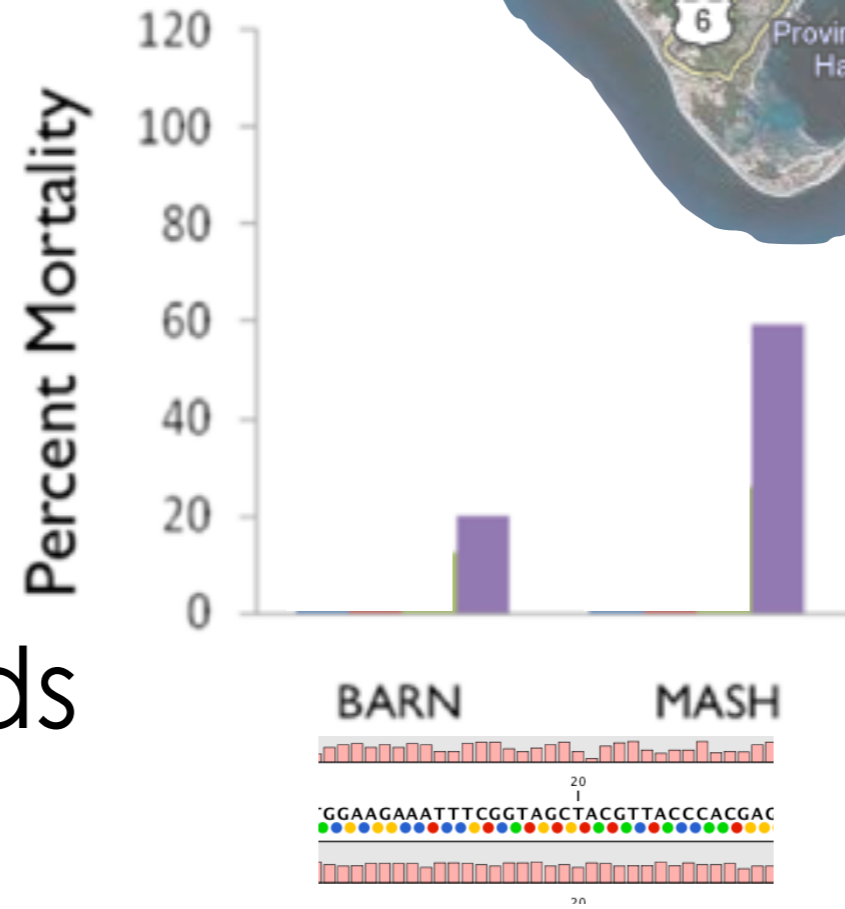
MASH



RNA-Seq

100 million reads

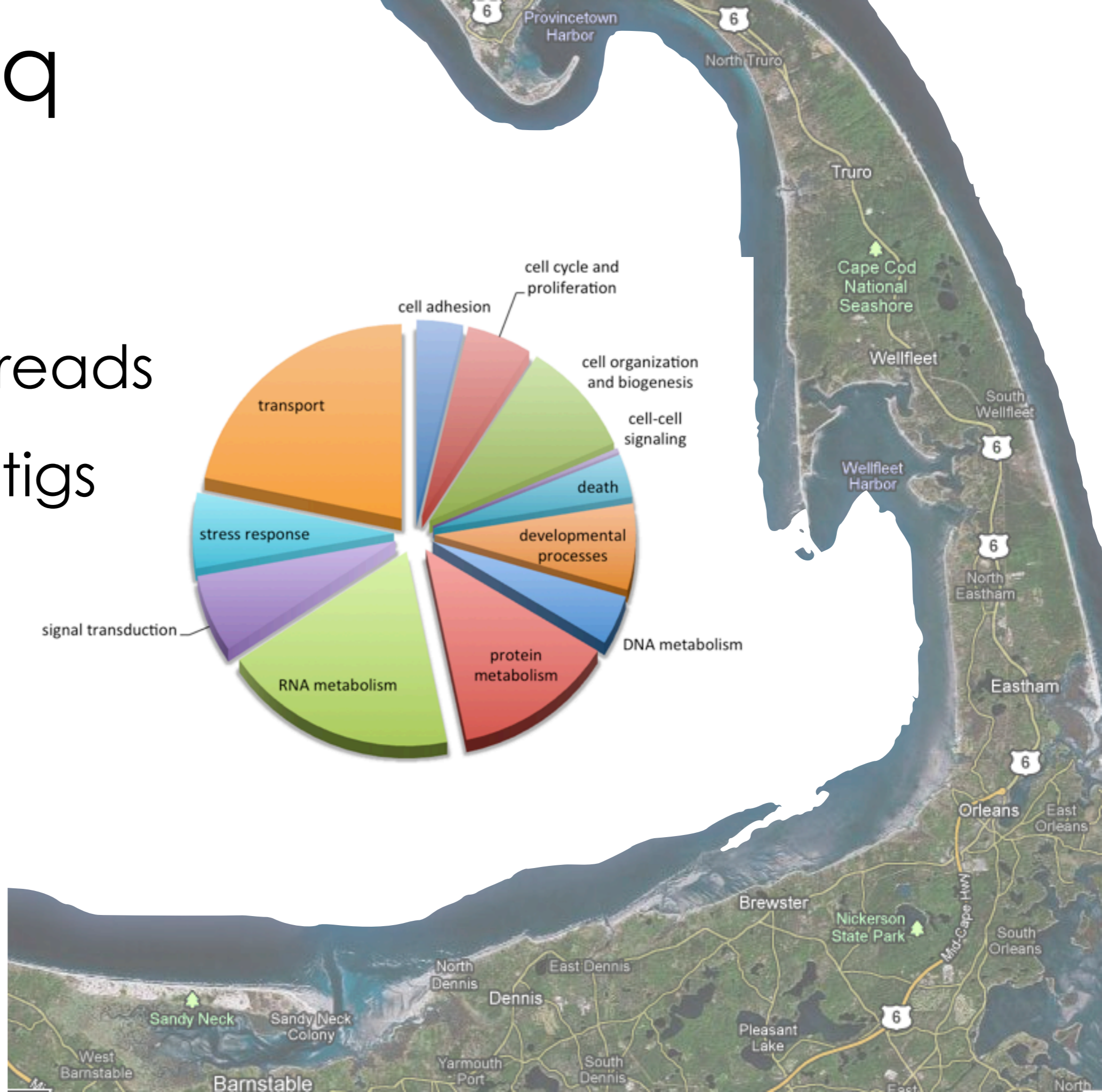
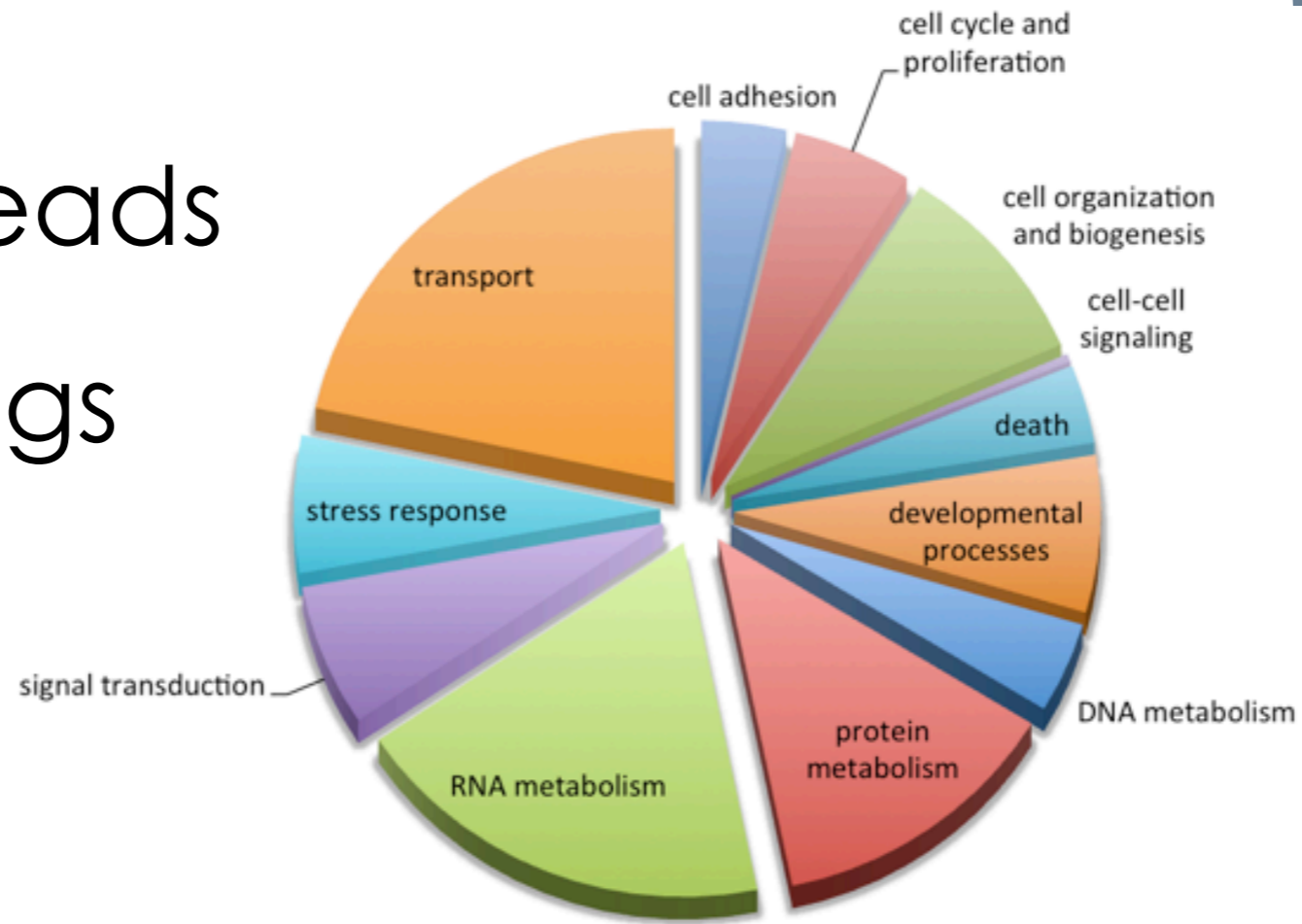
8482 contigs



