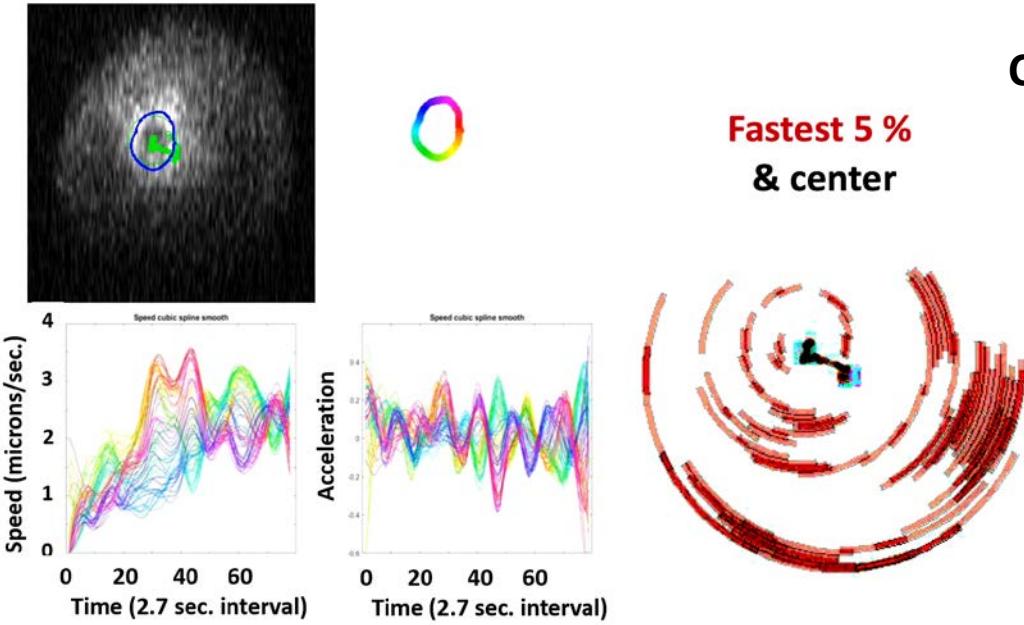




THE UNIVERSITY  
of NORTH CAROLINA  
at CHAPEL HILL

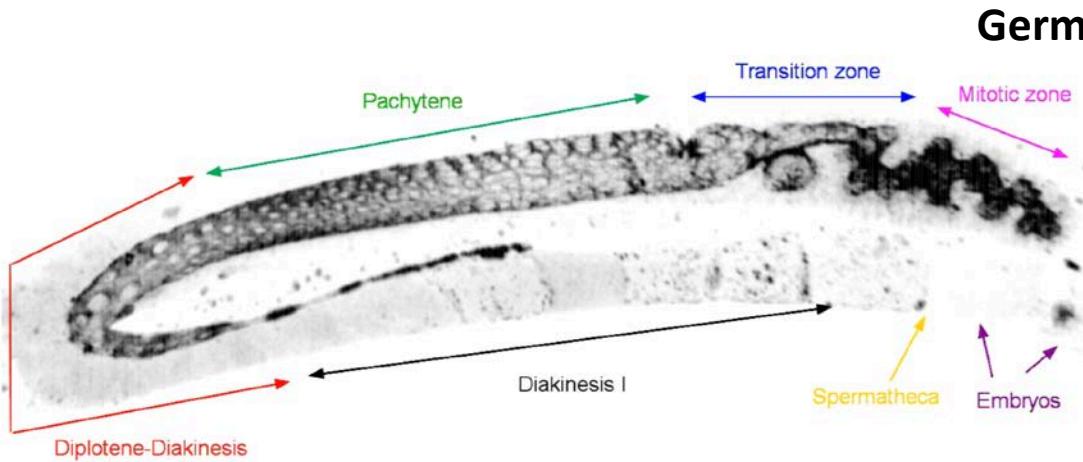
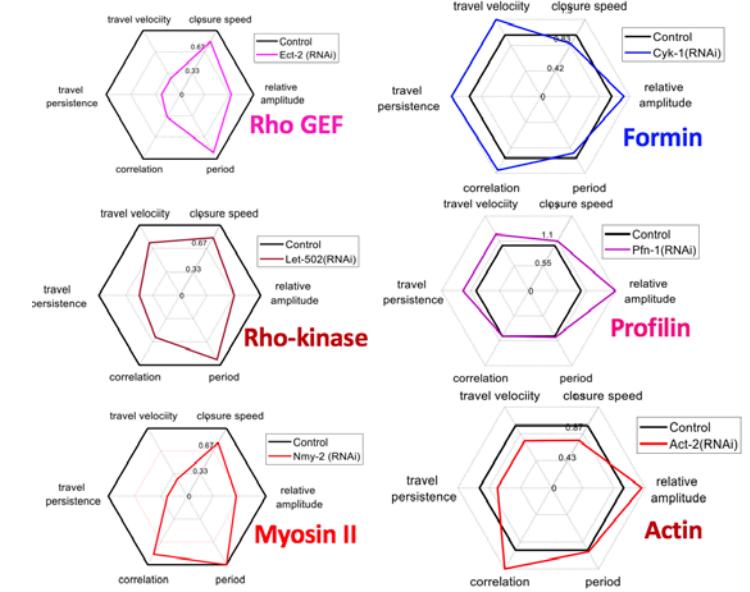


# Amy Shaub Maddox: Mechanisms of cell shape change and contractility



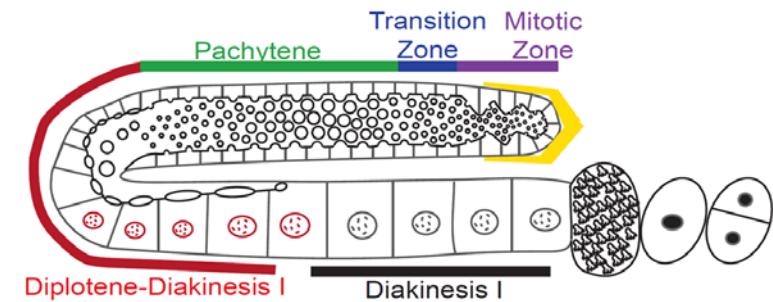
## Cytokinesis / Cleavage

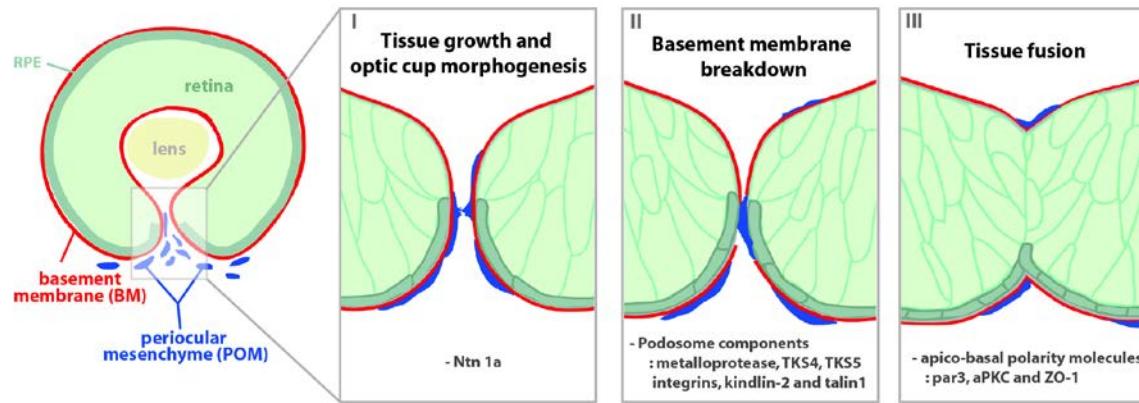
Dynamic rings exhibit speed oscillations  
(time-delayed negative feedback!)



