

2013

Pollen Biology


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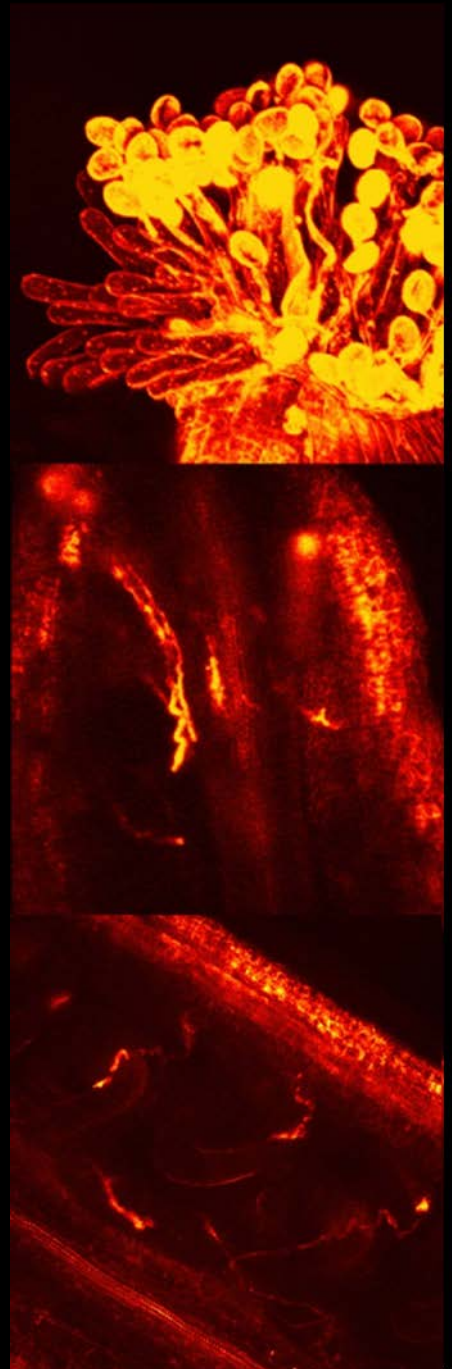
STEM WORKSHOP on Pollen Biology

University of Massachusetts
Biochemistry and Molecular Biology Department
(April 6, 2013)

Presented by: Professor Alice Y. Cheung
Professor Hen-Ming Wu
Dr. Yan-jiao Zou

Sponsored by the NSF supported Research Coordination Network
(RCN) on Integrative pollen biology (<http://pollenetwork.org/>)

Contact: acheung@biochem.umass.edu



Agenda

9:00 am Brief introduction of the workshop's agenda and experiments

9:30 am Get experiments started:
Pollination, pollen tube growth in the pistil
In vitro pollen germination,
semi *in vivo* pollen tube growth

9:45 am Lecture, Introduction to pollen biology and plant reproduction
and on experimental procedures

Dr. Zou gets more experimental samples going for the group

10:45am Break and Q@A from teachers in the audience

11:30- Sample observations (separate into two groups, one stay in
Lecture hall, another goes to Cheung microscope room;
Groups exchange tasks. Continue Q@A

12:45 pm Conclusion, Teacher's summer internship opportunity

Pollen Tubes deliver sperm cells for fertilization



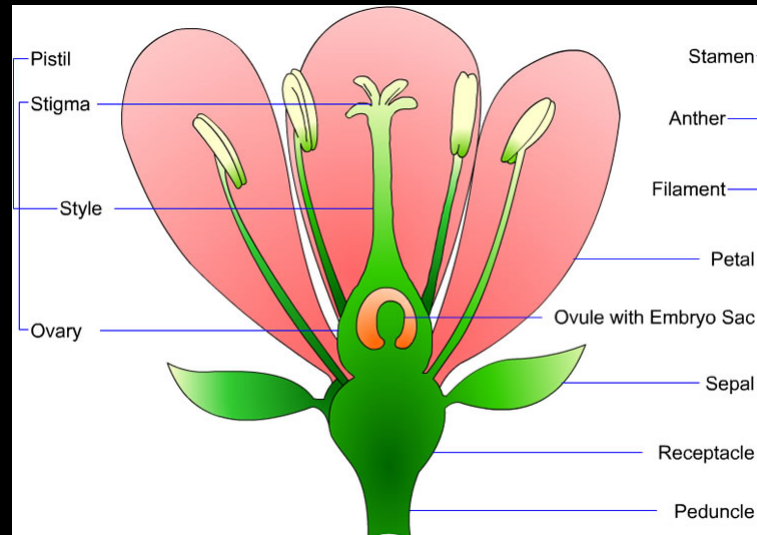
Maize
~30 cm in 30 hours
(~170 $\mu\text{m}/\text{min}$)



Tobacco ~4cm in
~24-30 hours
(~28 $\mu\text{m}/\text{min}$)



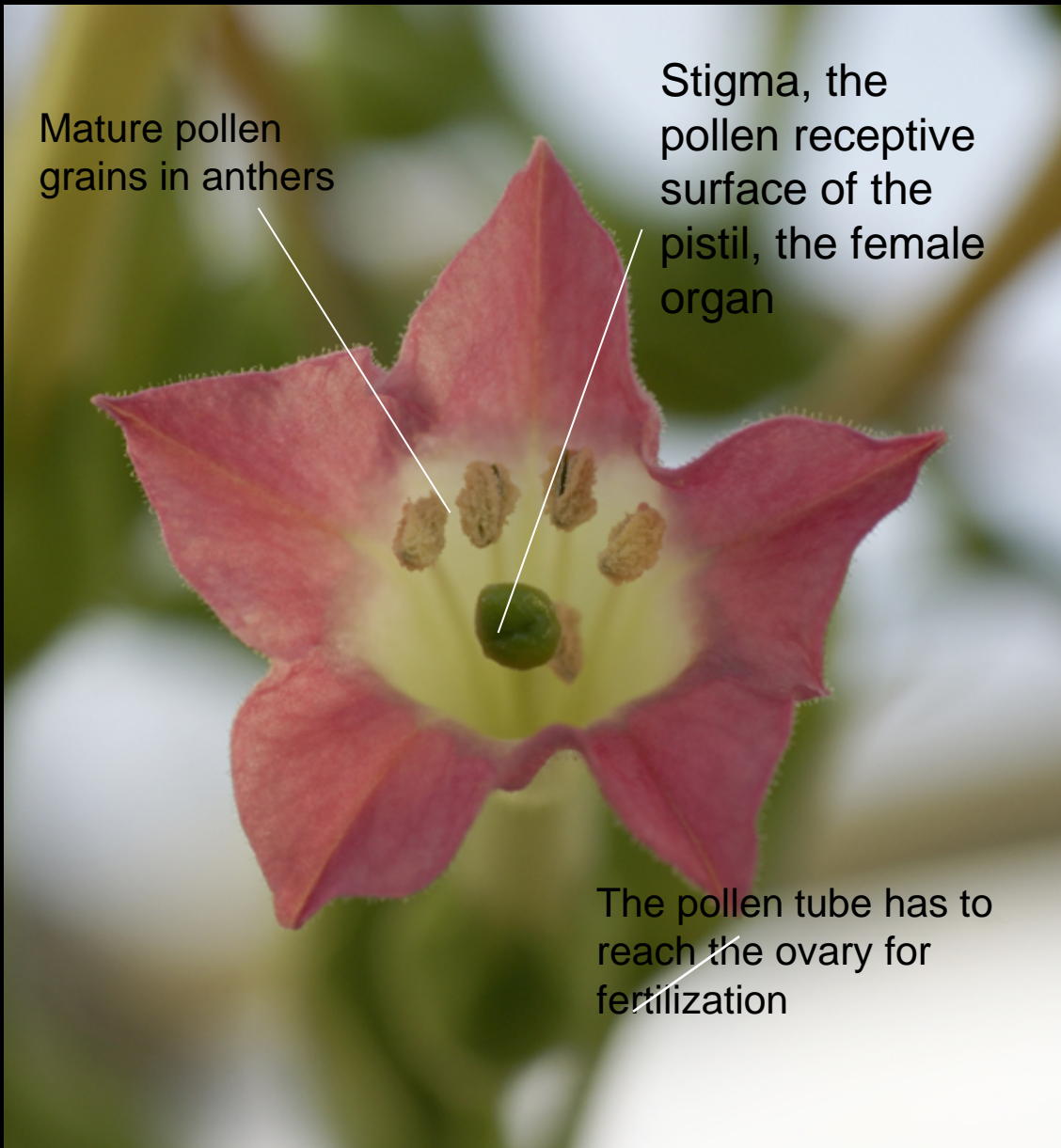
Arabidopsis
~8 mm in 8-12 hours
(~11 $\mu\text{m}/\text{min}$)