RNA-Seq

100 million reads

8482 contigs



RNA-Seq

100 million reads

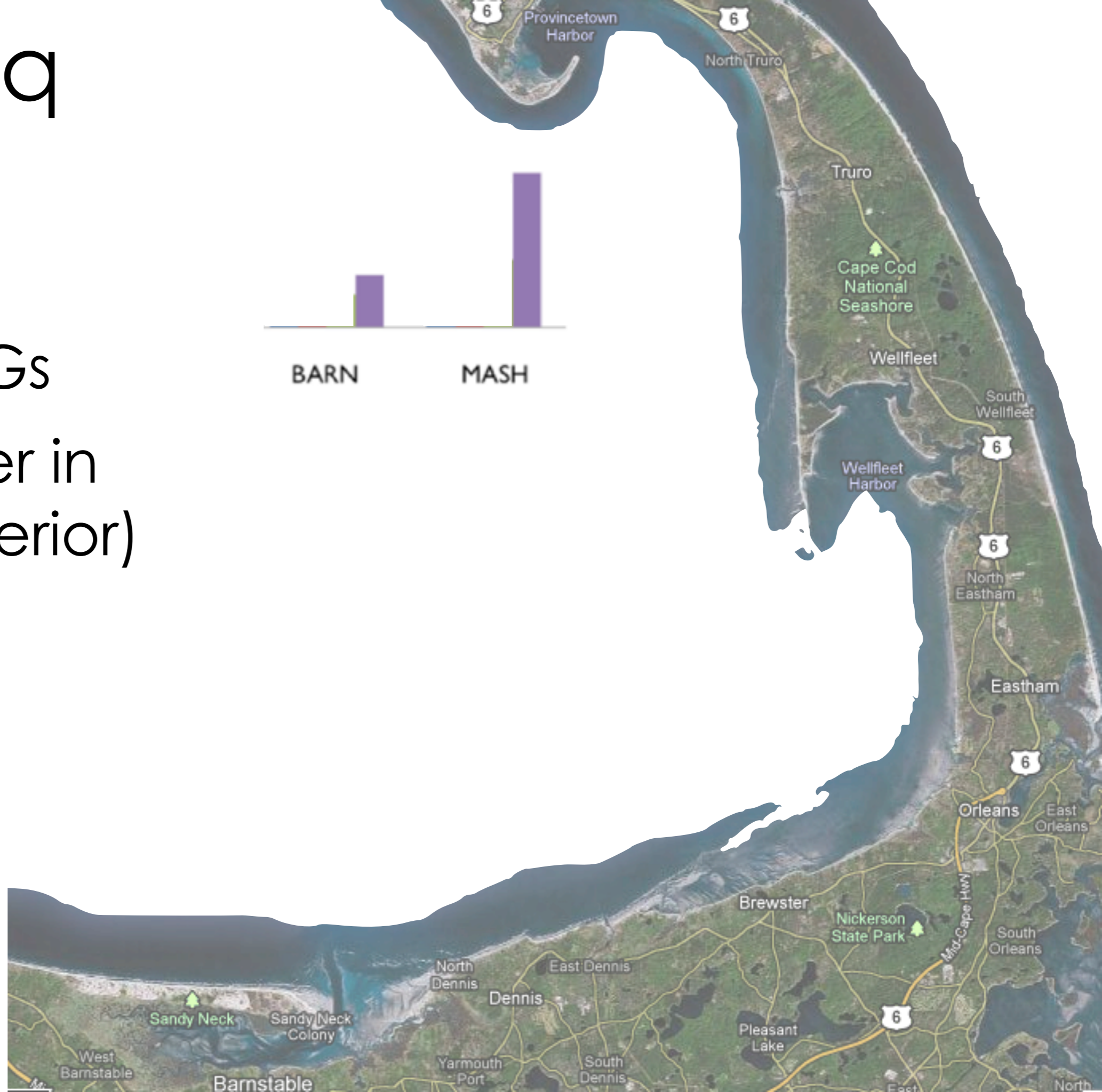
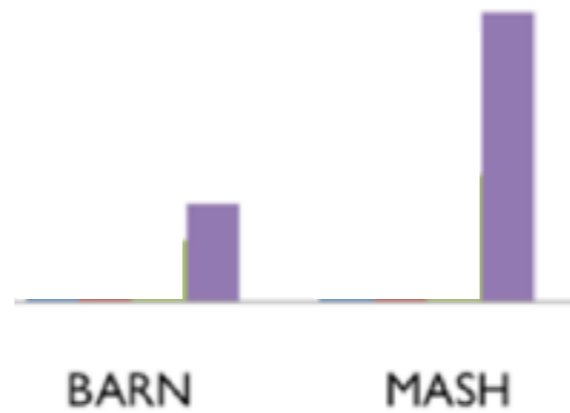
8482 contigs



RNA-Seq

684 DEGs

459 higher in
BARN (superior)



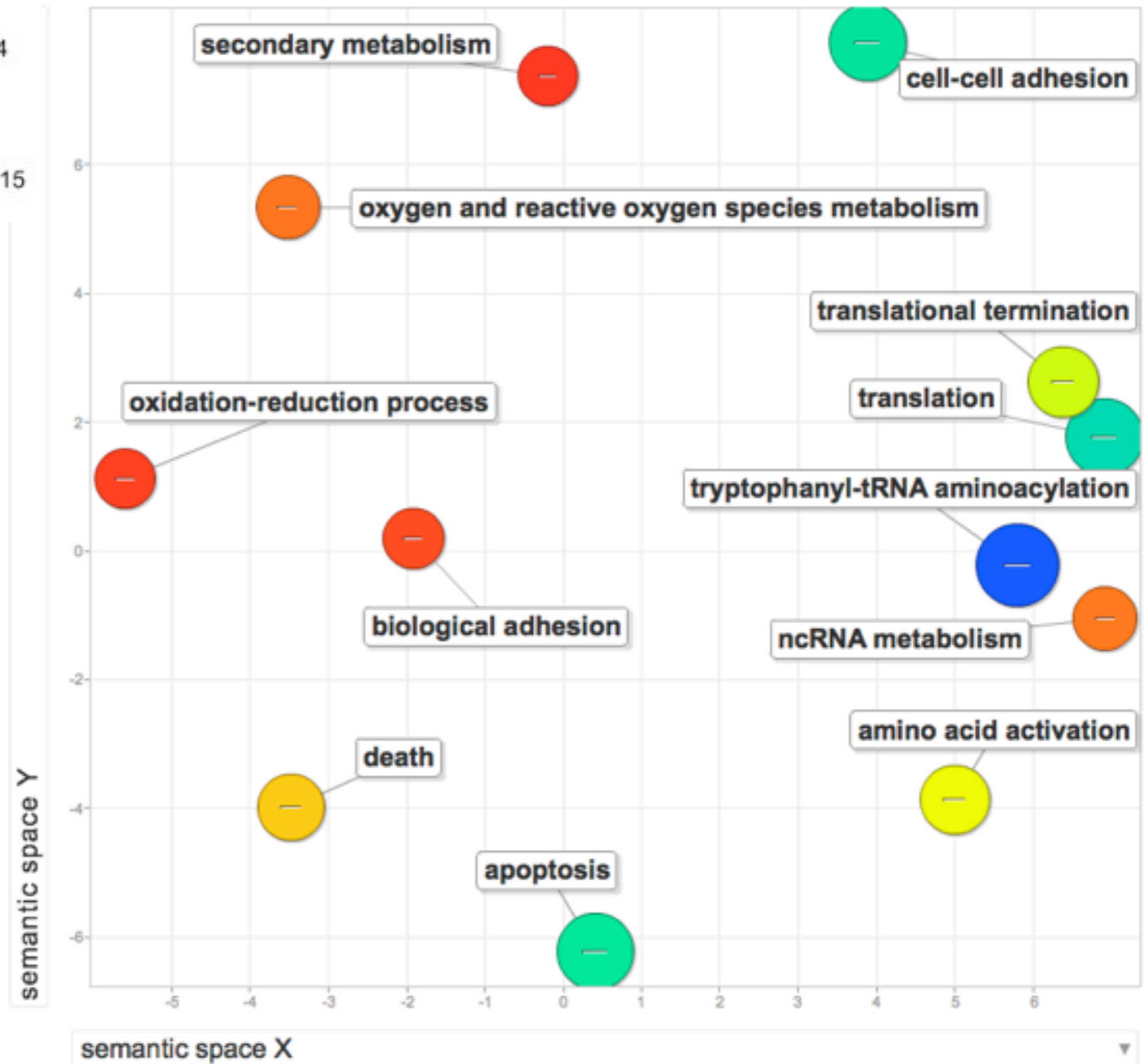
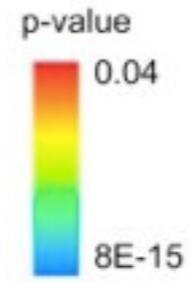
RNA-Seq