## Germline Intercellular Bridges

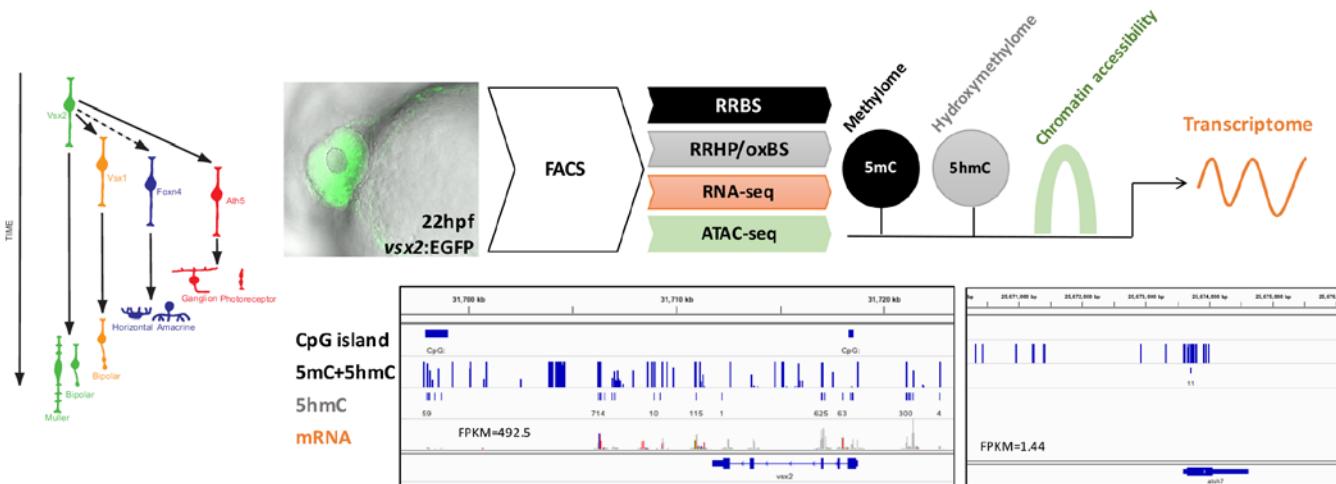
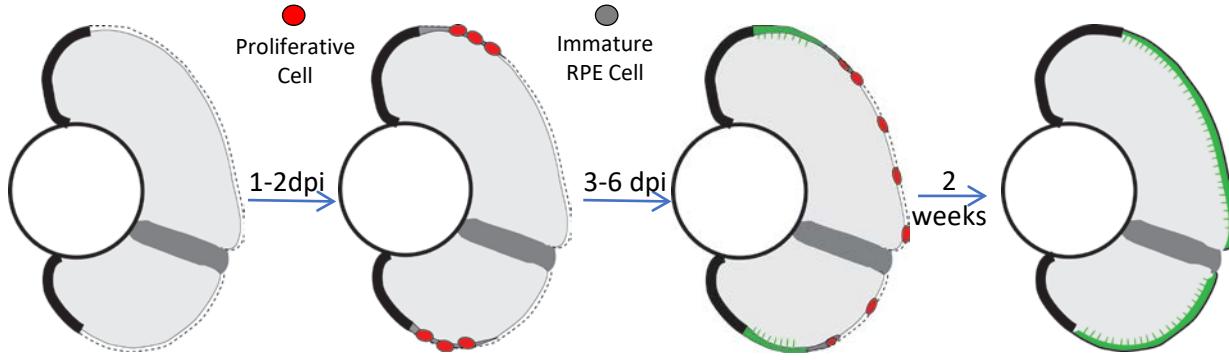
Stable rings contain “contractile” proteins  
(specialized contractile regulation (inhibition?))