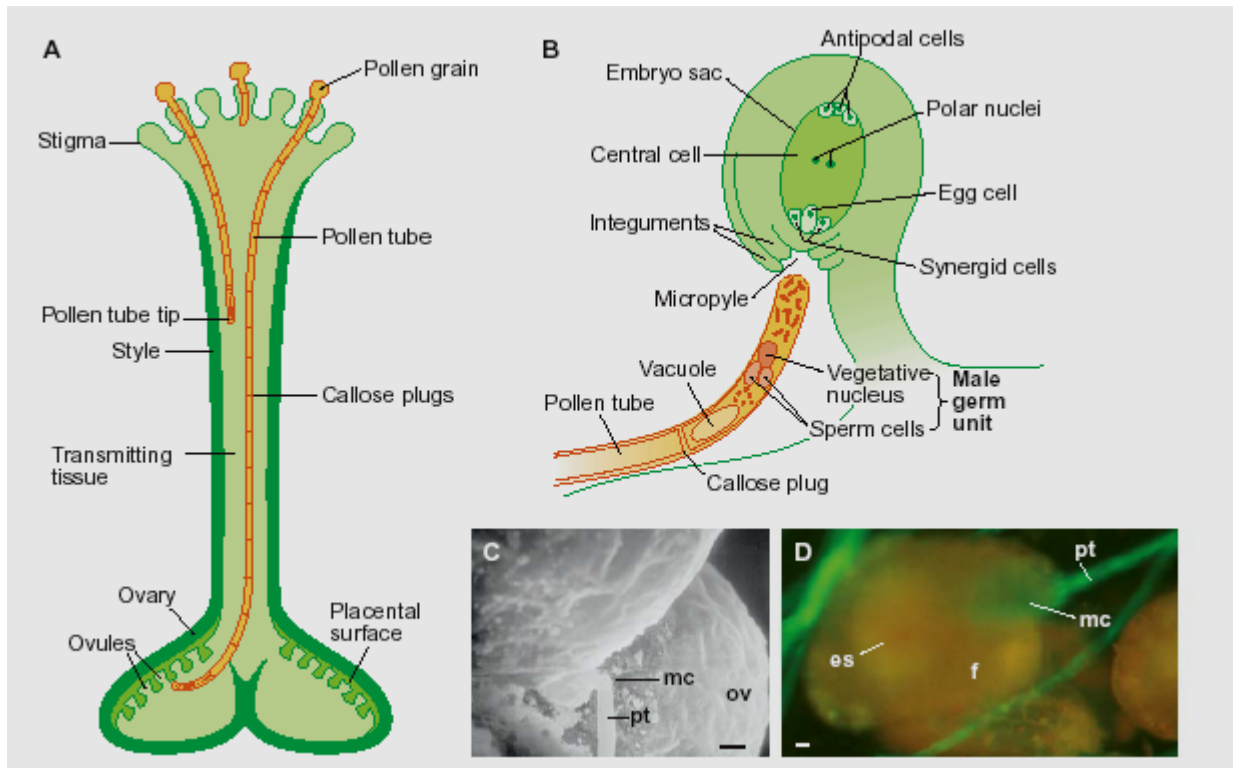


Mature pollen grains in anthers

Stigma, the pollen receptive surface of the pistil, the female organ

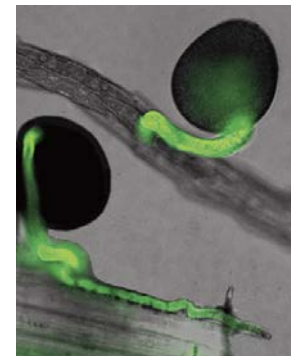
The pollen tube has to reach the ovary for fertilization





Cheung and Wu, Lures of the pistil (2001, Science)

Pollen grain expressing
“green fluorescent
protein (GFP)”



(Huang UCR)

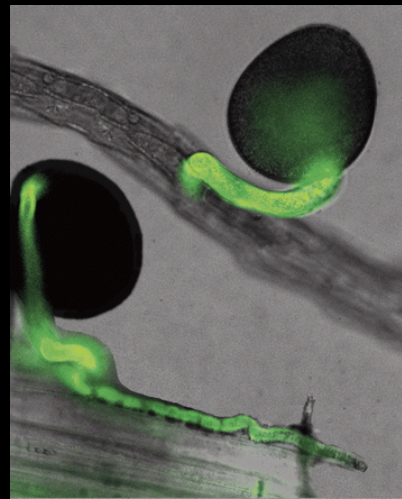
Pollen Tubes deliver sperm cells for fertilization



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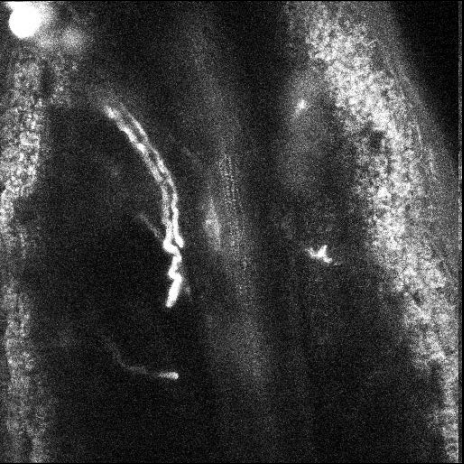
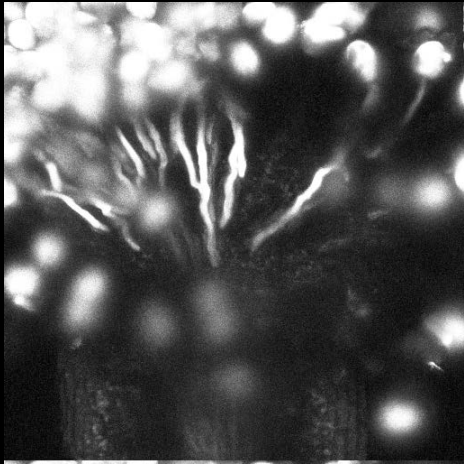
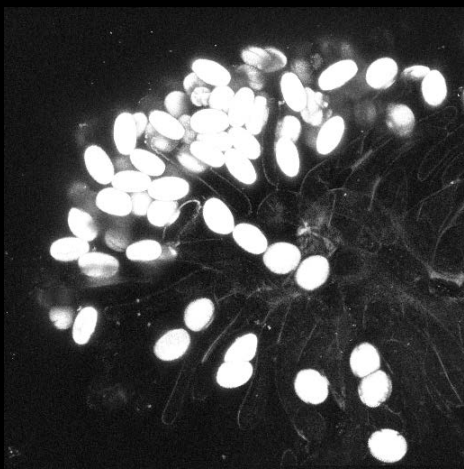
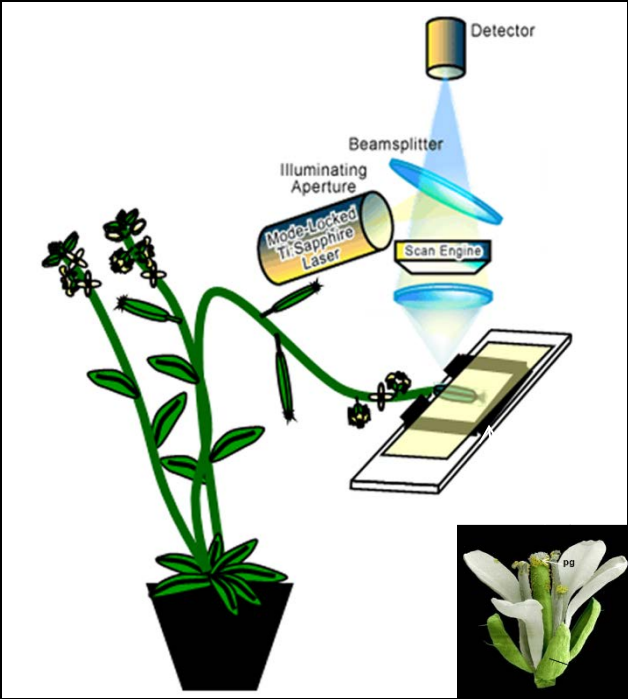
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Tobacco ~4cm in
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(~28 $\mu\text{m}/\text{min}$)