684 DEGs

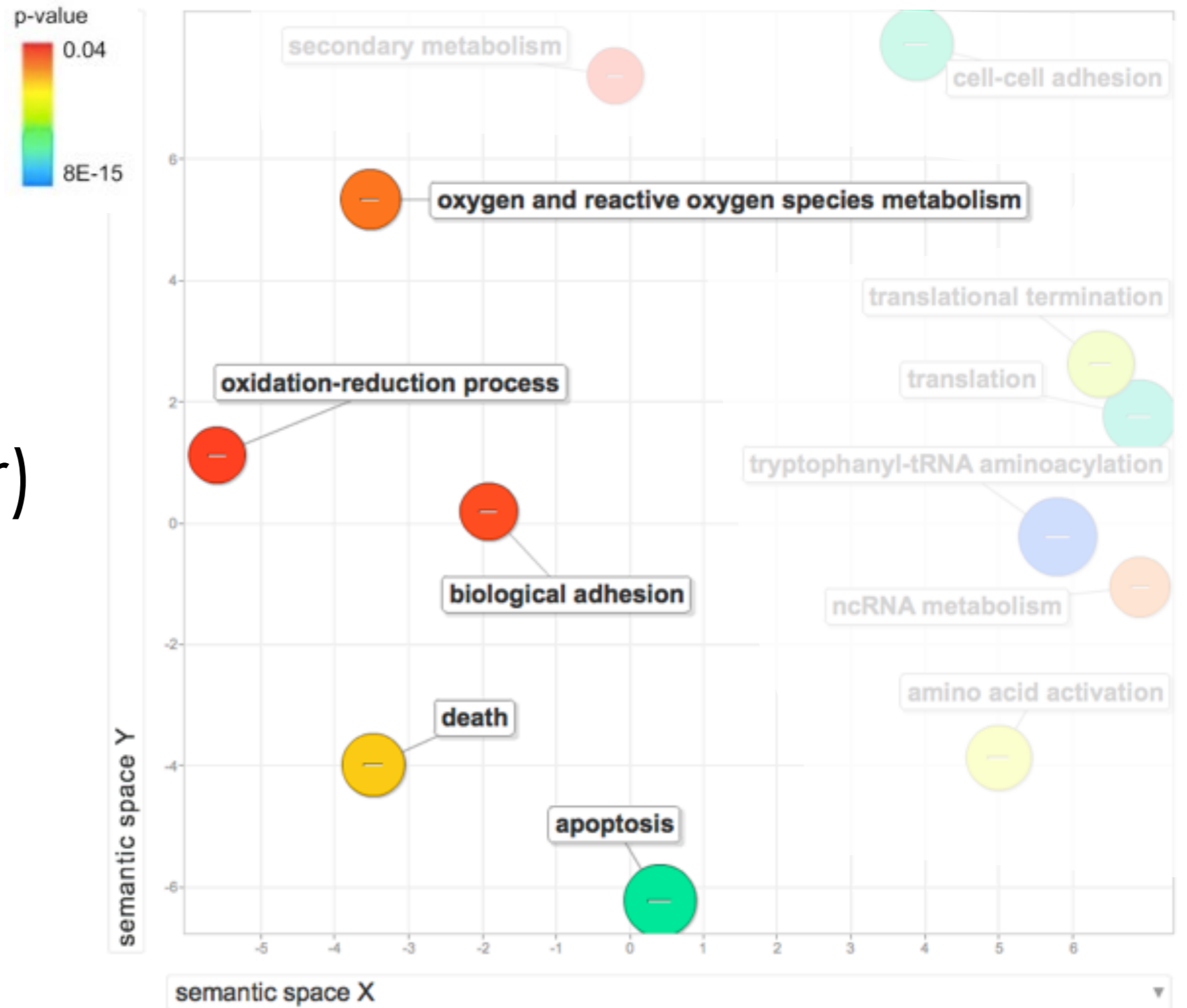
459 higher in
BARN (superior)

33 enriched
biological
processes

684 DEGs
459 higher in
BARN (superior)
33 enriched
biological
processes



684 DEGs
459 higher in
BARN (superior)
33 enriched
biological
processes



684 DEGs
459 higher in
BARN (superior)
33 enriched
biological
processes

apoptosis

baculoviral IAP repeat-containing protein,
apoptosis 1 inhibitor, TNF receptor-
associated factor 3, protein FADD

adhesion

neuroglian, protocadherin

oxidation reduction processes

peroxidase, thyroid peroxidase,
epidermis-type lipoxygenase,
hydroxysteroid 11-beta-dehydrogenase,
carbonyl reductase, cytochrome P450,
superoxide dismutase, sorbitol
dehydrogenase

translation

asparaginyl-tRNA synthetase, eukaryotic
initiation factor, tryptophanyl-tRNA
synthetase, eukaryotic peptide chain
release factor subunit