## Optic cup morphogenesis and choroid fissure closure

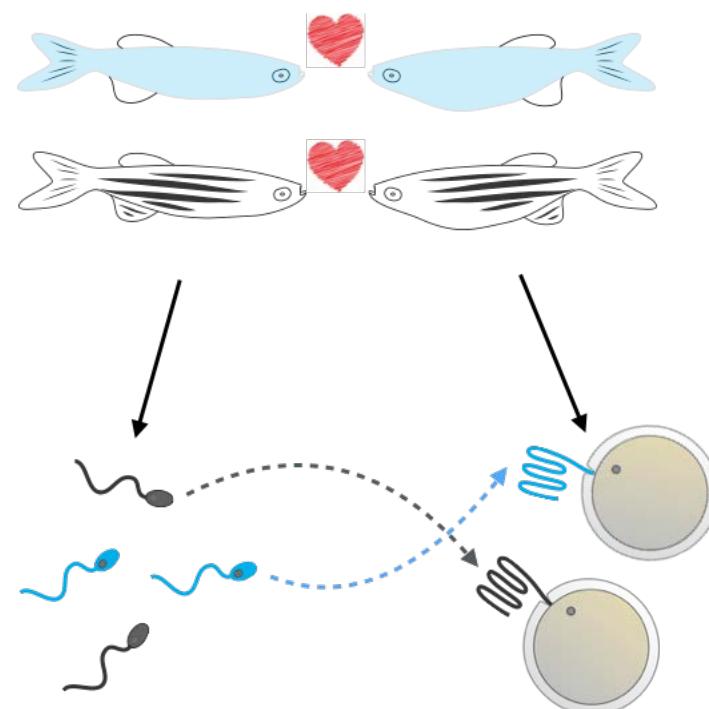
### RPE regeneration



## Retinal development and regeneration

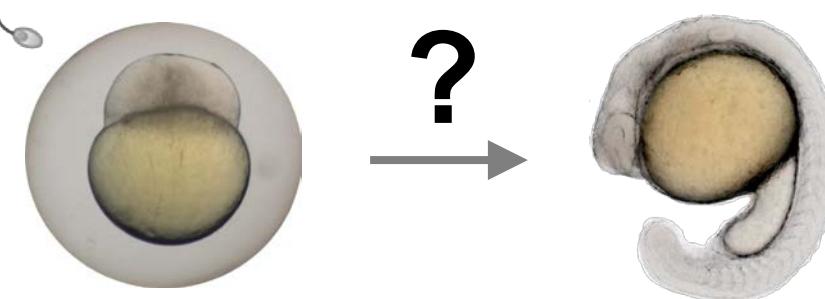
# Germline-to-embryo transition

Fertilization

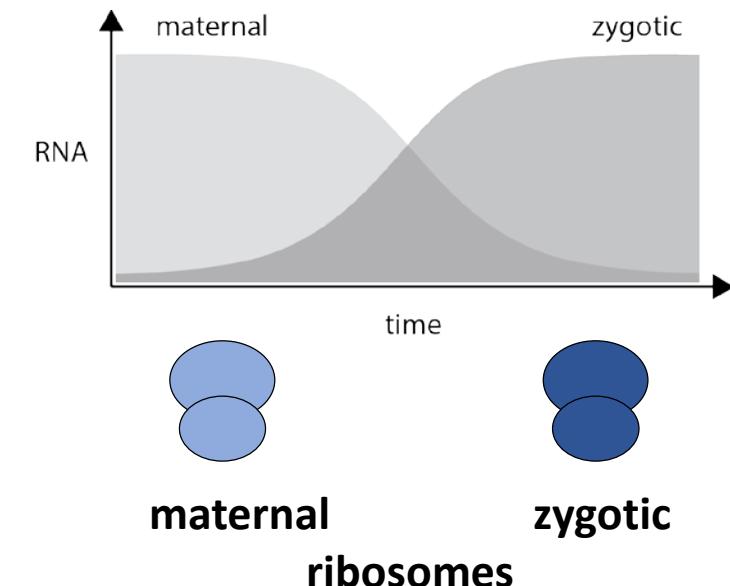


Short proteins

Bouncer, the gate-keeper of the oocyte    Toddler makes gastrulating cells move



Translation



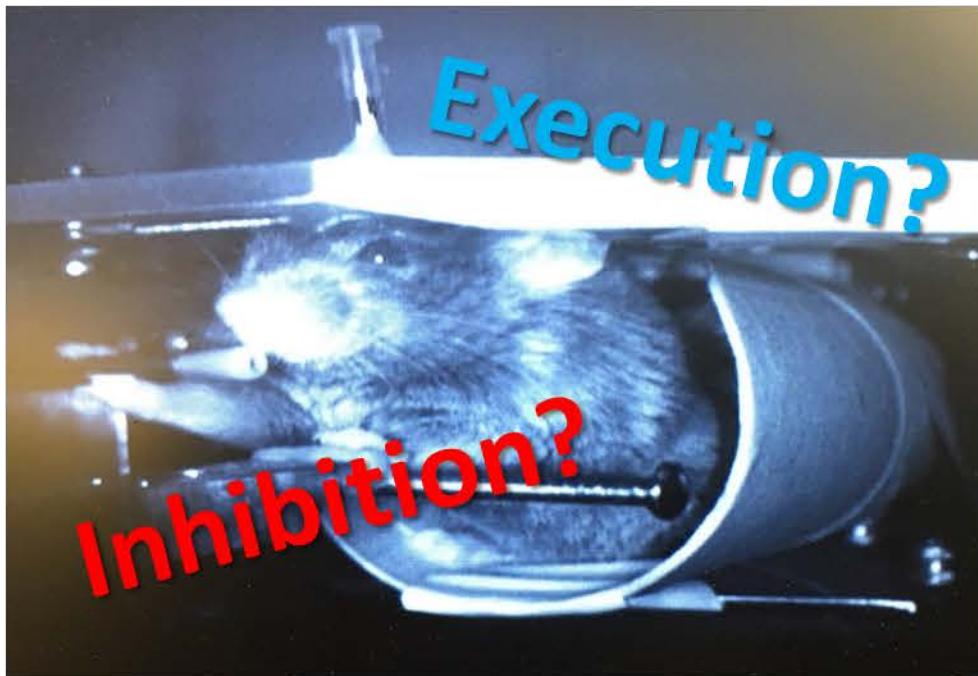
Andrea (Andi) Pauli

Lillie 118

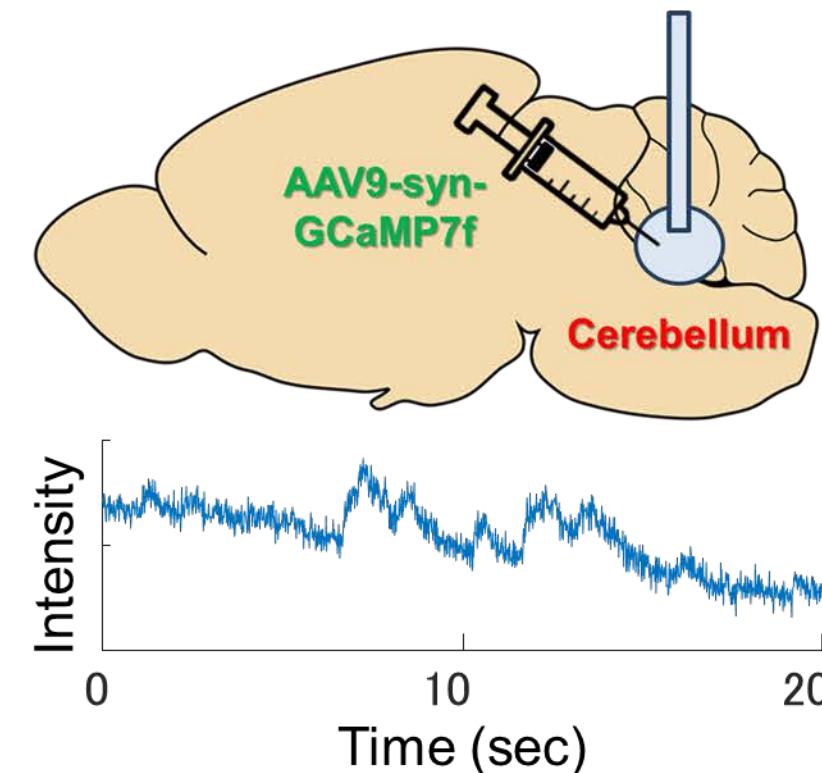
IMP, Vienna, Austria

Herberg et al., bioRxiv

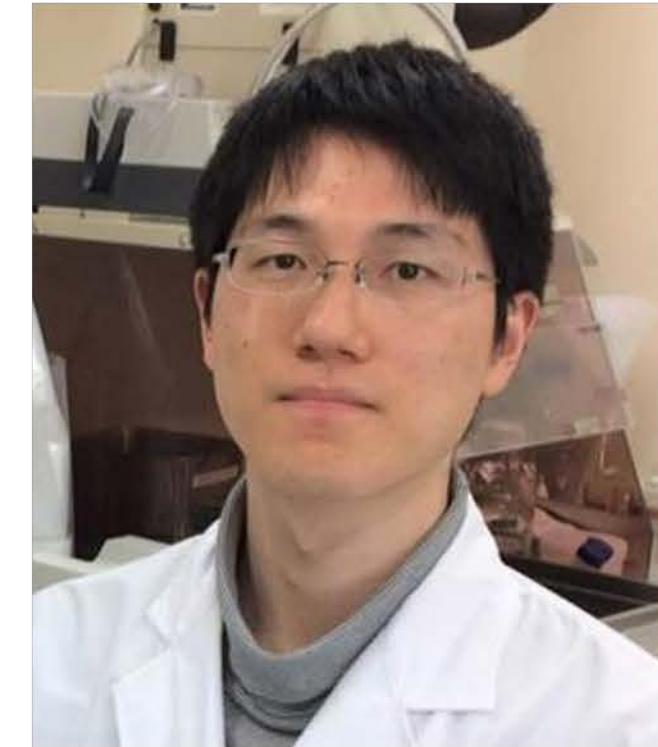
# How does our brain control behavioral inhibition?



**Behavioral inhibition task**  
of head-restrained mouse



Fiber photometry recording  
from **the Cerebellum**



**Junichi Yoshida**  
Grass Lab., Rowe 201  
[jun.y.neurosci@gmail.com](mailto:jun.y.neurosci@gmail.com)

# What the heck is Trichoplax?

dan Rohksahr

Disk shaped  
marine animal-  
crawls on ventral  
cilia -finds and  
eats algae..  
World-wide warm  
oceans

---

Only 6 cell types.  
No digestive track-  
Feeds externally  
NO NERVOUS  
SYSTEM

---

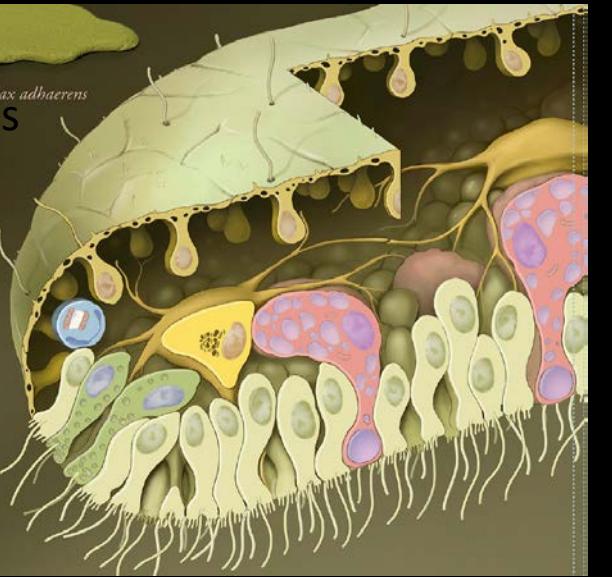
98 genes,  
11,514 MB  
87% homologs  
in other animals  
83% shared  
between Cnidaria  
and Bilaterians.