Show *in vivo* pollen germination movie

2-photon imaging of pollen tube growth in the pistil



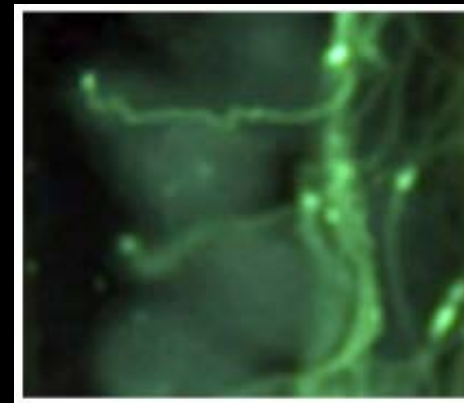
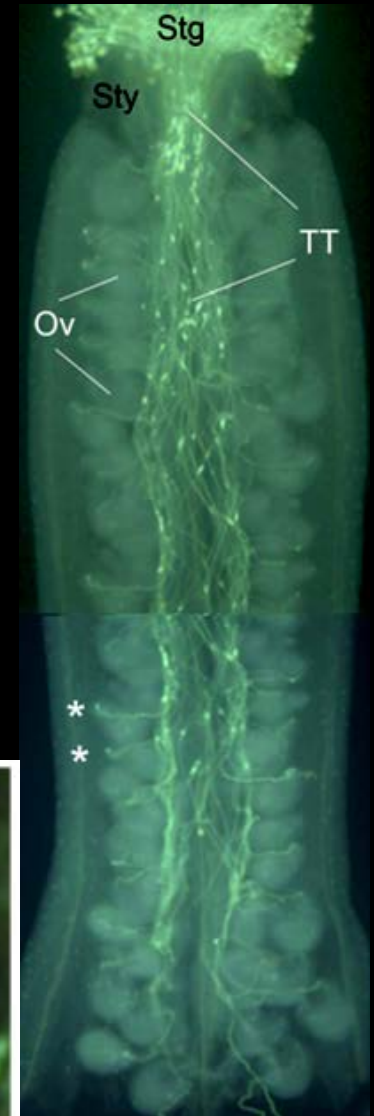
(Cheung et al. 2010
J. Exp. Bot)

Experiments we do or observe today:

1. Pollen tube growth in the pistil (Dr. Zou will prepare samples starting two days in advance, and prepare samples for observation the day before)