Genotyping



BARN



MASH

Restriction Enzyme
Assisted
Digestion
-
Sequencing

Genotyping

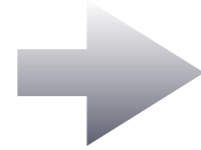


BARN



MASH

Restriction Enzyme
Assisted
Digestion
-
Sequencing



Reduce Representation

Genotyping

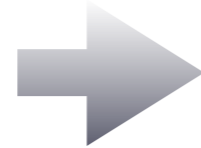


BARN



MASH

Restriction Enzyme
Assisted
Digestion



Reduce Representation

-
Sequencing

Sequence multiple individuals

Genotyping

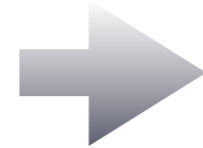


BARN



MASH

Restriction Enzyme
Assisted
Digestion



Reduce Representation

-
Sequencing

Sequence multiple individuals

145 Diagnostic Markers

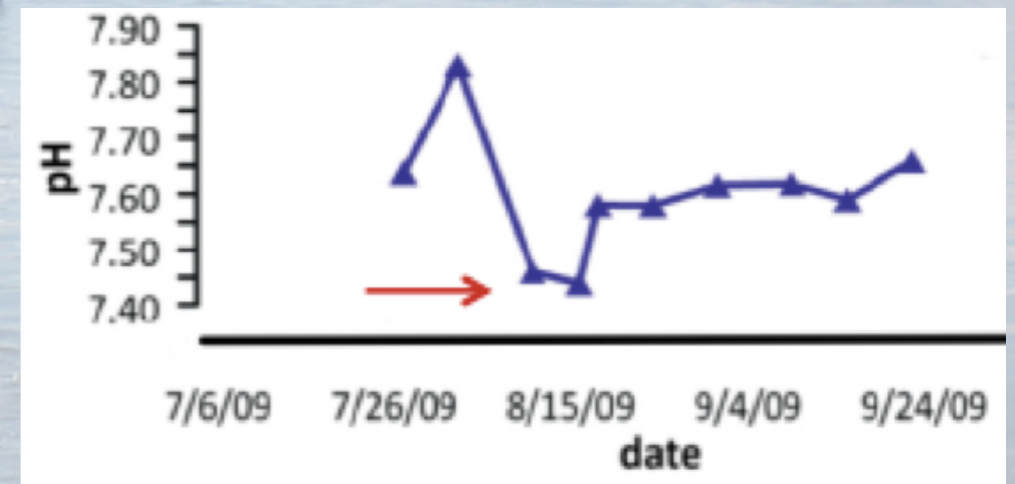
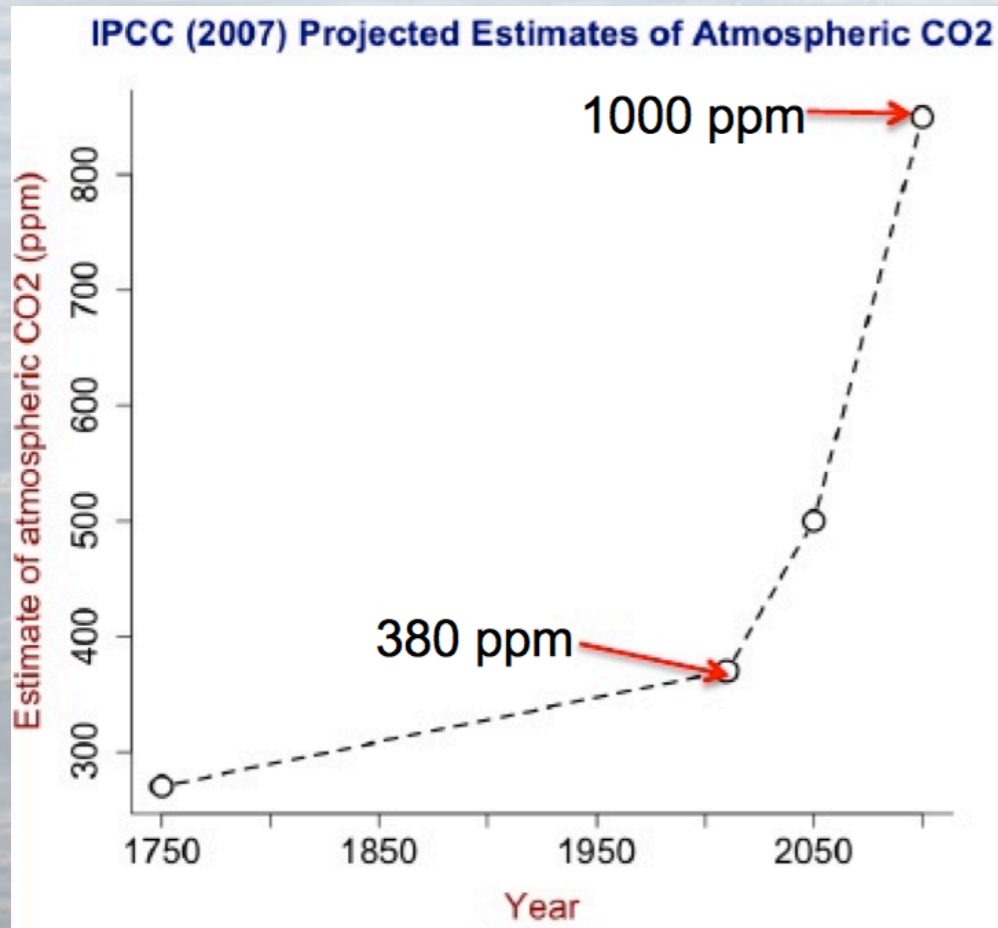
Environmental stress