Tatjana Mayorovska  
Carolyn Smith  
Tom Reese

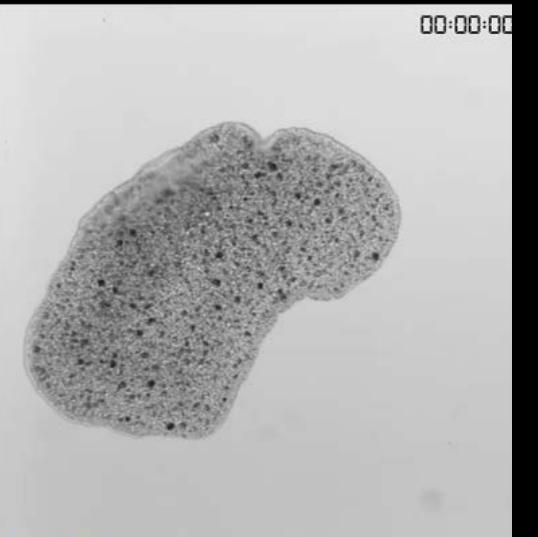
*Trichoplax adherens*, Schultz, 1883

treese@mbl.edu

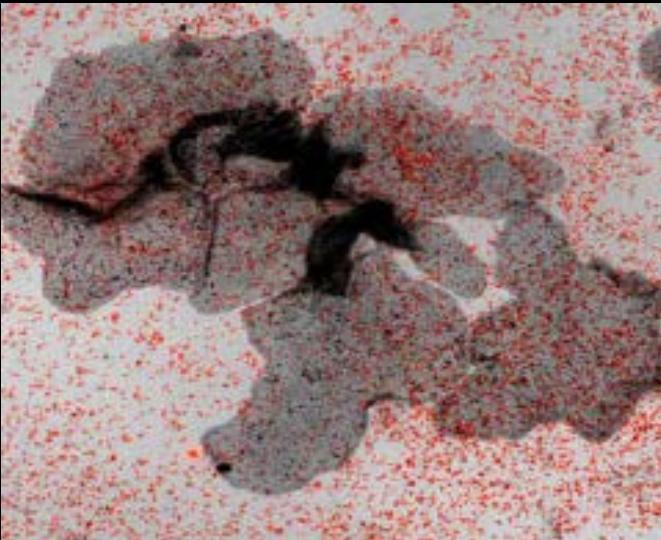
Two types of secretory cells in Trix



Spritzing Endomorphin-2  
induces reversible pauses



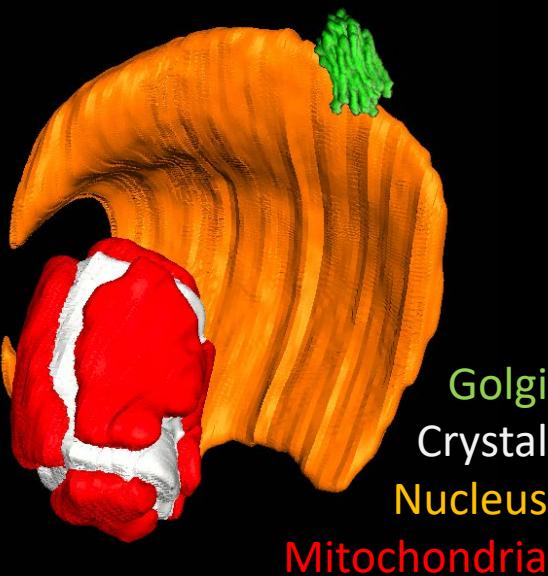
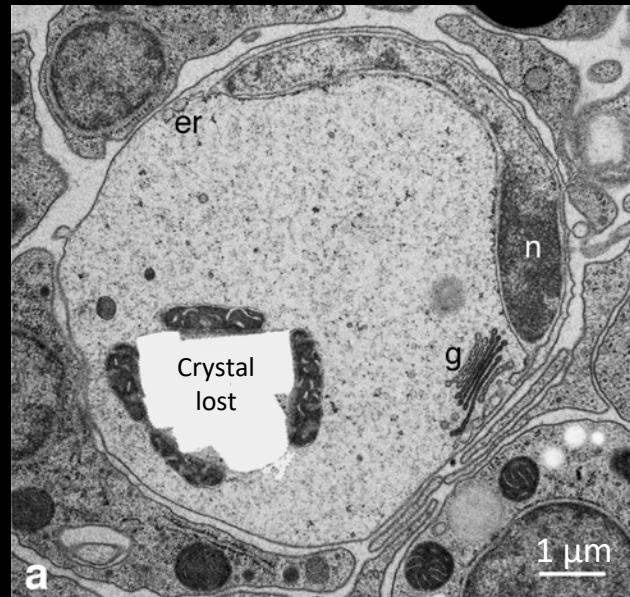
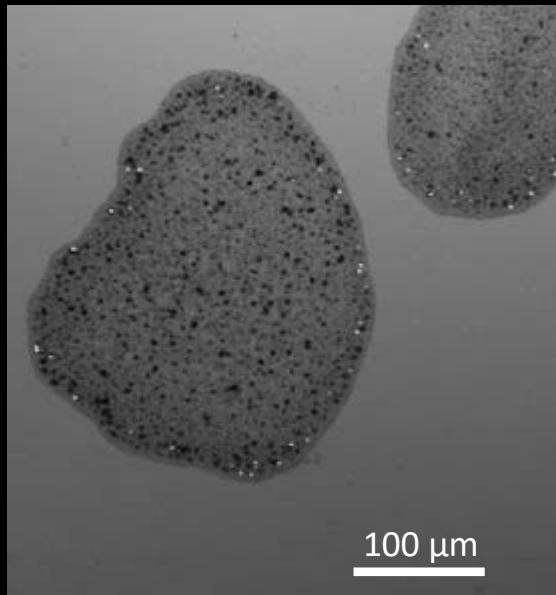
Trix pauses over algae and  
bombs them with its lipophil cells



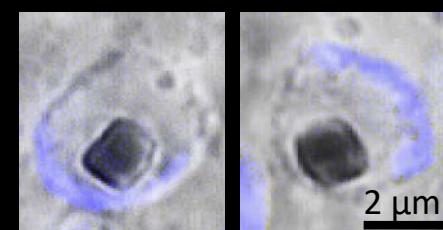
Trichoplax on agar laid over a clump  
of algae crawl to ward the algae.



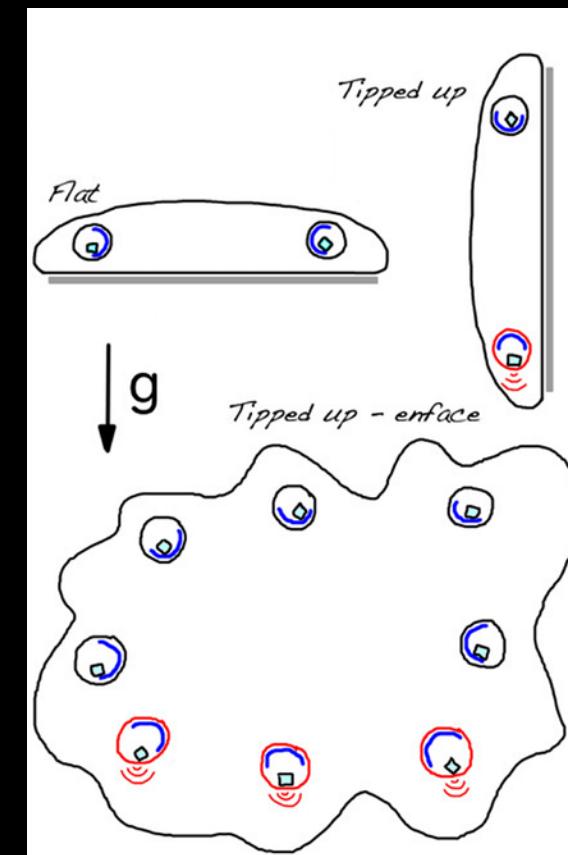
# What do tiny crystals in Trichoplax tell us about its lifestyle and origin?



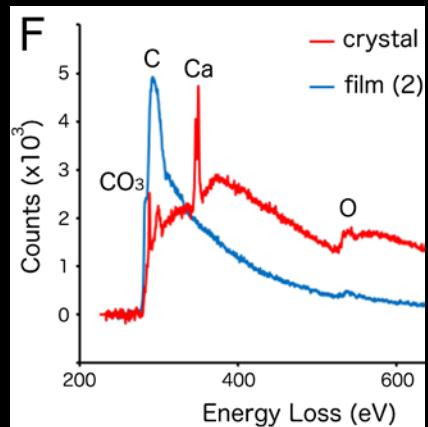
Crystals fall down in tipped animals, and to touch the down side of the crystal cell, at either the nuclear cup or plasma membrane.



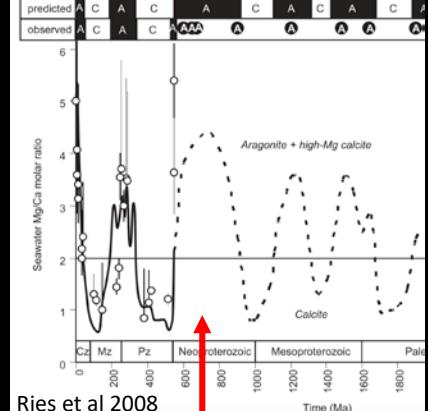
Crystals cells might be selectively activated depending on orientation of the animal. A large number of crystal cells (>100) compensates for the absence of a nervous system.



Since crystals do not contain Mg, the mineral is most likely **aragonite**. This suggests that crystals might have evolved in a Trichoplax ancestor 700 MA years ago, when Trichoplax is thought to emerge.



| predicted | A | C | A | C | A | C   | A | C | A | C |
|-----------|---|---|---|---|---|-----|---|---|---|---|
| observed  | A | C | A | C | A | AAA | A | A | A | A |



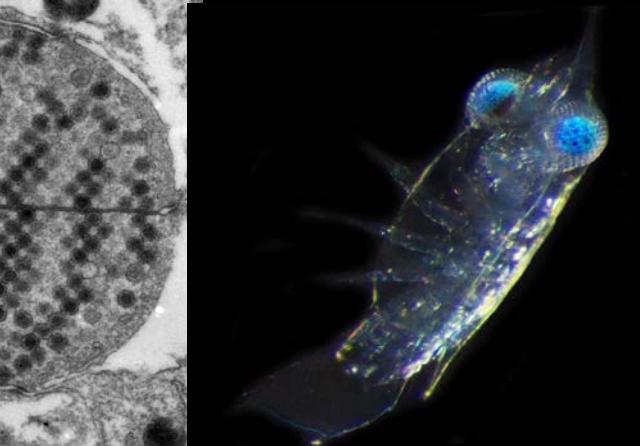
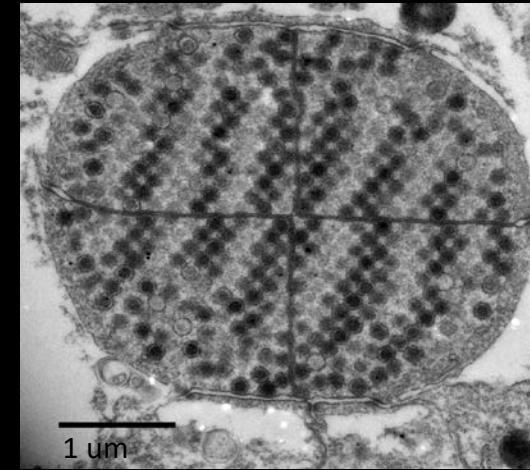
# Mantis Shrimp Brains & Behavior