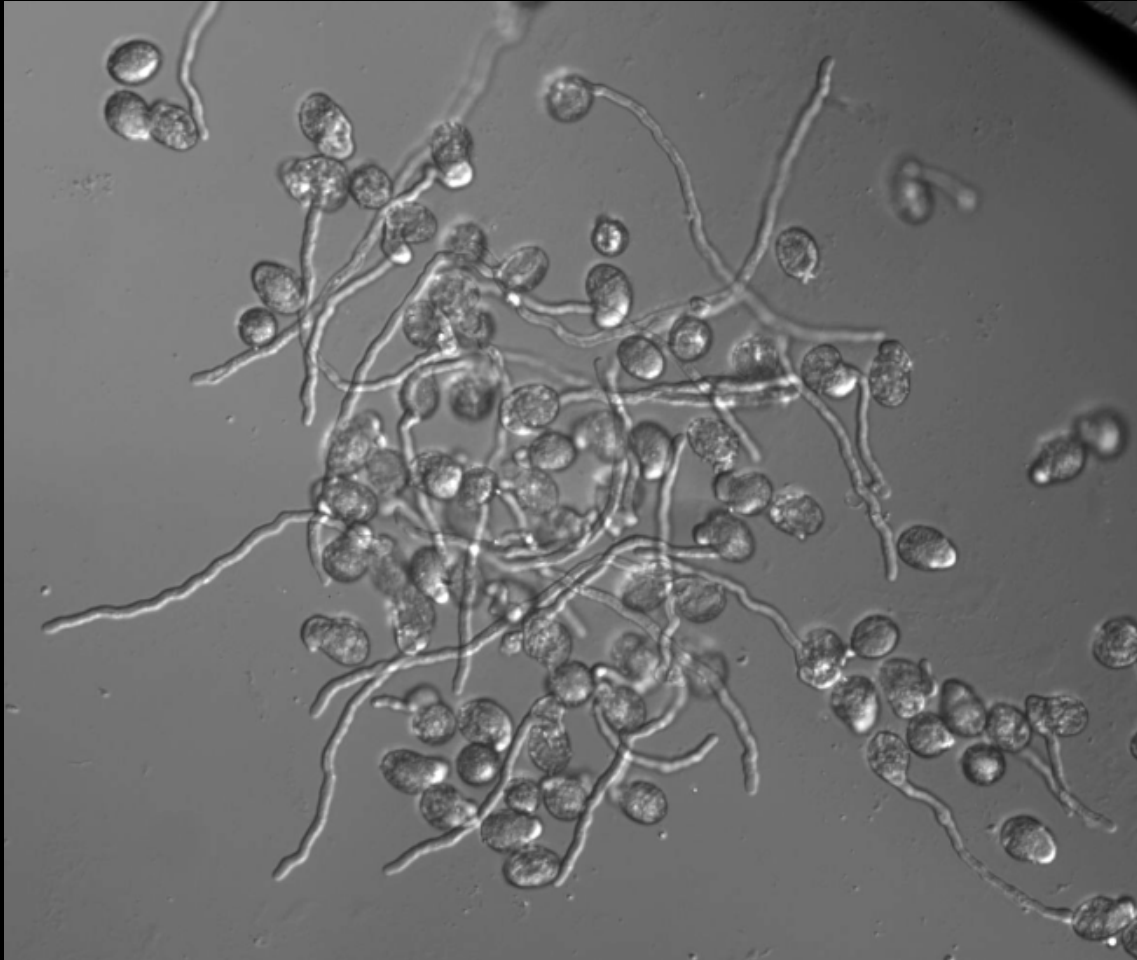


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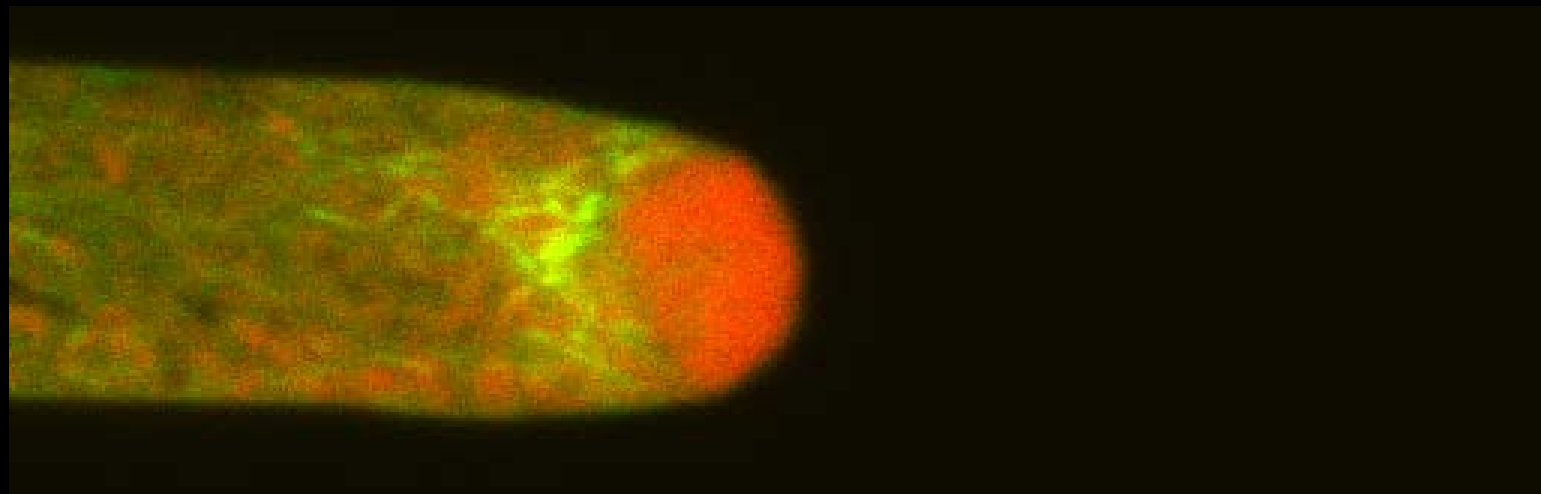
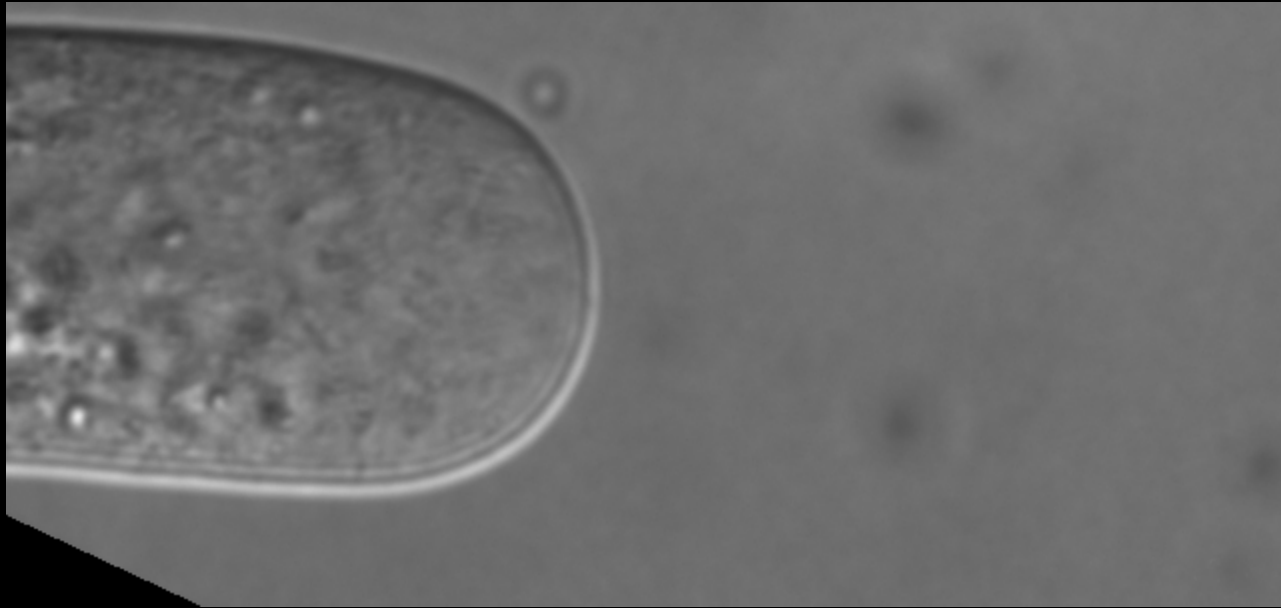


Experiments we do or observe today:

2. *In vitro* pollen germination (Dr. Zou will start samples before workshop, and during the first half of the workshop)

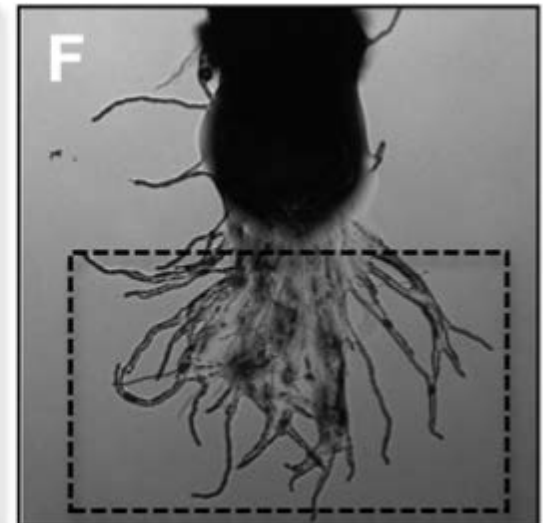
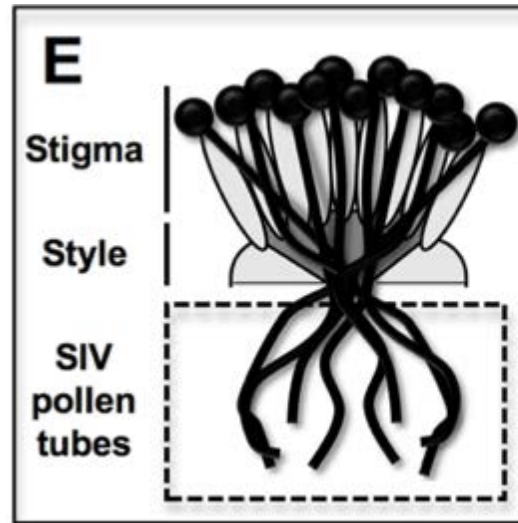