Ocean acidification and clam larvae

Ruditapes philippinarum

Environmental stress

Ocean acidification and clam larvae
Ruditapes philippinarum

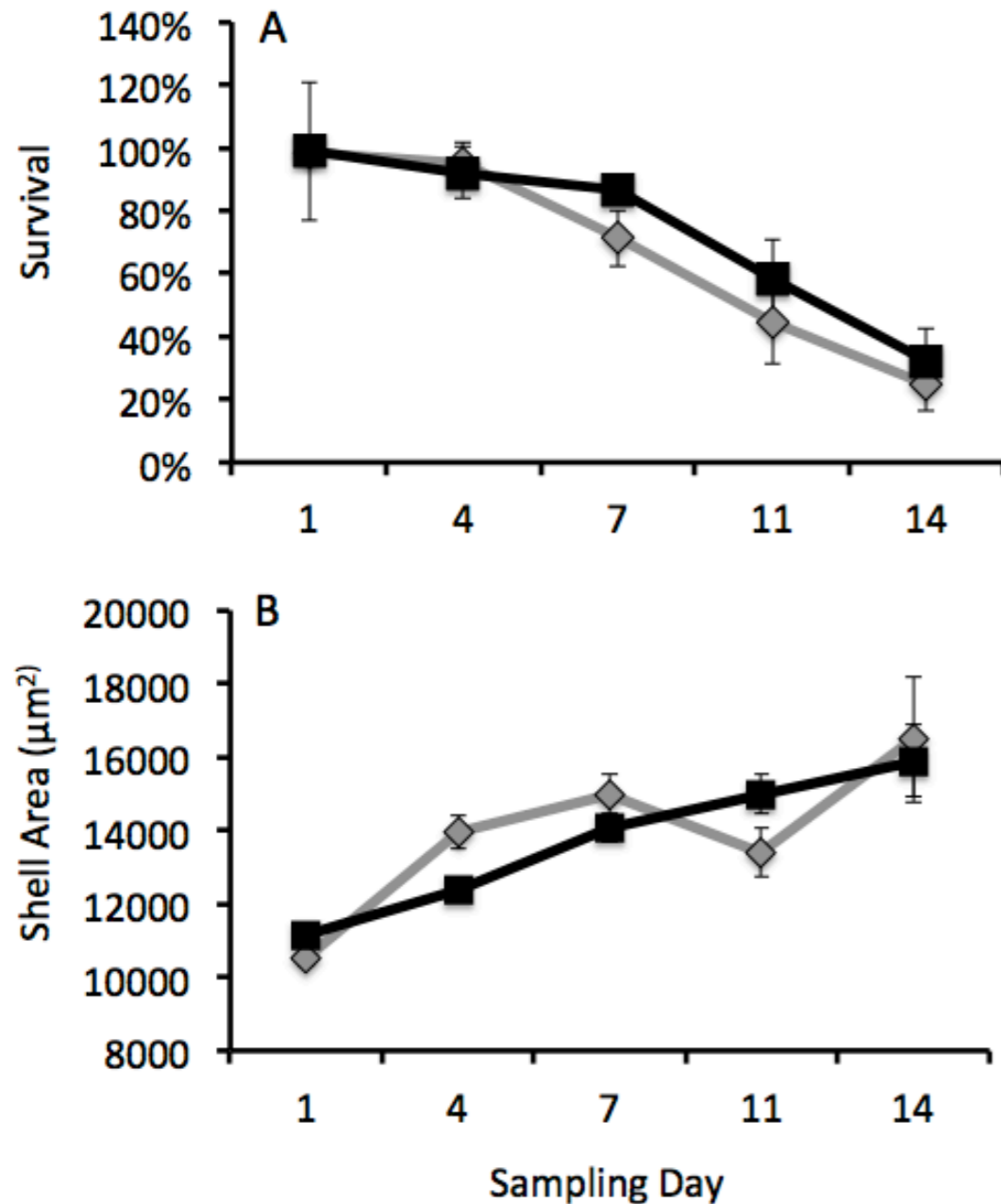


Locales in PNW already experiencing acidified conditions

Above Figure: Alin et al.
Feely et al. 2008, 2010

Environmental stress

Ocean acidification and clam larvae

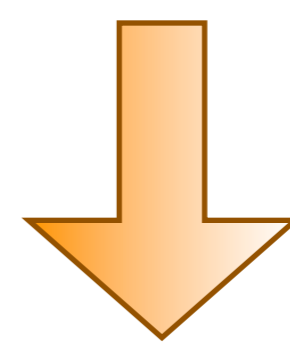


Larval Exposures:
No affect on growth
or survival

Environmental stress

Ocean acidification and clam larvae

240 million reads



RuphiBase

RNA-Seq

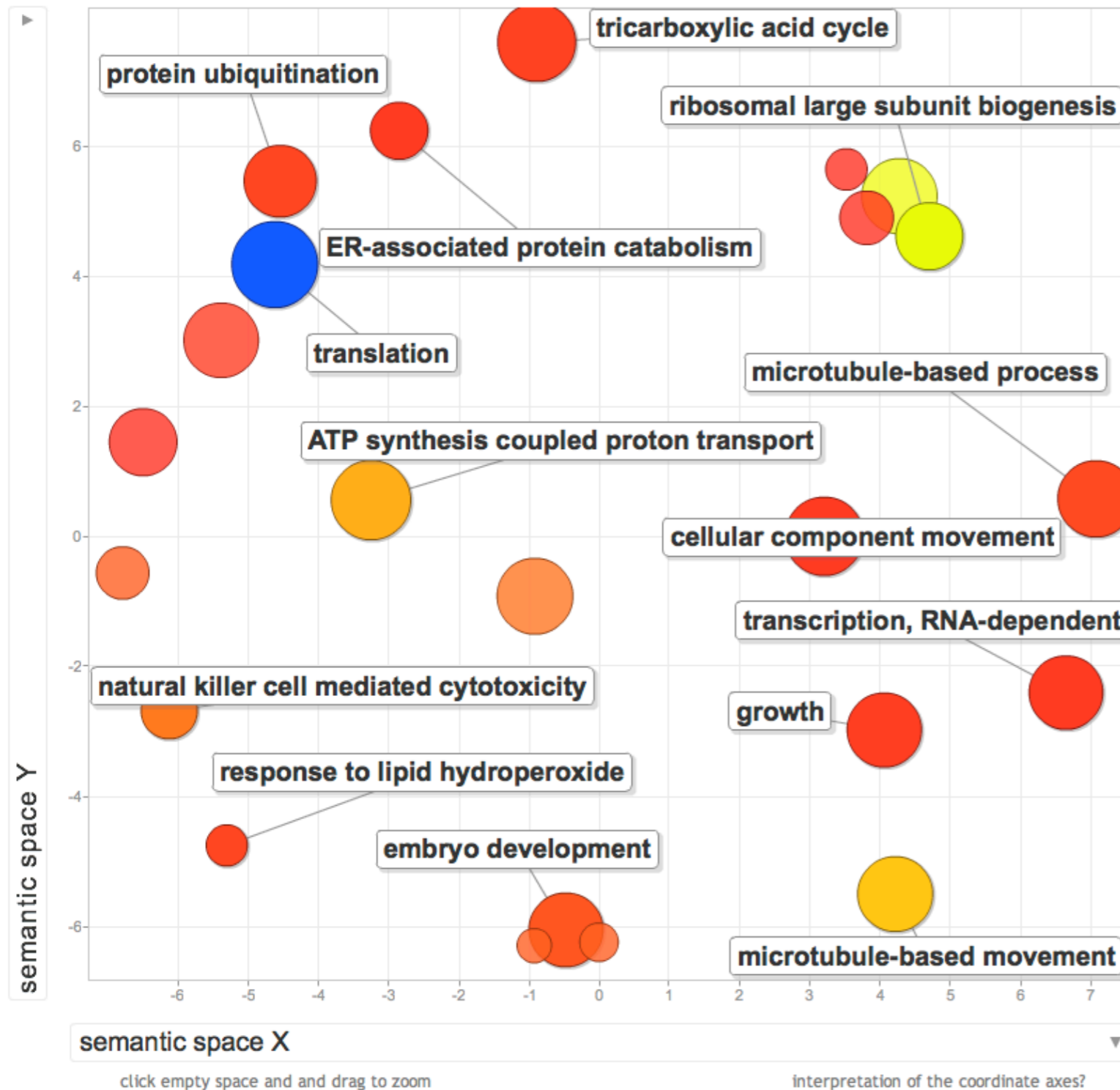
3800 : 162 DEGs

781 annotated

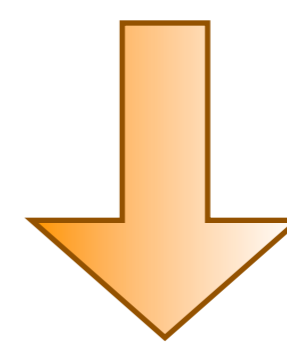