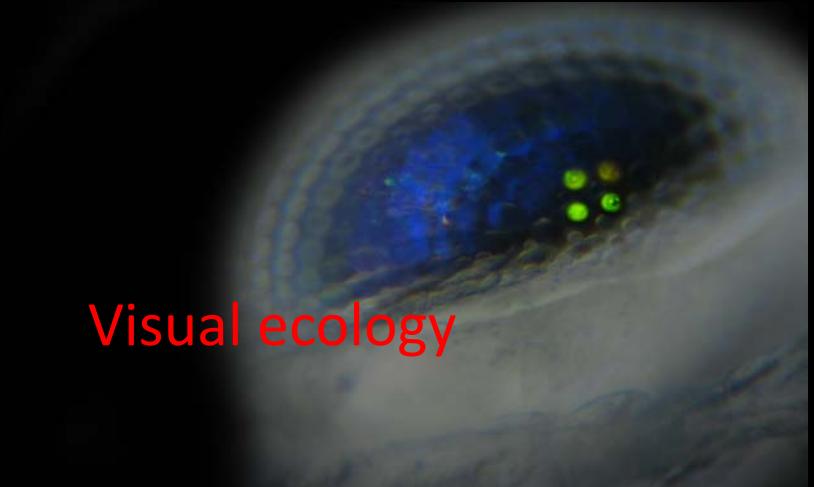
@DrKateFeller  
[www.Katefeller.com](http://www.Katefeller.com)



Neuroethology



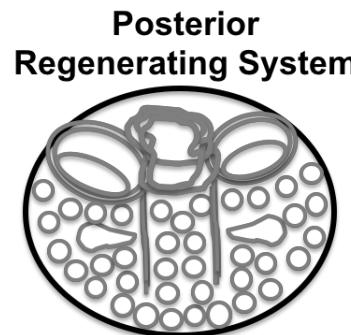
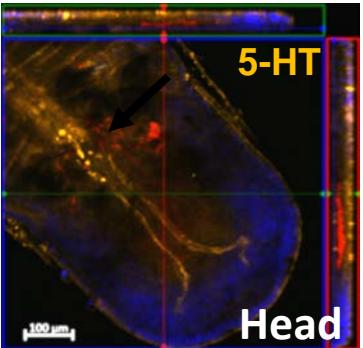
Visual ecology



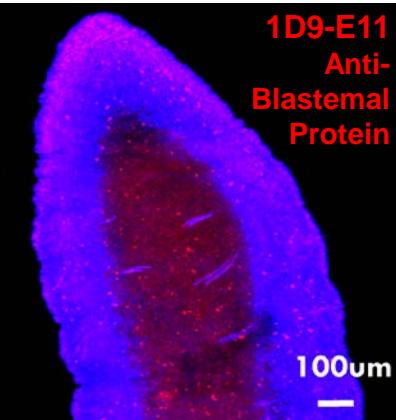


*Lumbriculus  
variegatus*

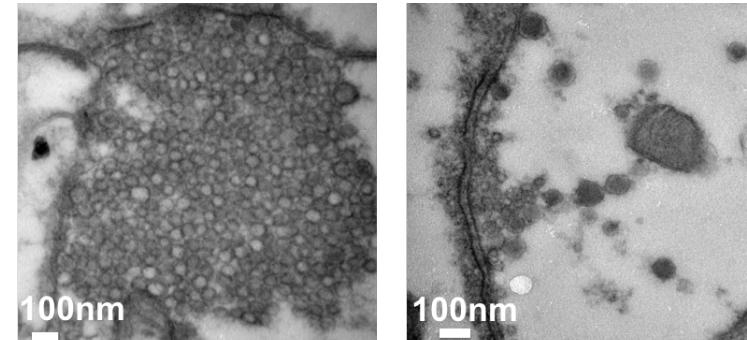
24hrs Post -  
Amputation



1wk  
Post -  
Amputation



# Making Heads or Tails of Regeneration using an Annelid model.

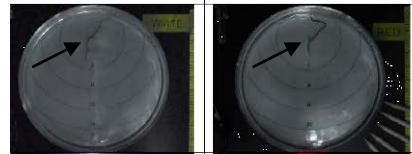


>L. variegatus beta-catenin consensus sequence (5' - 3')  
AGTCGTACCGCATGATGAATTCCCGCAATGATGCCGCTCATCGCGA  
TGAACAATACGACCGATCCGGAGACGACTCGATGCACCGCCGAACACTCACA  
ATCTCTCGCATCACCGTCAAGGCTTCGCCATTCAAATCCGGTGAATCCA  
GCCCTGGTCCGGCTTGTGAGTTCTCGATGAACTGGTTCTTACGCCATCAC  
TACTCTGCATAATTGCTCTGCATCAAGAAGGGAGCAAGATGGCGTTACCTC  
GCGGGCGGACTACAAAAATGGTGGCCTGCTACCTCGAAACAACGTCAAATTC  
CTTGCAATCACAACCTGATTGCTCCAGATTCTAGCTATGAAATCAGGAAAGCA  
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CGTACAATTACGAAAATTTGGACATCGGAGTCCTCAAAGTTCTC  
GGTCTGTCTAGCAACAACTCTCGATTGTAAGCTGGGAATGAGTGCATTG  
TCGATGCATCTCGGTATCAGAGTTCGAGGCTCGTCAGAACACTGCCGTGGACCA  
TCGAAATCTCGGATGCTCAACAAAAGTGGAGGGGATCAAGGTTACTTCA  
GACCGTTGTCACCTCTGGCTCCAACTGACATCAACATCGTCACATGTTCTCG  
GAATTCTGTCACCTGACTTGCACAAACCCAGAACAGATGGCGTATGCCA  
GGTGGGAGGAGTCGAGGCTGGTCCGACCGTTCTCCAGGCCAGACCGAG  
AGGATATCACGGAACCAGCTGTGTGTC



Veronica Martinez-Acosta  
MRC 306  
vgmartin@uiwtx.edu

Lights  
off



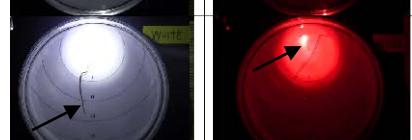
0 sec.



15 sec.



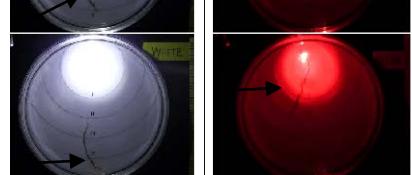
30 sec.



45 sec.

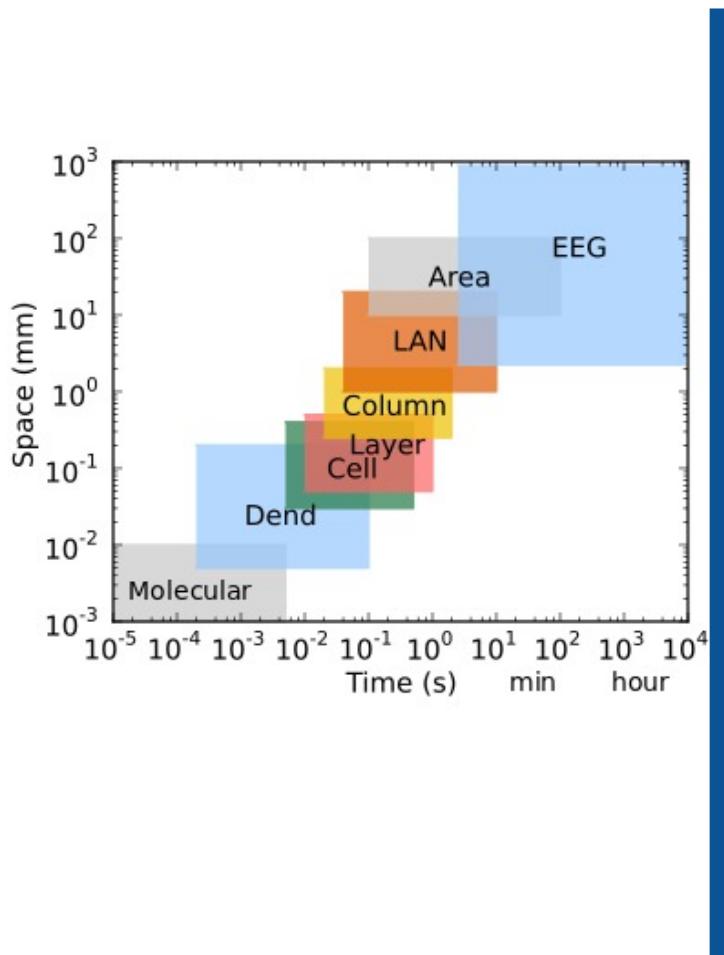


60 sec.