Show *in vitro* pollen tube growth movie



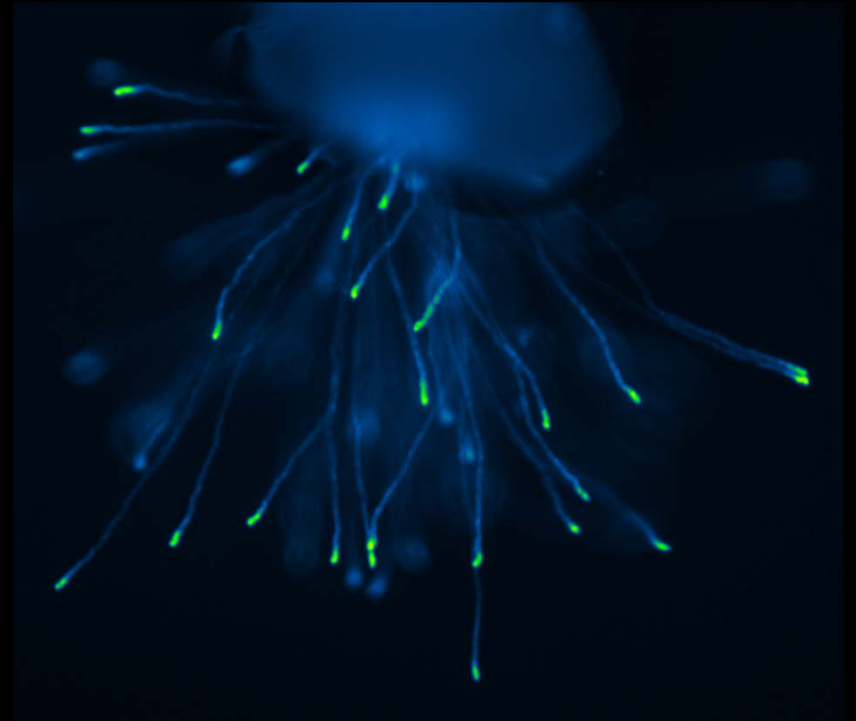
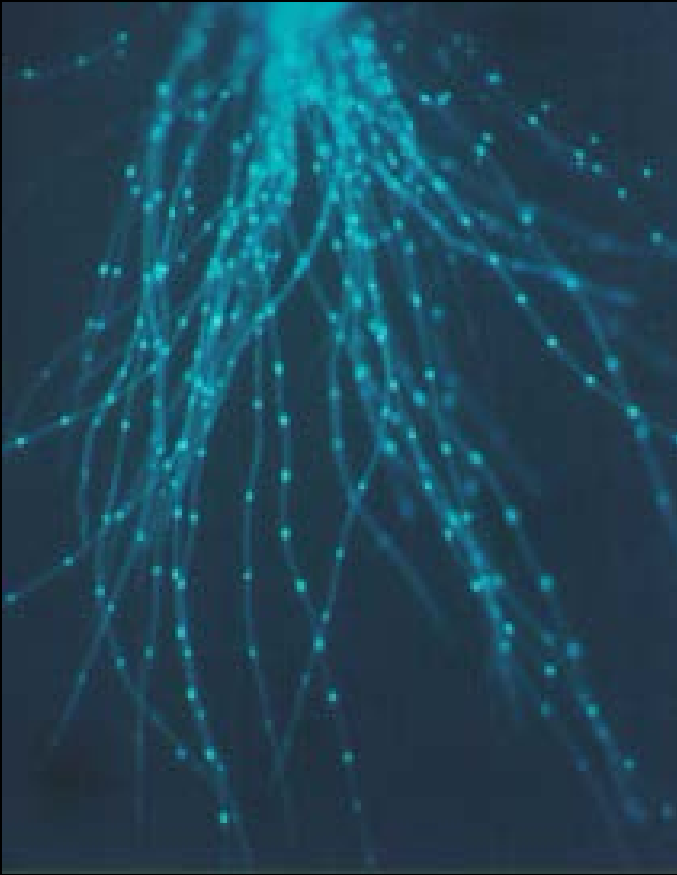
Experiments we do or observe today:

2. Semi-*In vivo* pollen germination (Dr. Zou will start samples before workshop, and during the first half of the workshop)



Experiments we do or observe today:

3. Semi-*In vivo* pollen germination (Dr. Zou will start samples before workshop, and during the first half of the workshop)



~ 9:30 am

In vitro germination of lily, tobacco, and *Arabidopsis* pollen

Dr. Zou will have slides with media, pollen resuspended for you
To put onto the slides.

Should finish in 15 or twenty minutes (i.e. so germination
can get started by 10 am)

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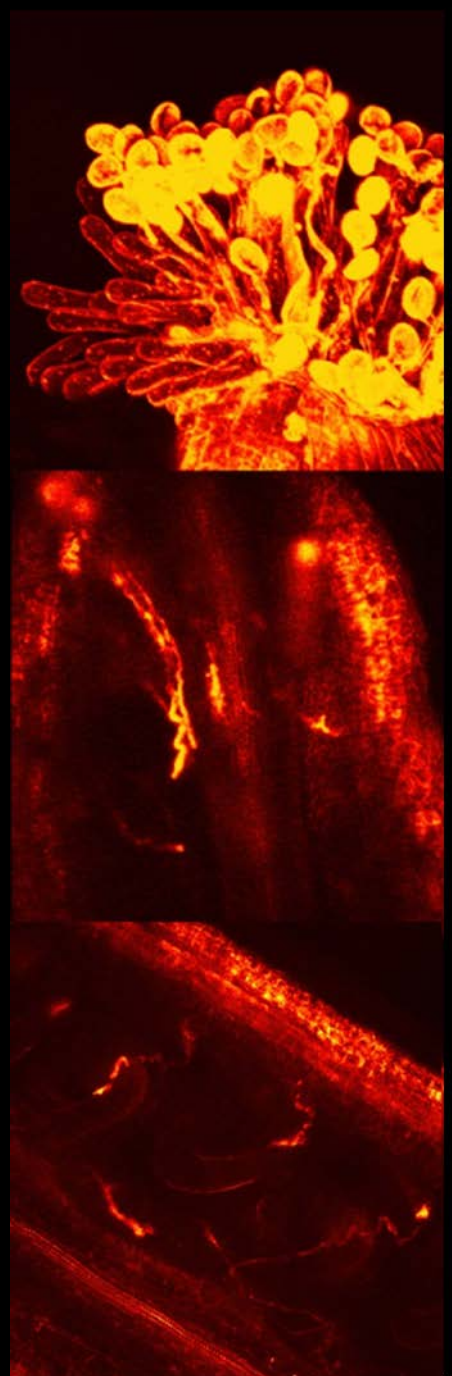