55 processes

Environmental stress

Ocean acidification and clam larvae



240 million reads



RuphiBase

RNA-Seq

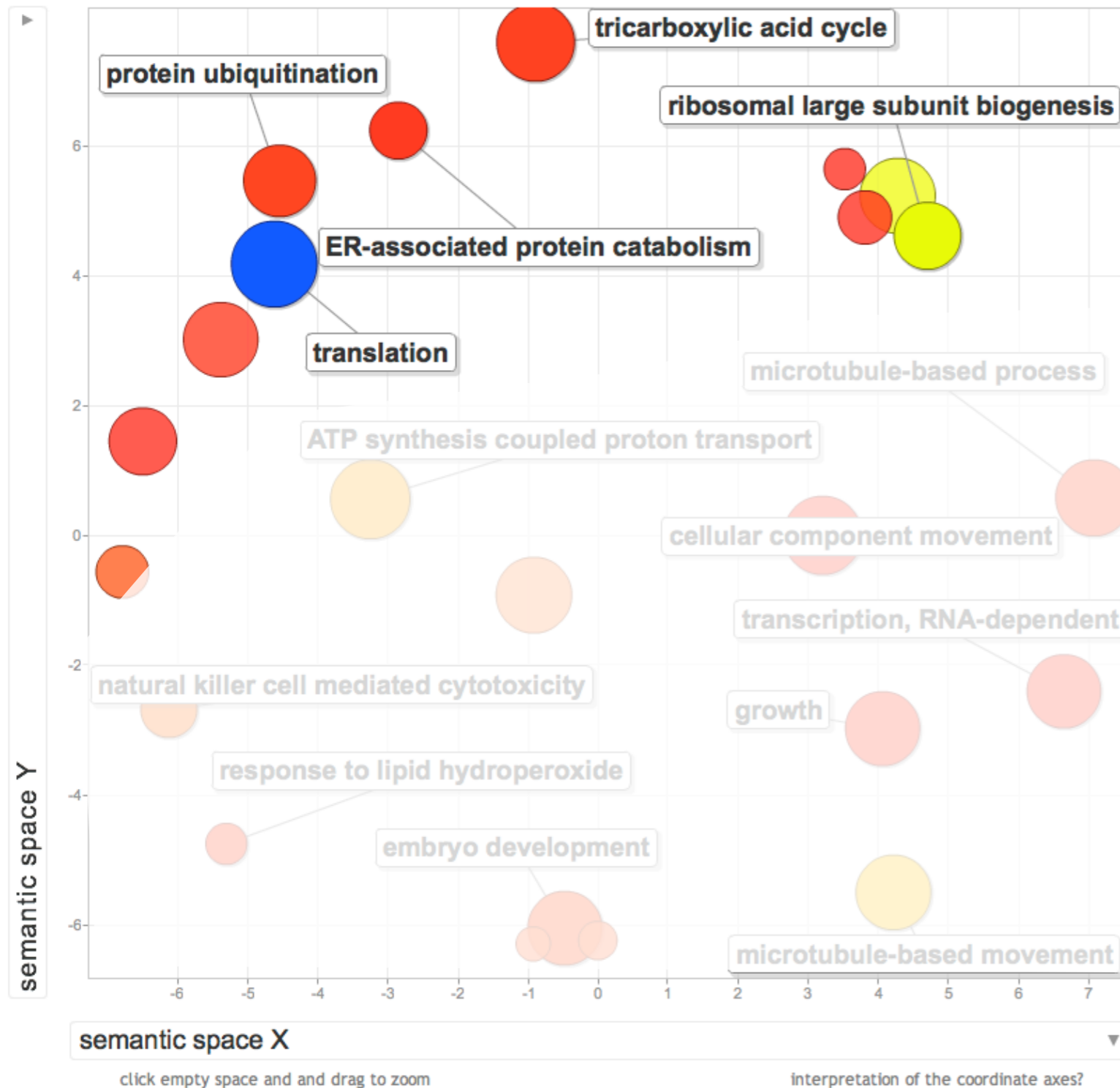
3800 : 162 DEGs

781 annotated

55 processes

Environmental stress

Ocean acidification and clam larvae



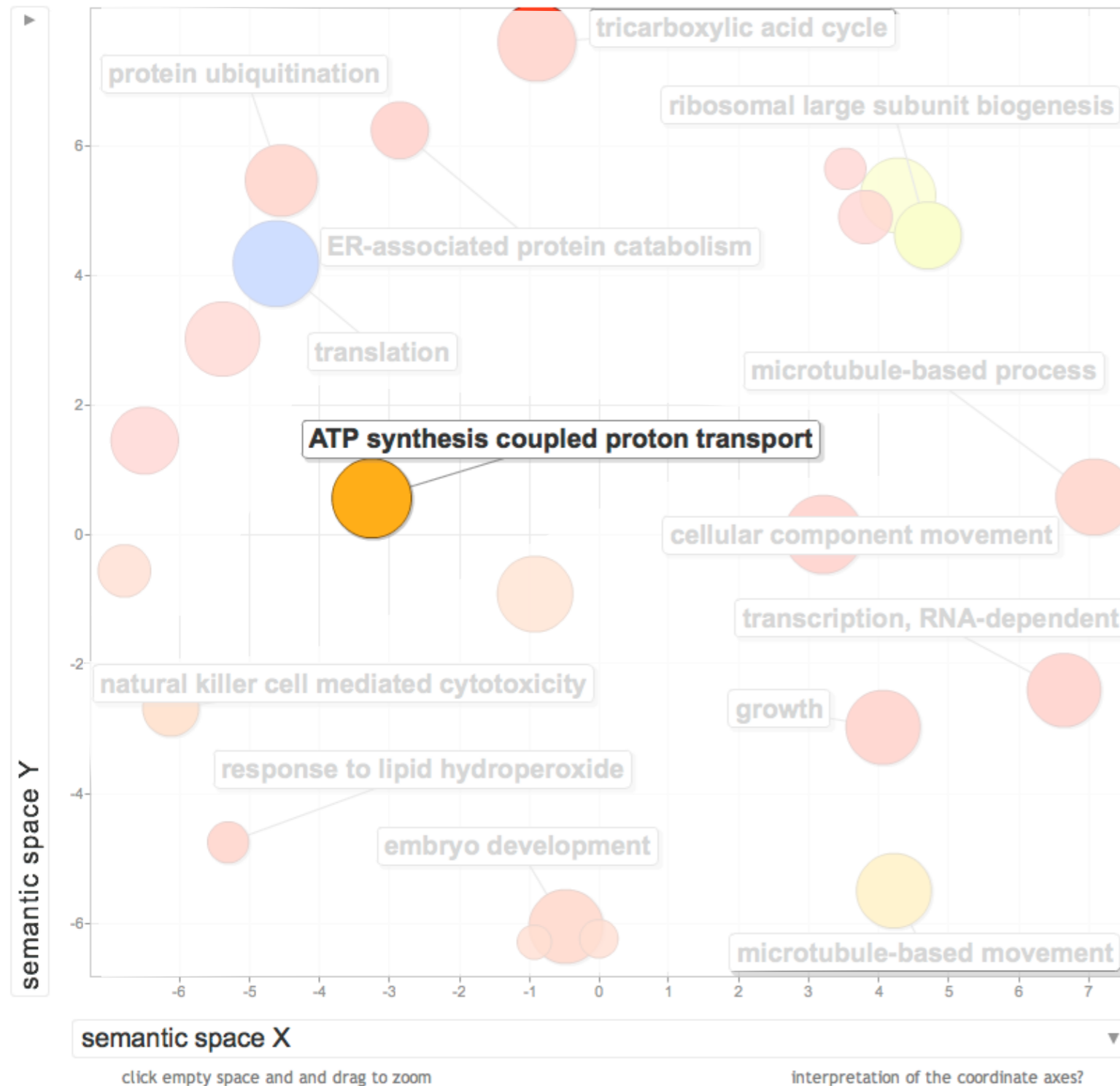
Translation

**ATP coupled
proton transport**

Development

Environmental stress

Ocean acidification and clam larvae



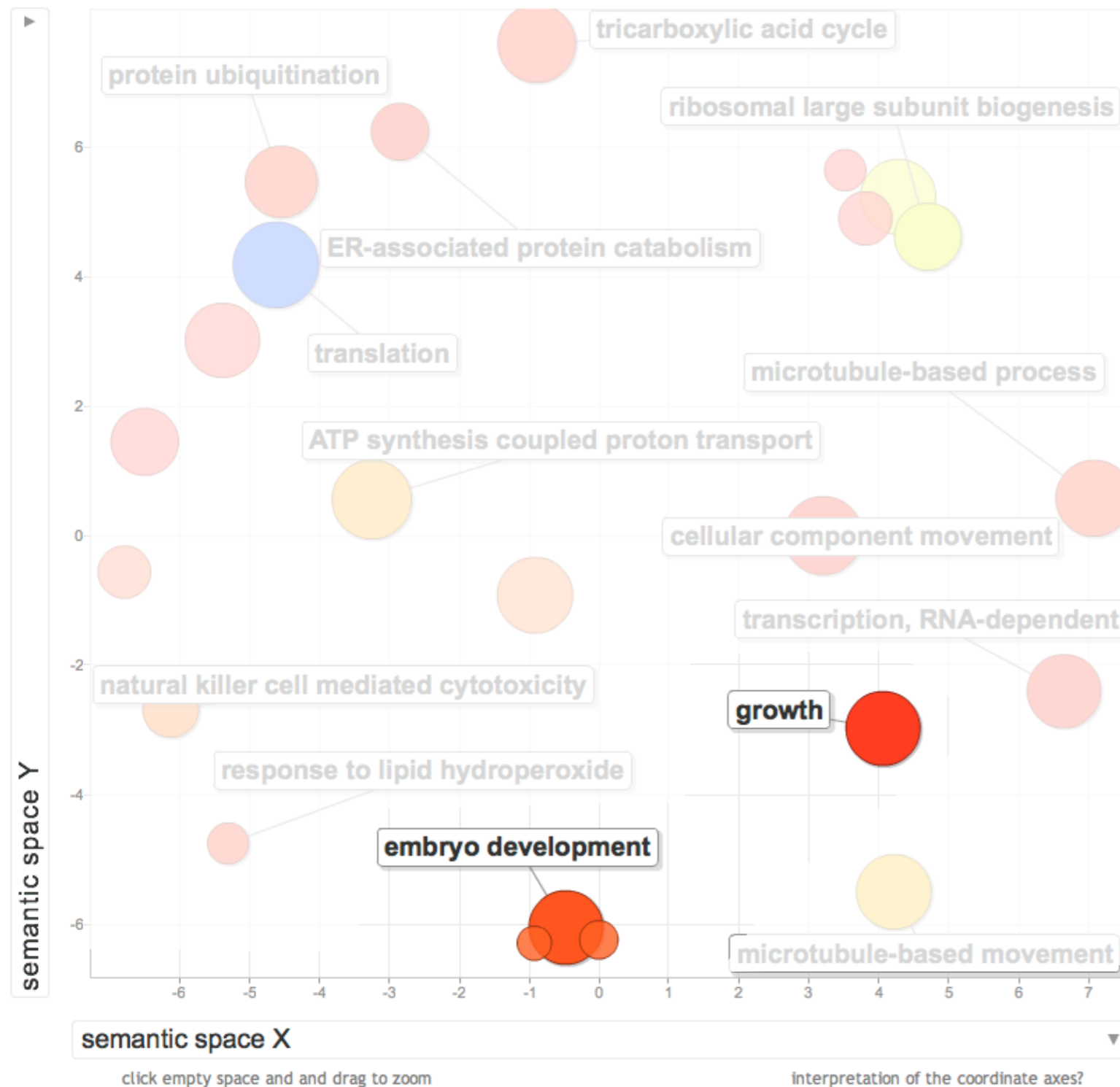
Translation

**ATP coupled
proton transport**

Development

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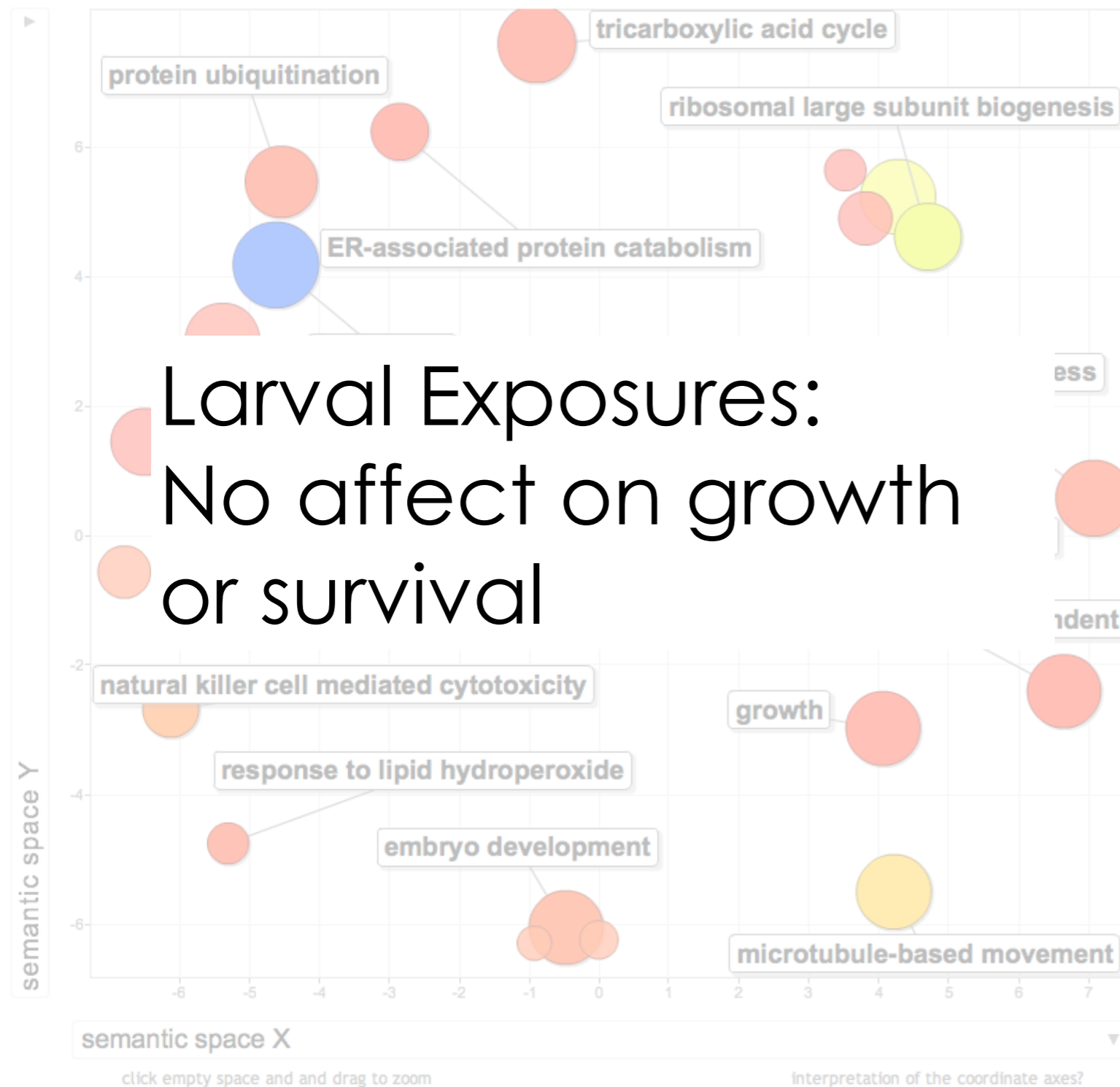
Translation