A Diverse Legacy, A Bright Future

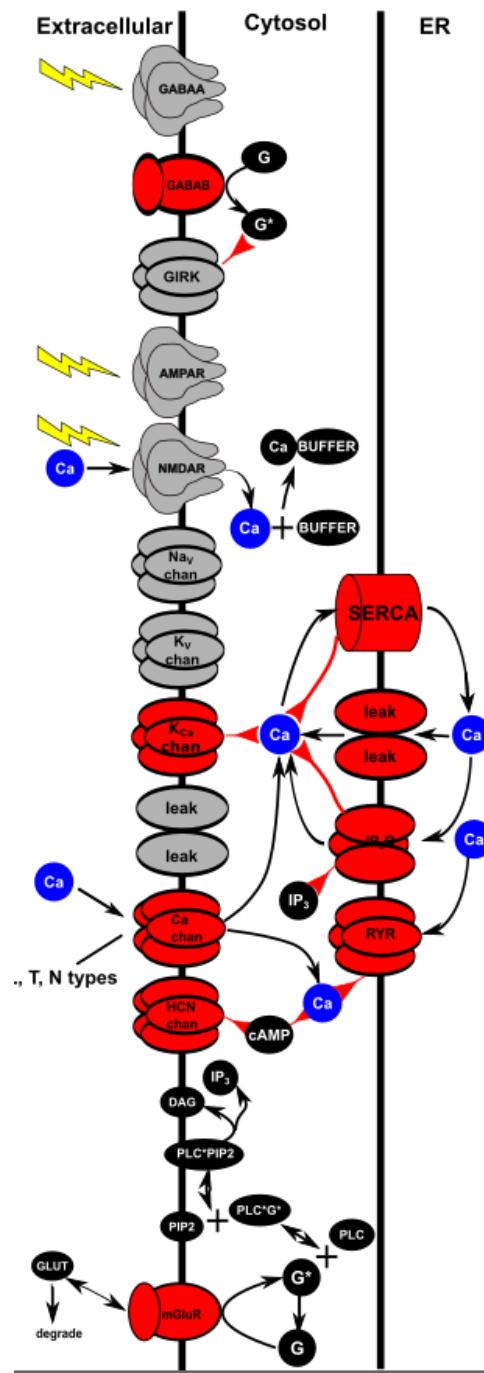
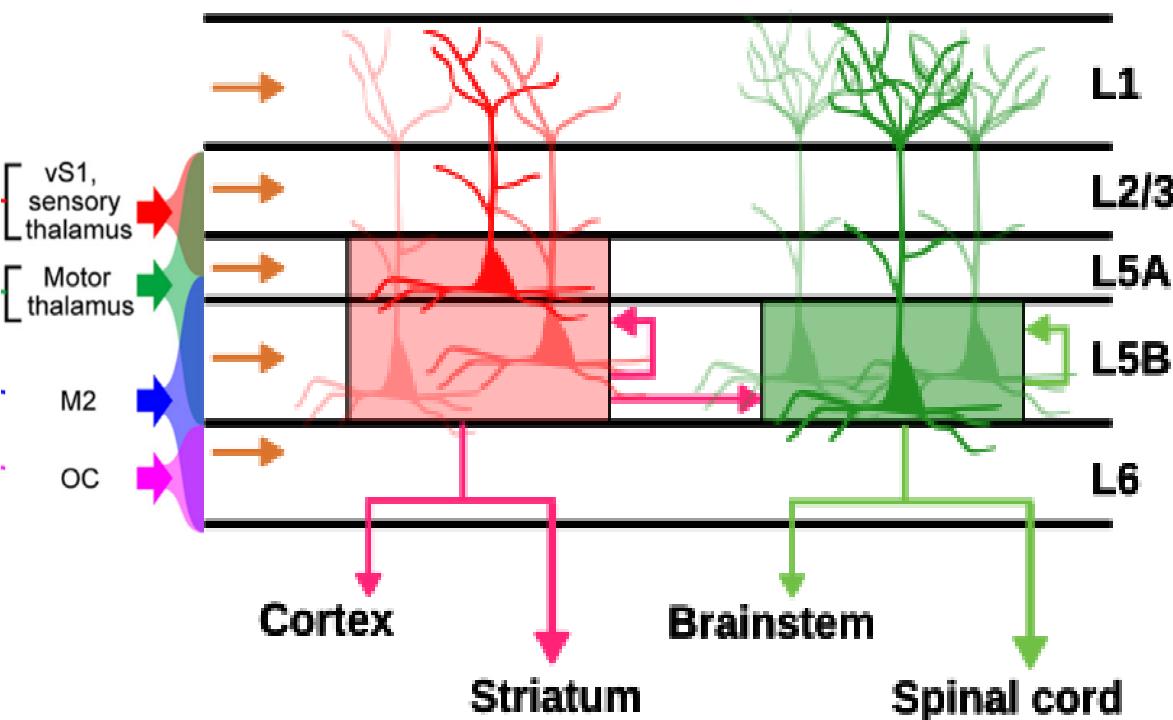


# Multiscale modeling

## Computational Neuroscience

[bill.lytton@downstate.edu](mailto:bill.lytton@downstate.edu)

web: [neuron.yale.edu](http://neuron.yale.edu), [netpyne.org](http://netpyne.org)

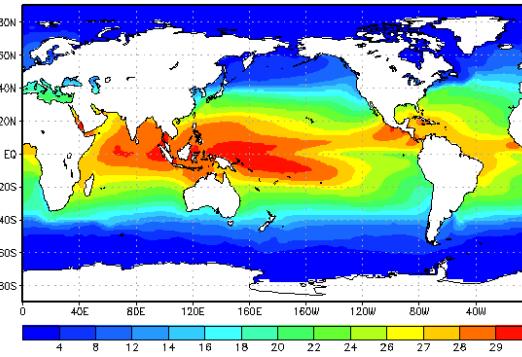
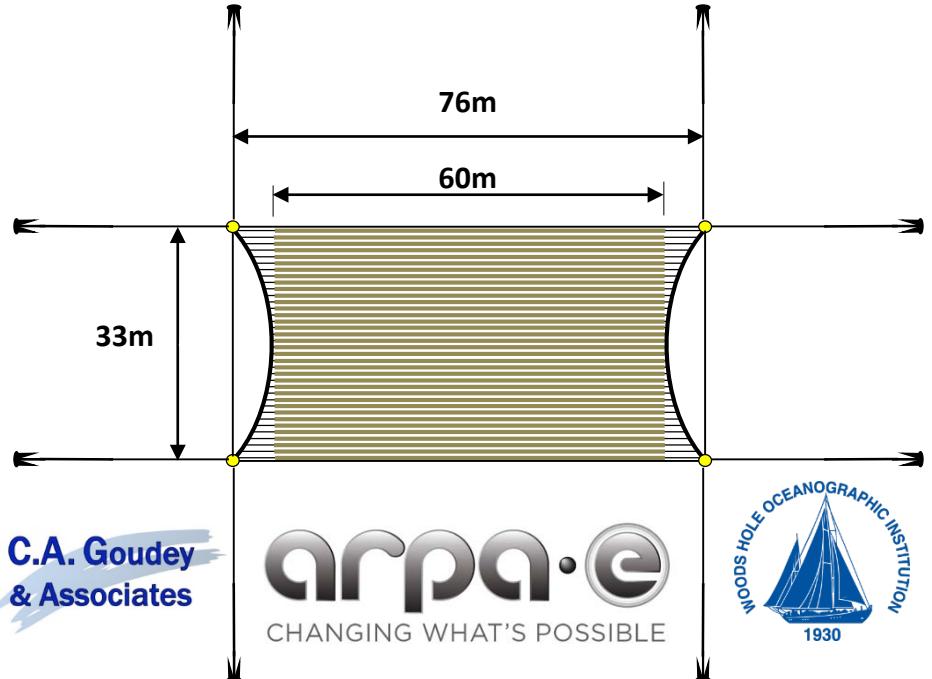


# 1. Tropical seaweed cultivation and harvesting

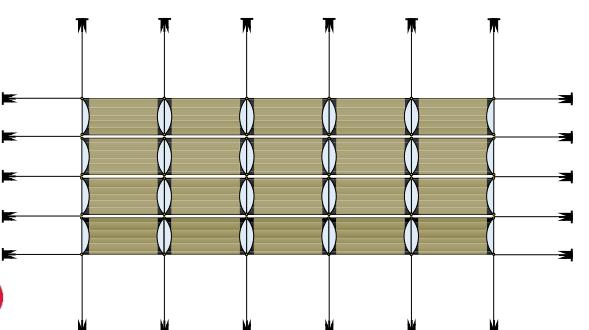
Loretta Roberson  
Marine Biological Laboratory  
lroberson@mbl.edu