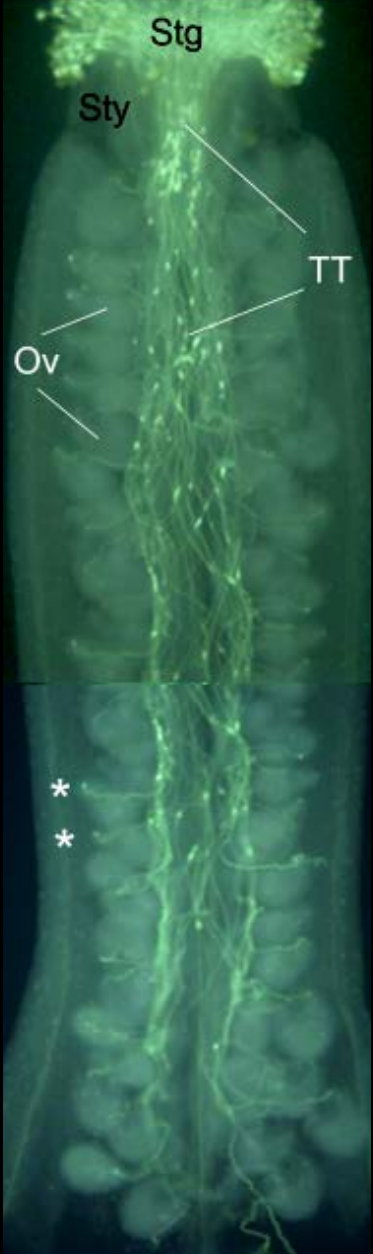
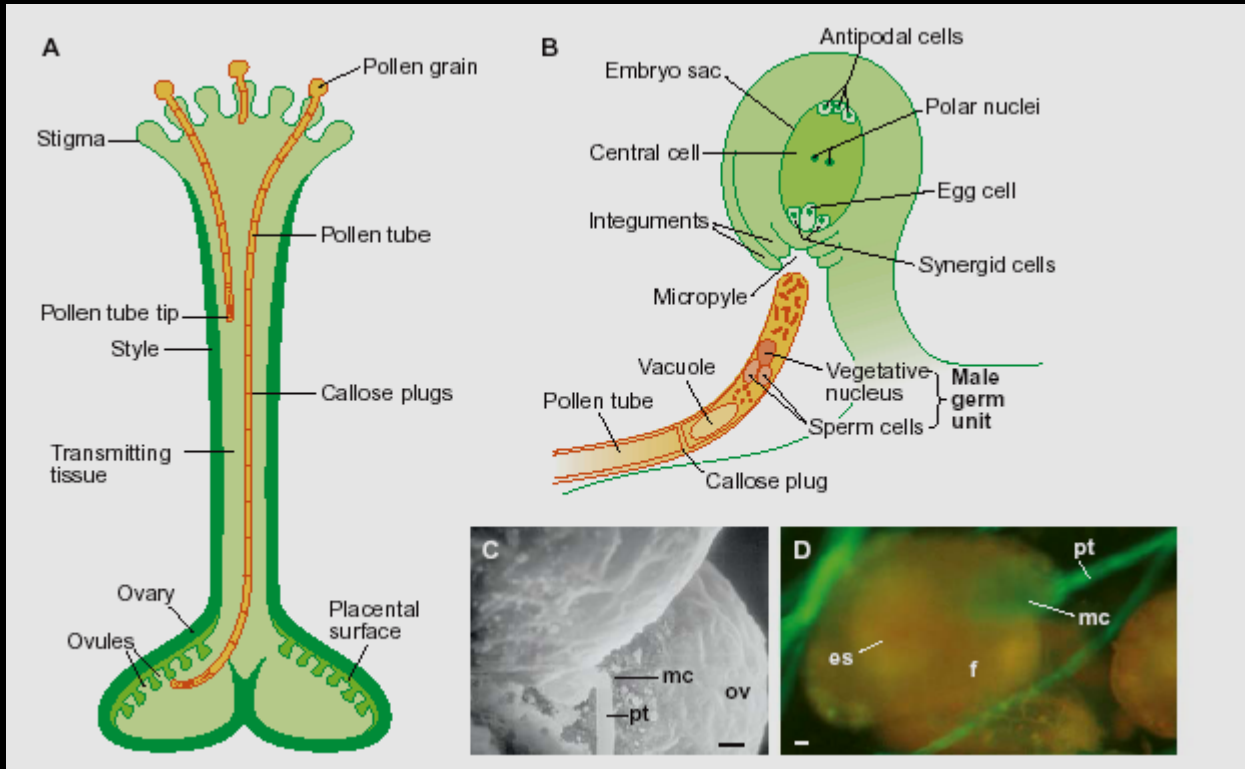
<http://pollennetwork.org/>

Summer internships for teachers available:

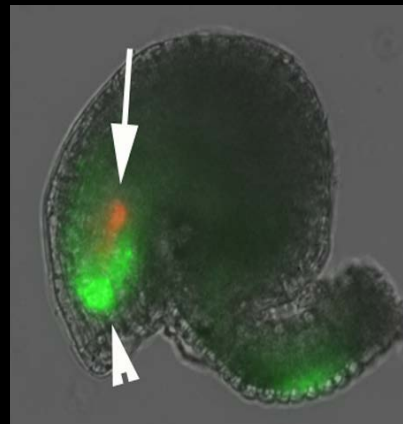
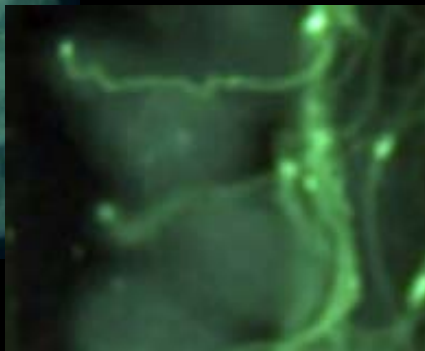
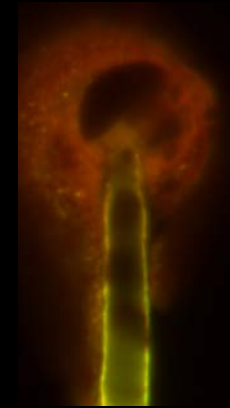
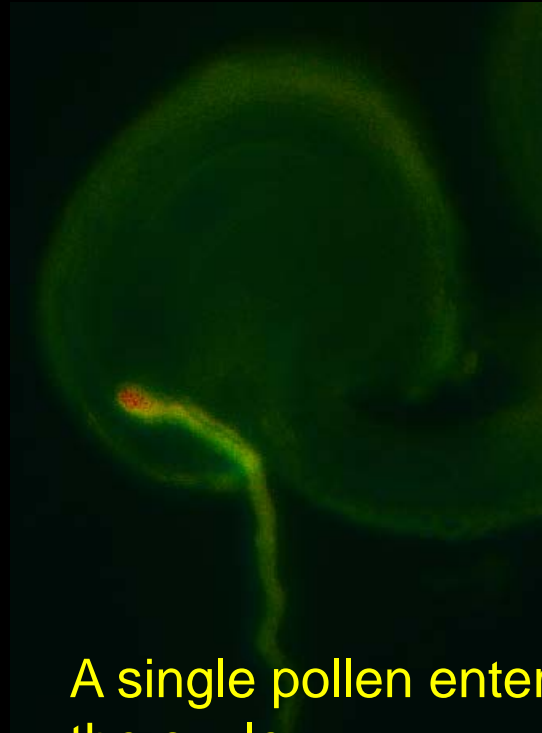
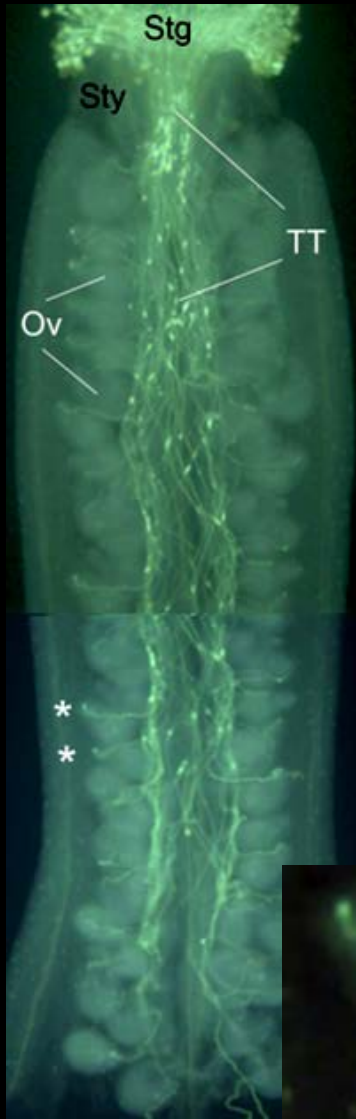
Supports for \$750 per 40 internship hours for
up to \$3000 per summer (e.g. 20 hrs week for
8 weeks)