**ATP coupled
proton transport**

Development

Environmental stress

Ocean acidification and clam larvae

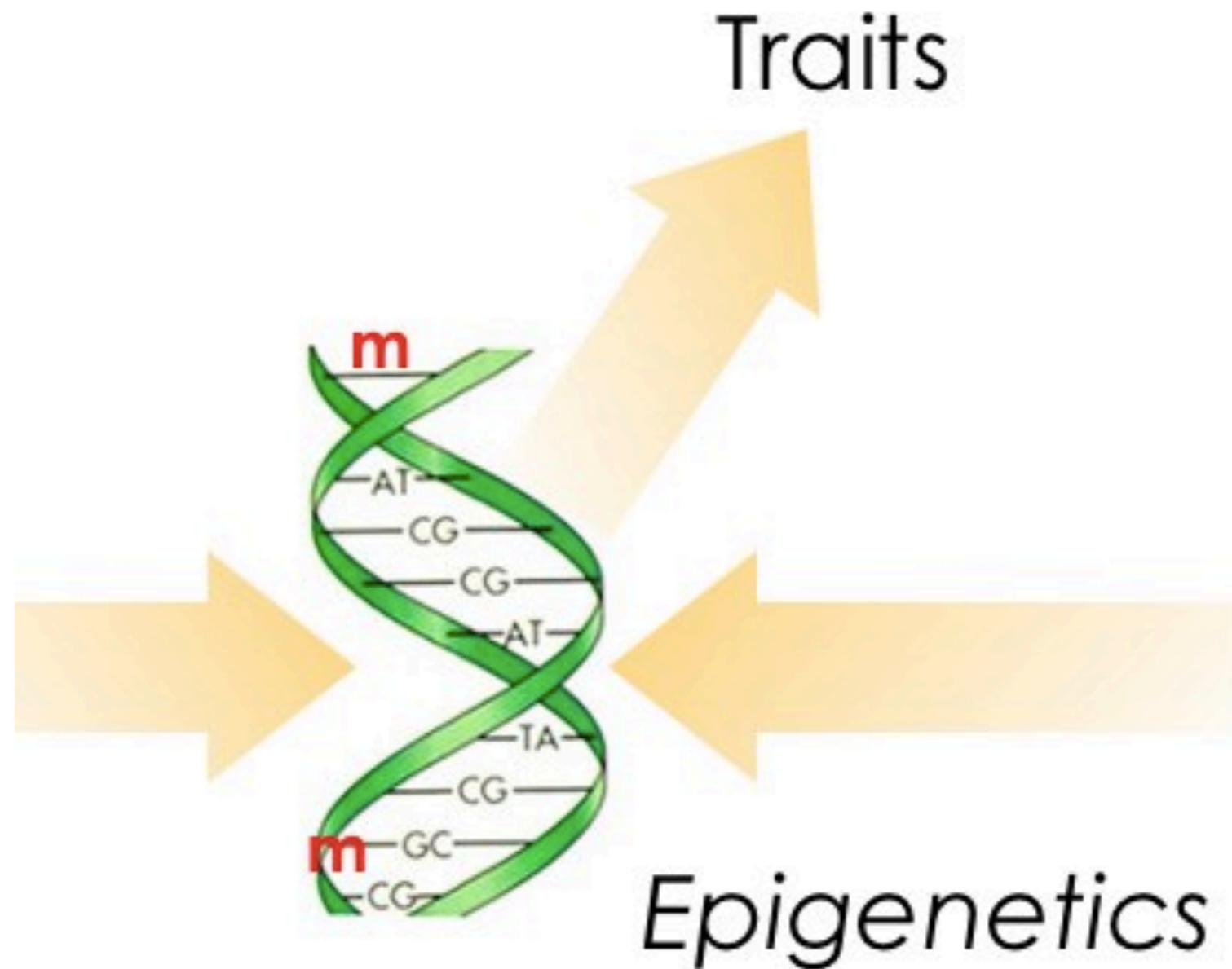


Epigenetics

DNA methylation in *Crassostrea gigas*

Epigenetics

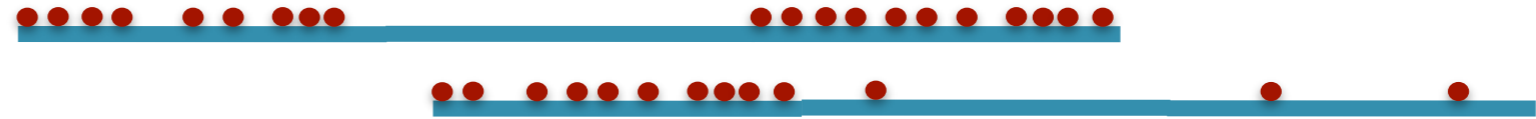
DNA methylation in *Crassostrea gigas*



Epigenetics

MBD-Seq

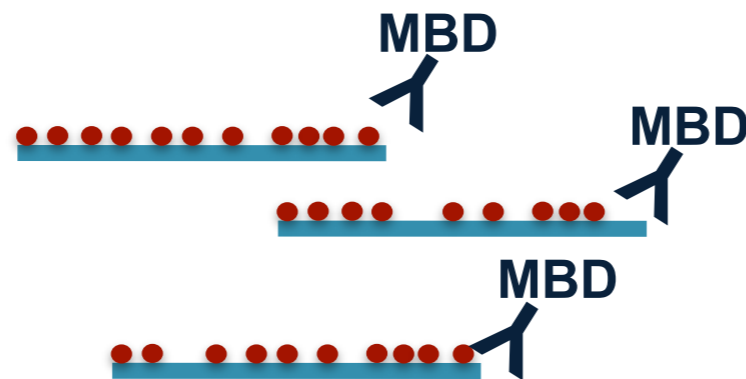
genomic DNA



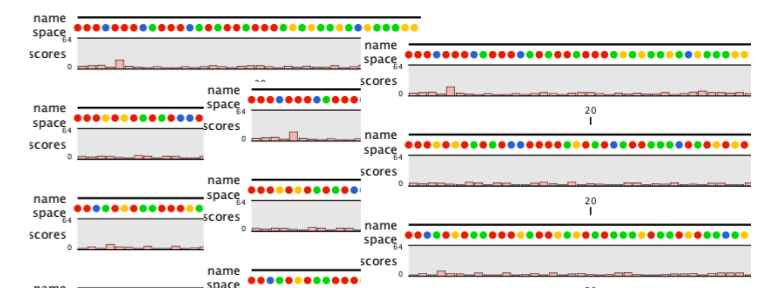
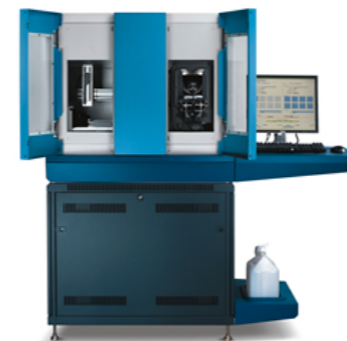
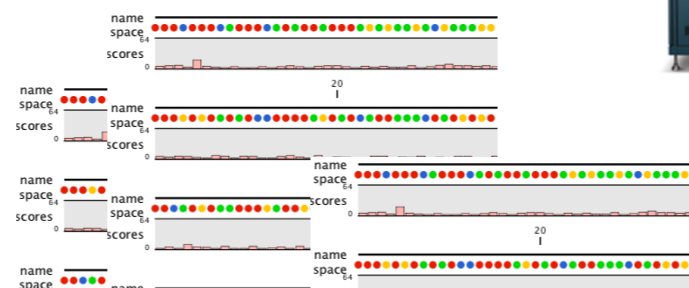
fragment