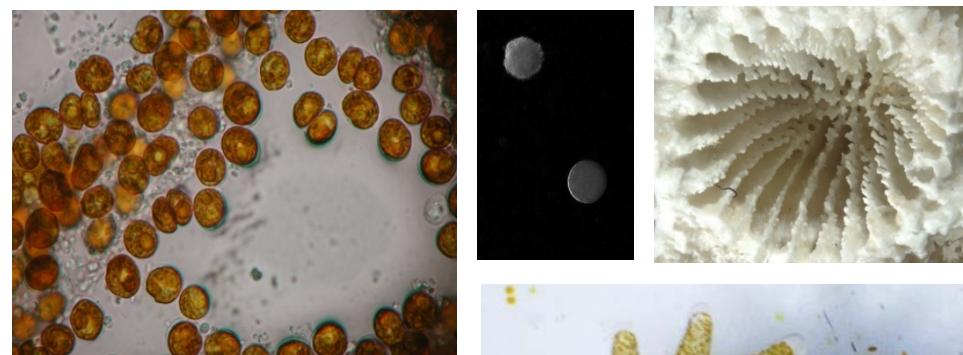
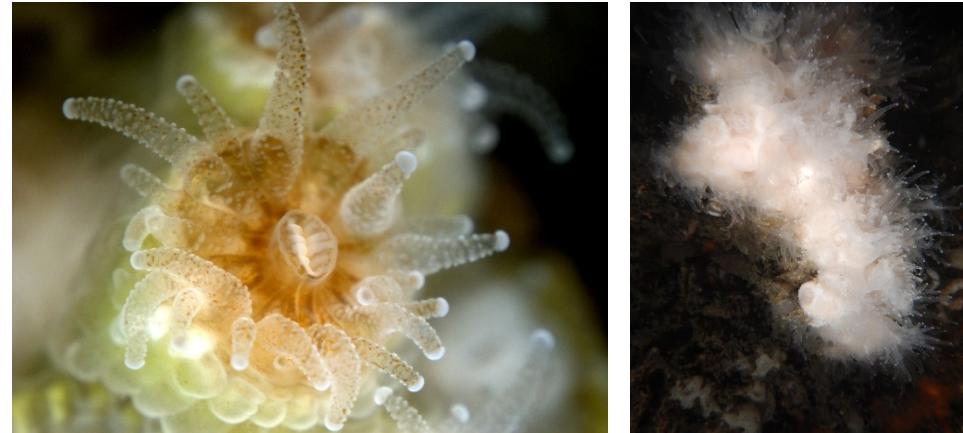
Basic cell has 60 growlines at 0.5 m spacing yielding 3,600 m of grow length.



Over 400 of these 5 x 4 arrays could fit in a test area in Puerto Rico yielding 28,800 km of growline or 1 million WMT of annual *Eucheuma* production.

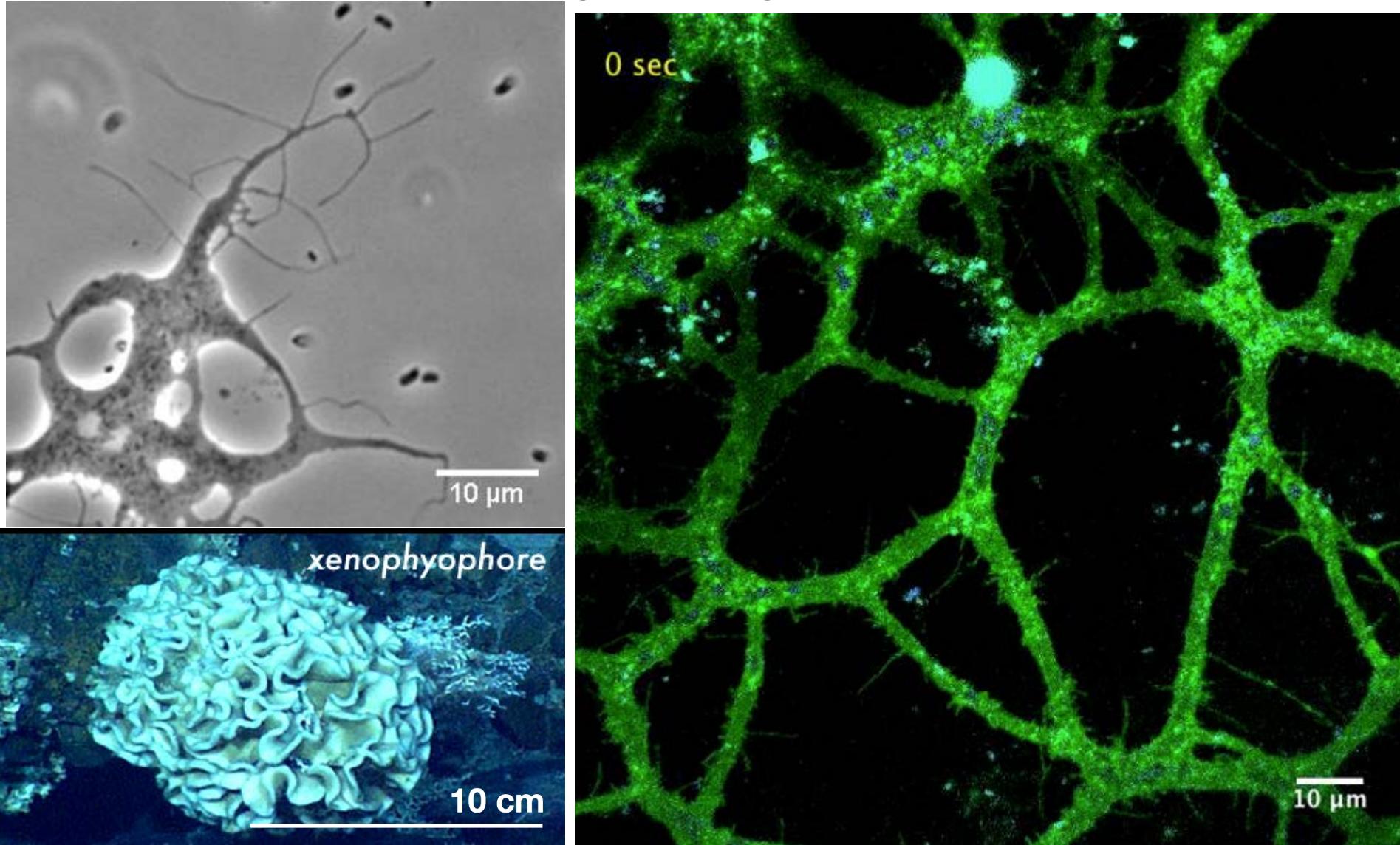


# 2. Impact of temperature changes on coral physiology



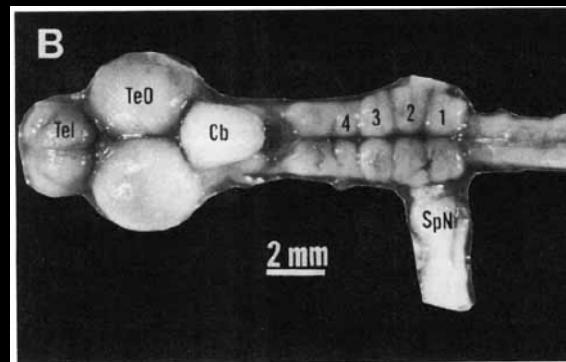
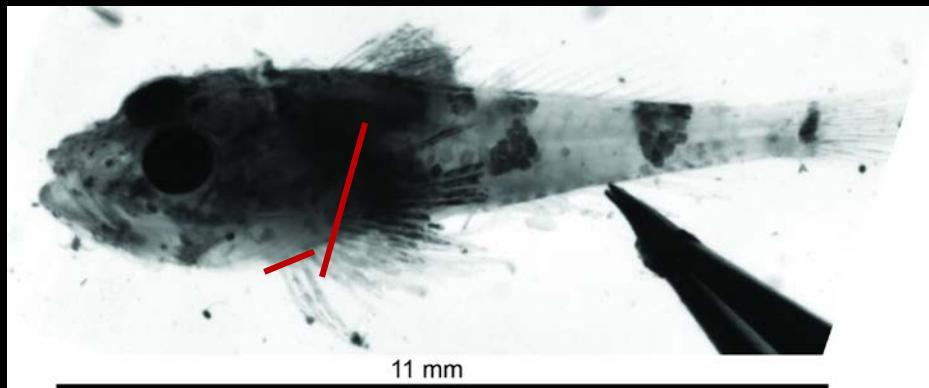
# Cytoskeletal evolution of a multinucleate Rhizarian amoeba

New ingredients (genes) or new recipes (mechanisms)?