Contact Alice Cheung

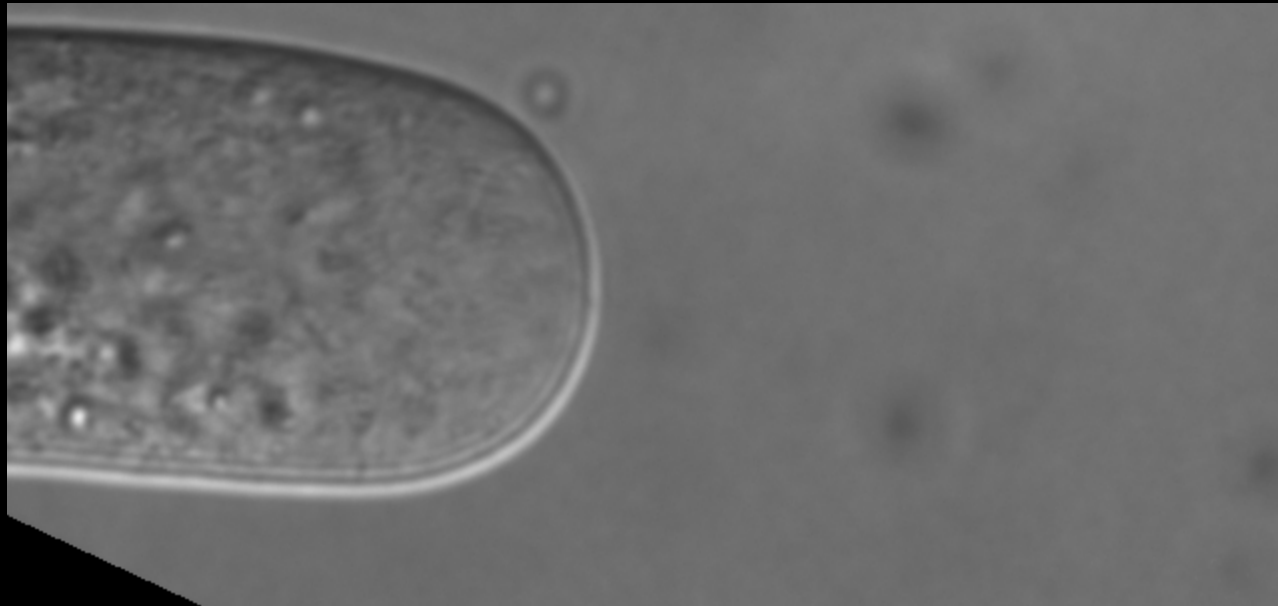




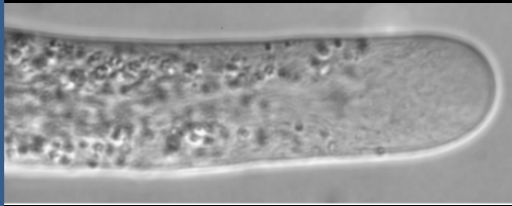
Pollen-Ovule Interaction



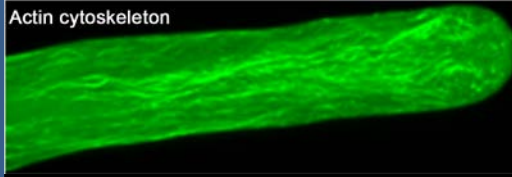
Show *in vitro* pollen tube growth movie



Pollen tube growth cell biology



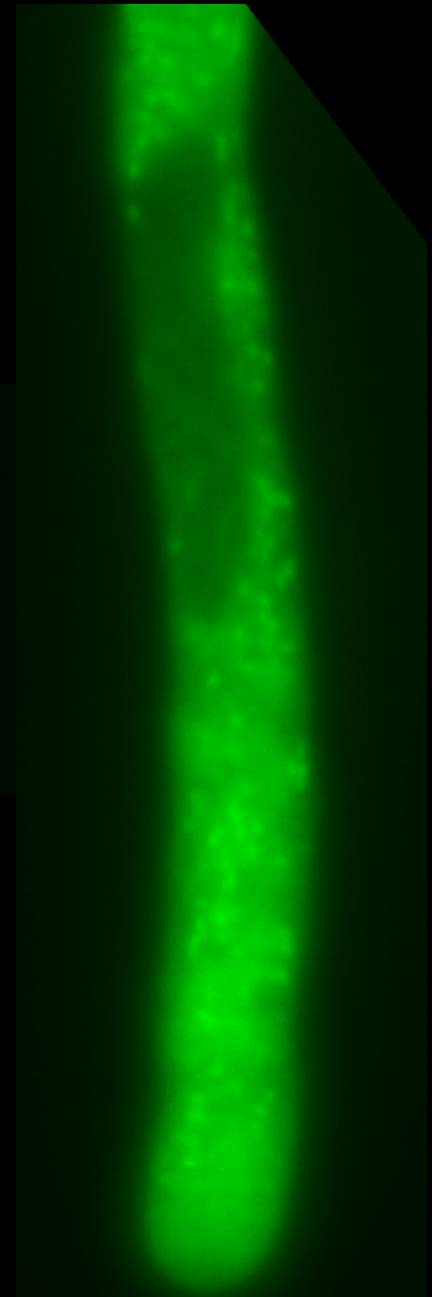
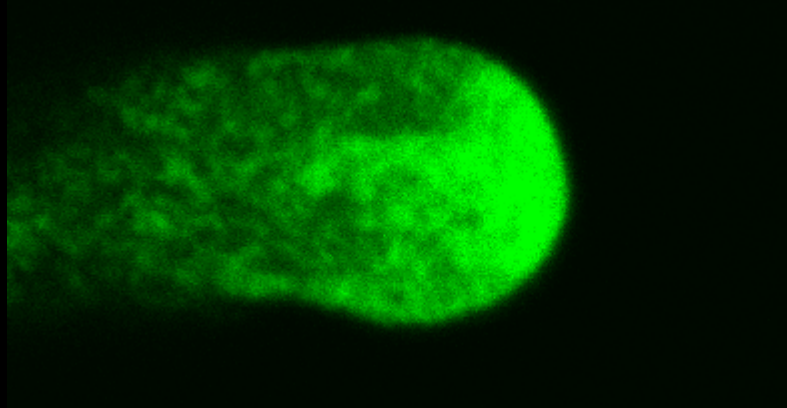
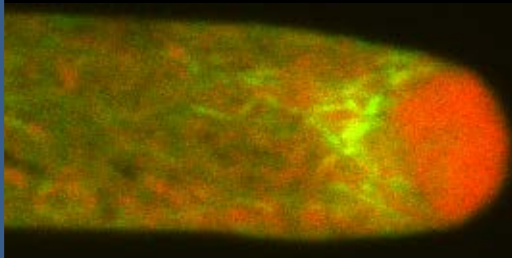
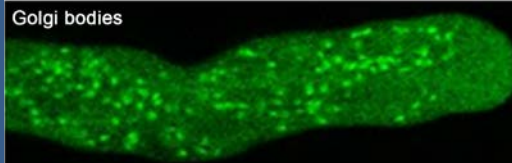
Actin cytoskeleton