enrich

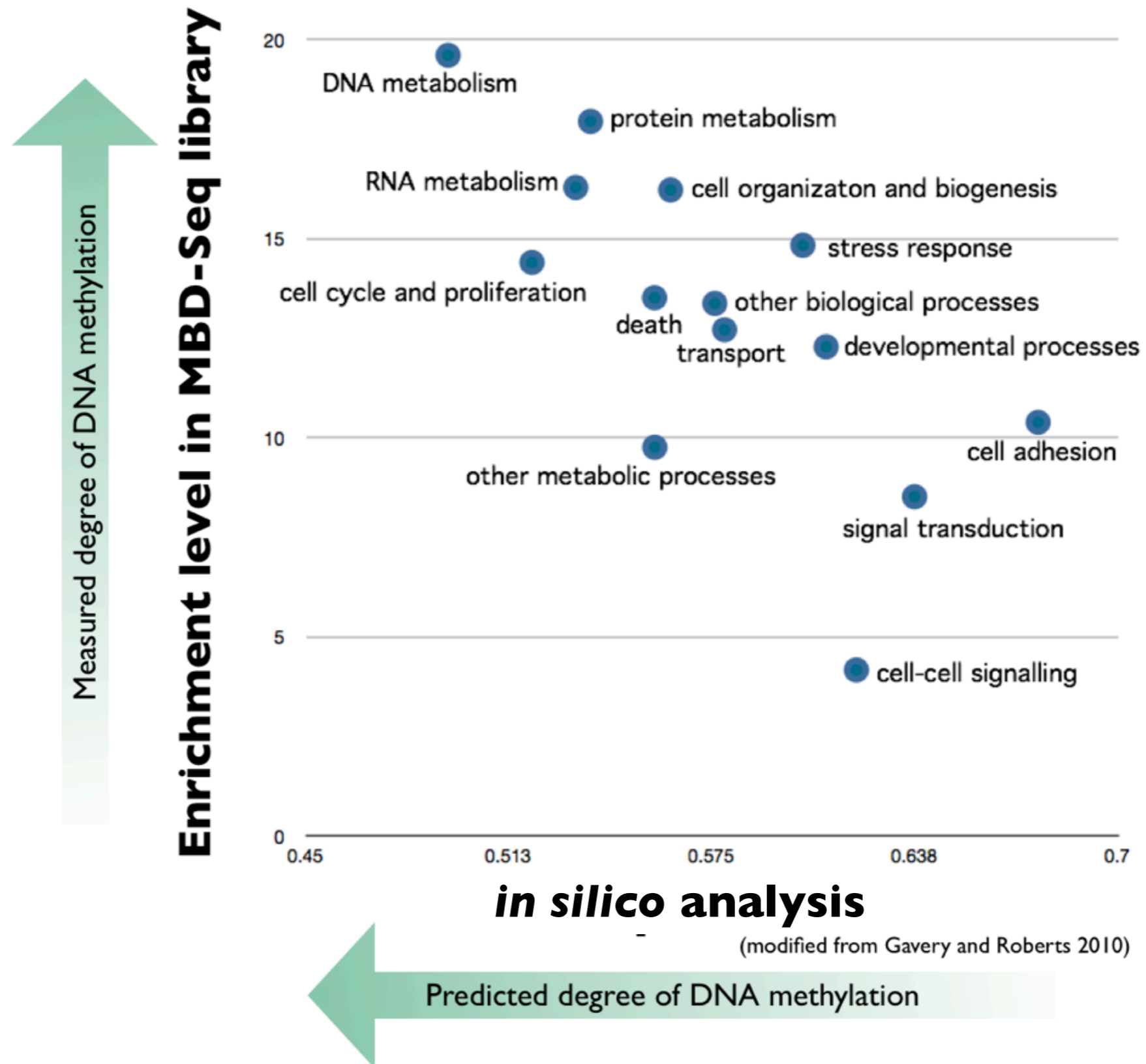


sequence



Epigenetics

MBD-Seq



Epigenetics - directions

Are epigenetic marks independent of genetics marks?

What role do epigenetic marks play in commercially important traits?

Epigenetics - directions

Are epigenetic marks independent of genetics marks?

What role do epigenetic marks play in commercially important traits?



High resolution mapping efforts

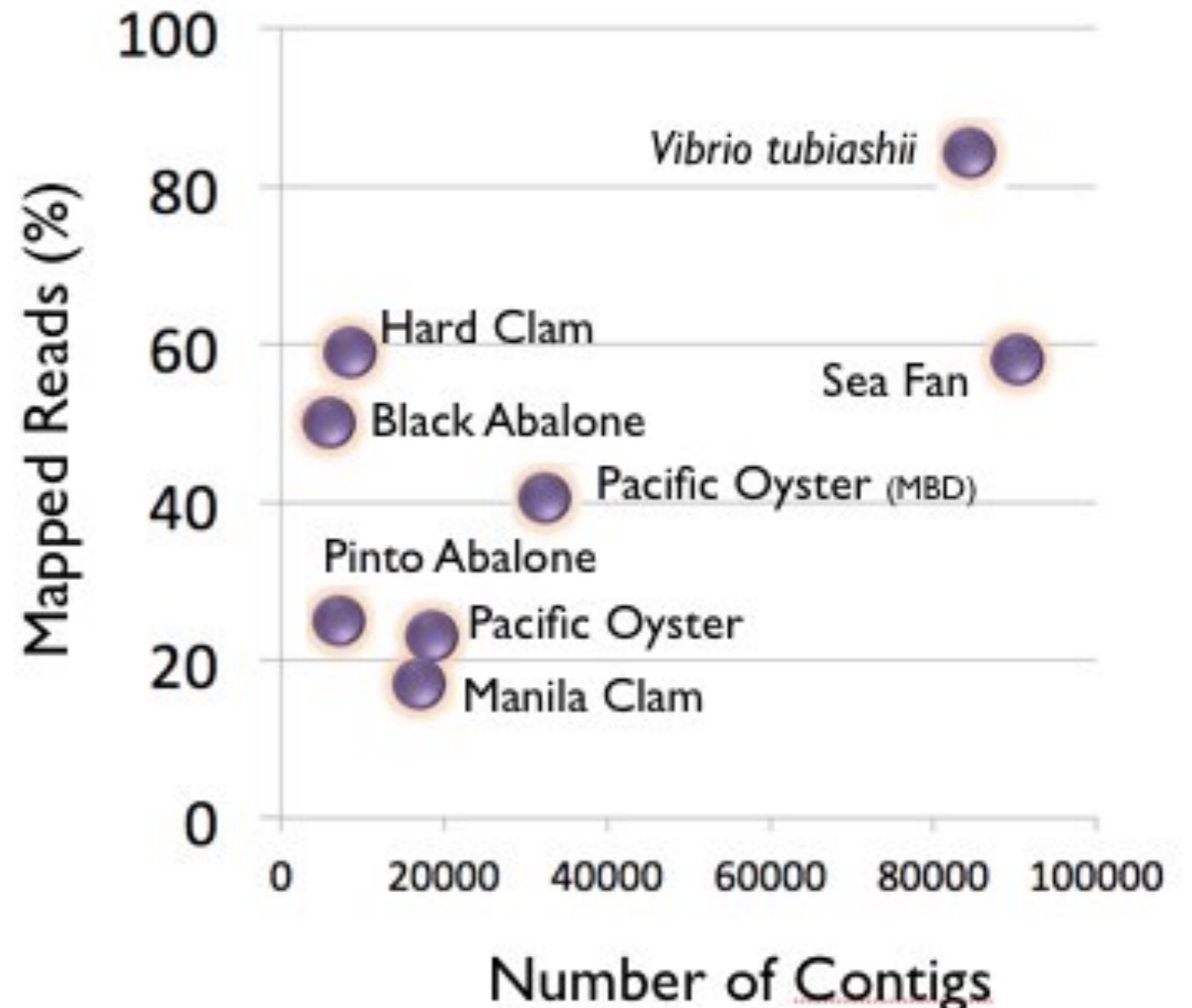
Coupling Bisulfite Sequencing with MBD

Summary

Limited, ultra-short read sequencing can efficiently provide relevant biological information and genomic resources.

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Summary

Limited, ultra-short read sequencing can efficiently provide relevant biological information and genomic resources.

Availability of shared transcriptomic and genomic sequences will facilitate increased application of short-read sequencing technology to improve aquaculture production.

Acknowledgements

Scott Lindell
Dave Bushek
John Kraeuter
Caroline Storer

Carolyn Friedman
Dave Metzger
Paul McElhaney
Shallin Busch
Sam White

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funding

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NRAC



NOAA

Saltonstall-Kennedy
Washington Sea Grant



EPA
STAR



more information

fish.washington.edu/genefish

goo.gl/TJgA2