Scott C. Dawson and Sarah Guest (UC Davis)

# What are the molecular mechanisms involved in evolutionary trait gain in vertebrates?



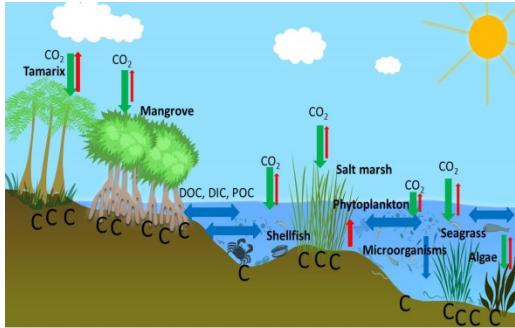
Aim 1: Identify which genes are differentially expressed at the anatomical locations of novel skeletal and neural traits

Aim 2: Develop methods to functionally test the role of individual genes in novel sea robin traits

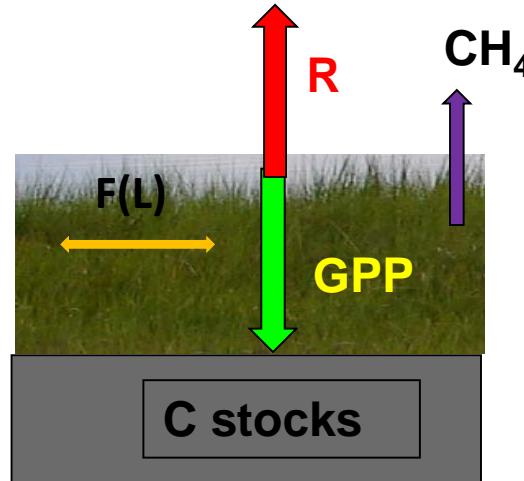
Amy Herbert  
Grass Fellow  
Rowe 201  
[herbert6@stanford.edu](mailto:herbert6@stanford.edu)



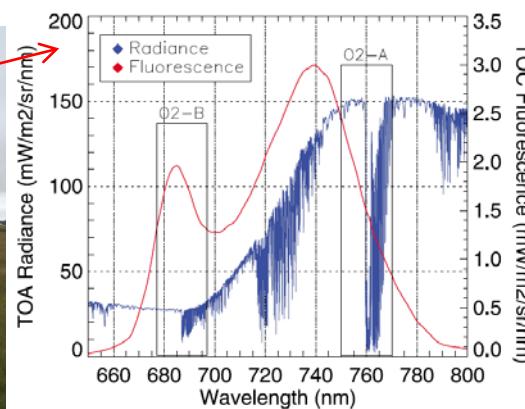
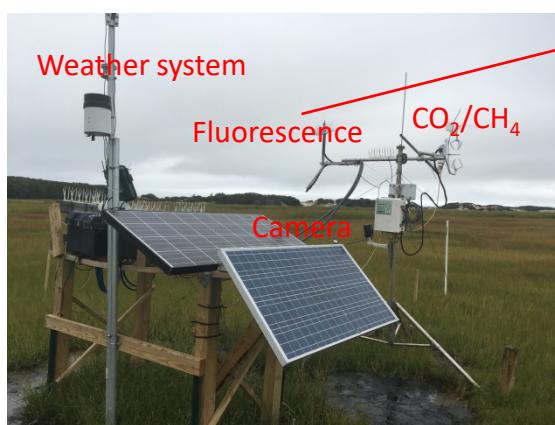
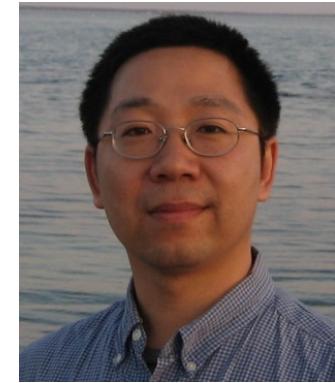
# Quantifying coastal “blue” carbon to offset climate change



Coastal ecosystems have strong ability to store carbon (Tang et al. 2018)



Jim Tang  
Starr 317  
jtang@mbl.edu

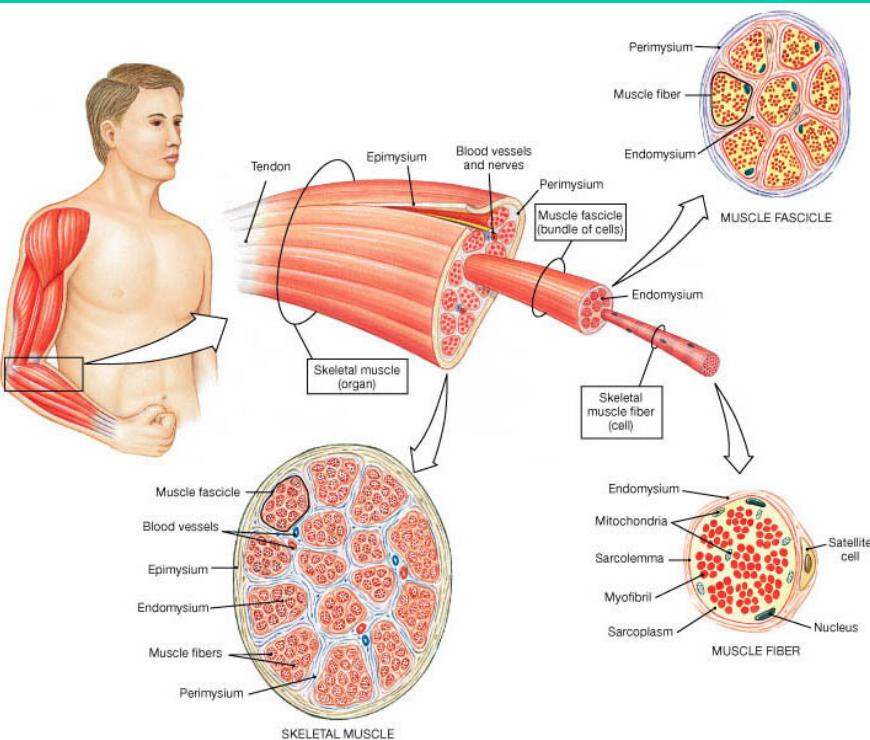


Solar induced fluorescence, a proxy of photosynthesis

Applying the concept to evaluating the carbon benefit of coastal restoration.

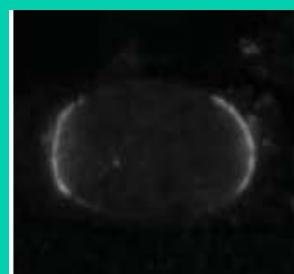
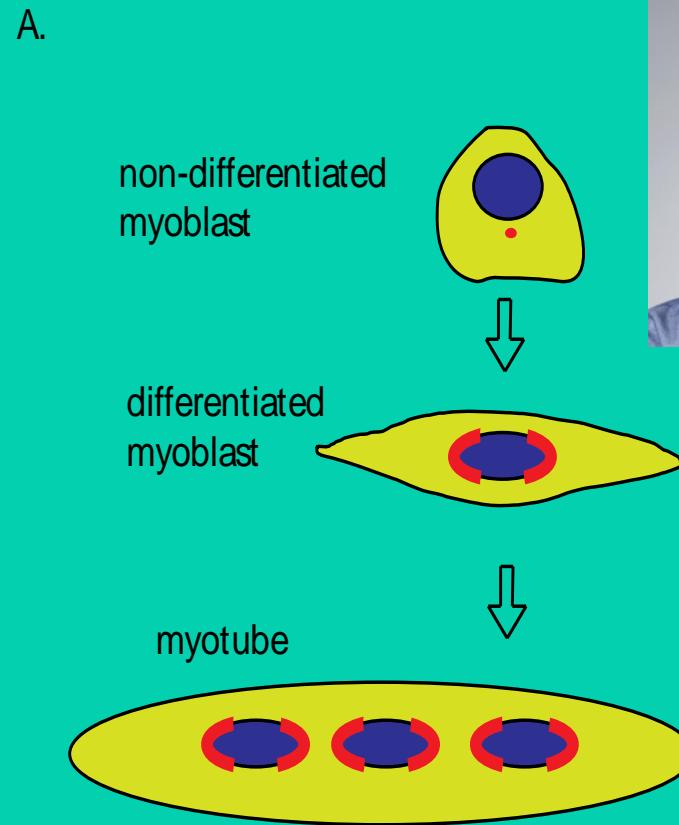


# A role for cell anisotropy on nucleus-cytoskeleton connections



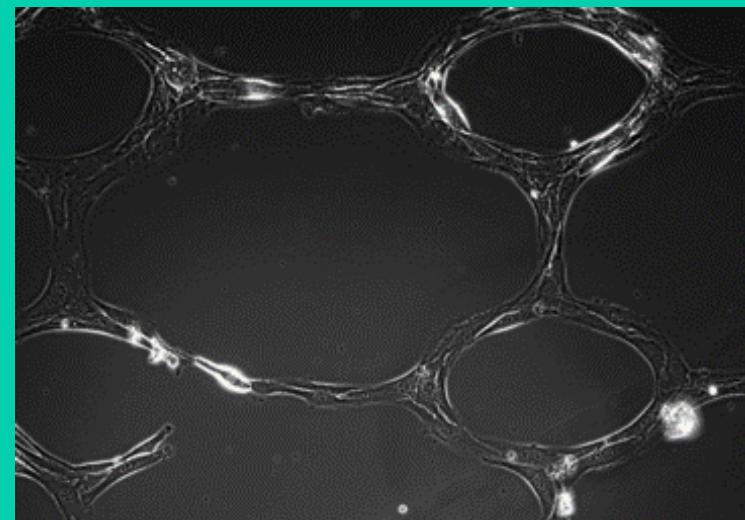
Human Skeletal Muscle cells

- Multinucleated
- Nuclei in specific positions



Edgar R. Gomes

- Does myoblast and myotube cell anisotropy affects nuclear anisotropy?



Manipulate cell shape *a la carte*