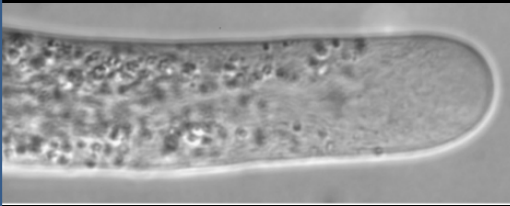
Vesicles



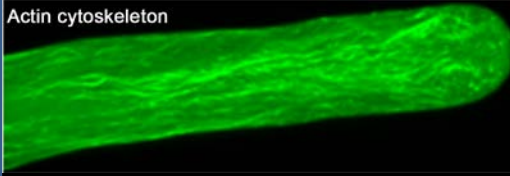
Golgi bodies



Pollen tube growth cell biology



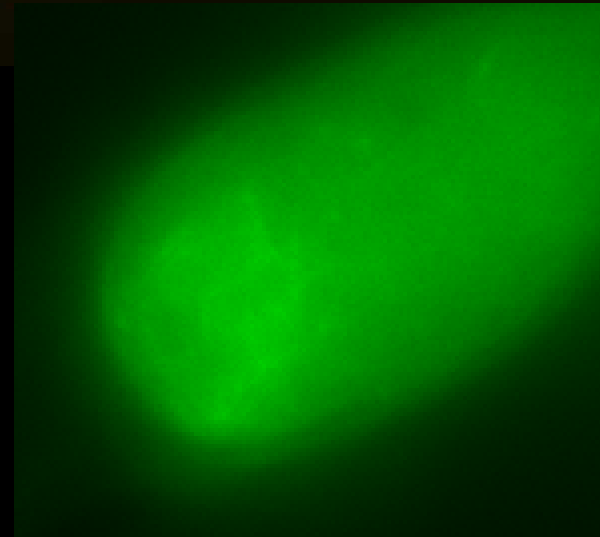
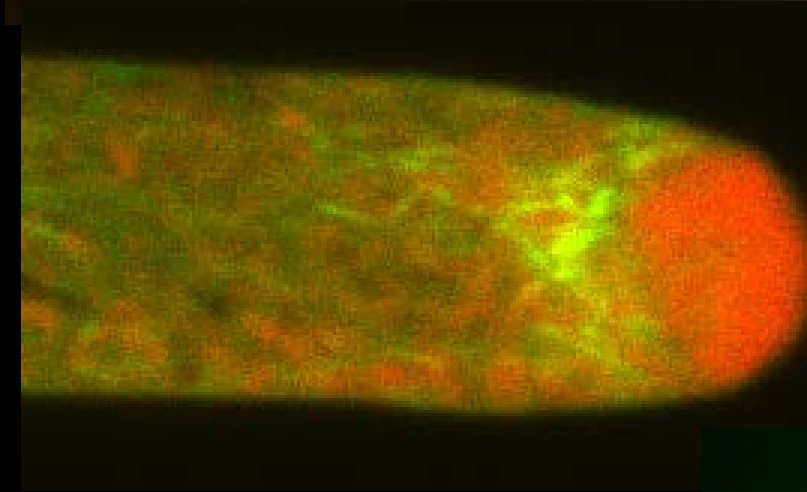
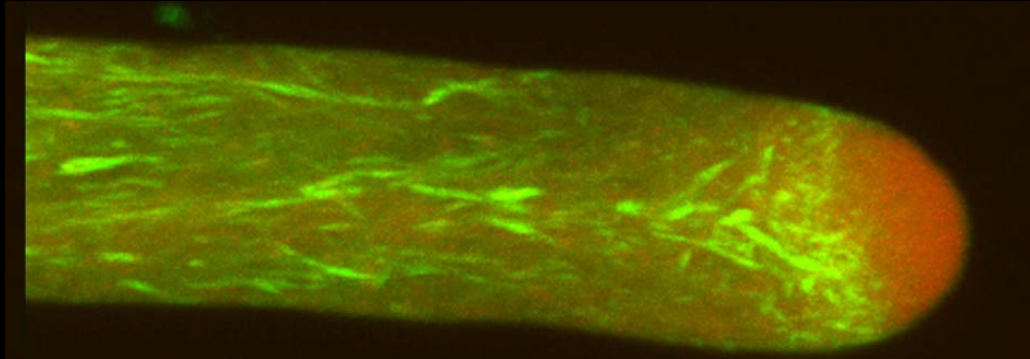
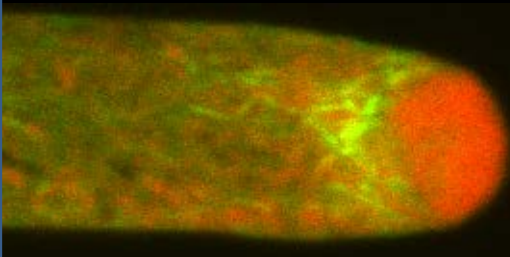
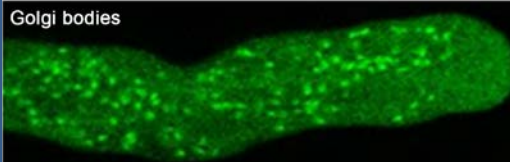
Actin cytoskeleton



Vesicles



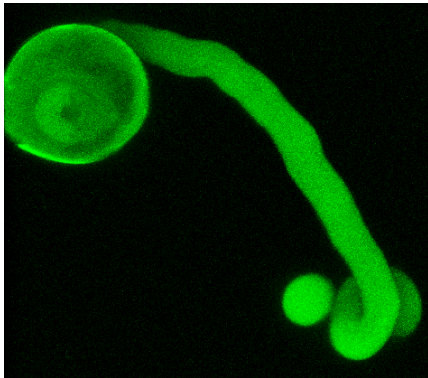
Golgi bodies



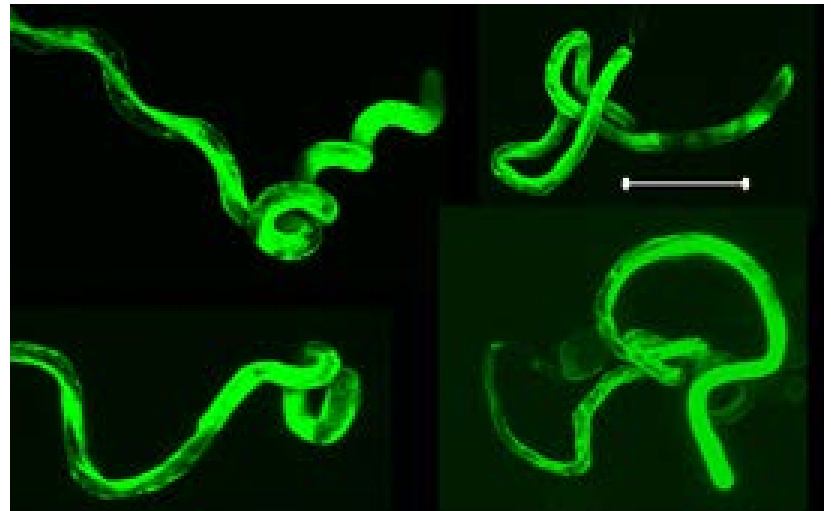
Subapical actin structure



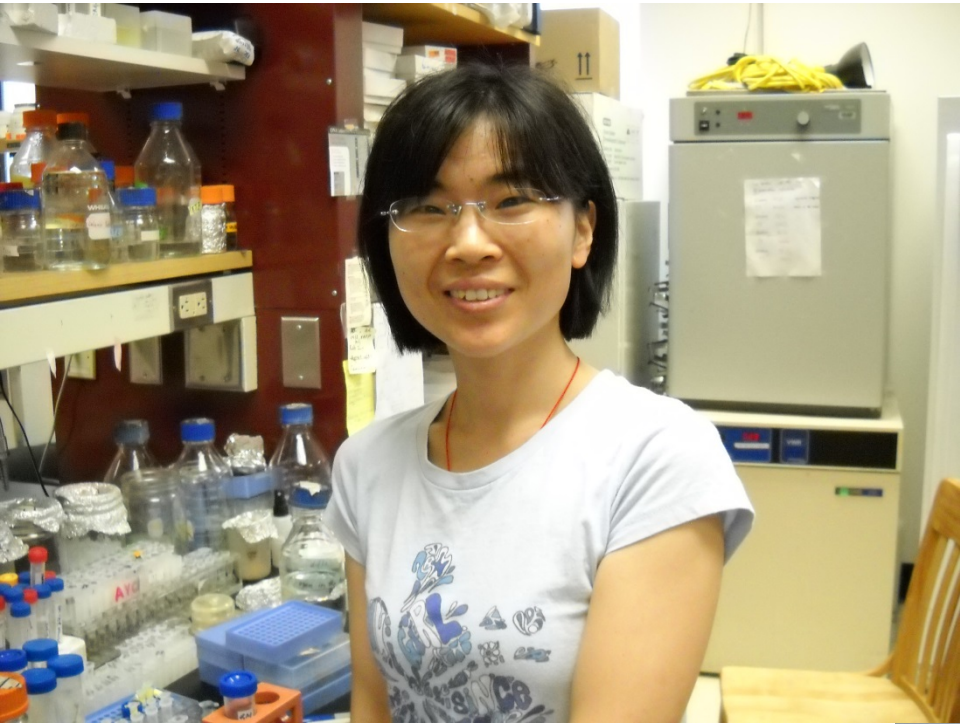
Disrupts apical vesicle recycling
(e.g. disrupt Rab11 GTPase)



Diminishes subapical actin structure, e.g. reduce apical actin polymerization



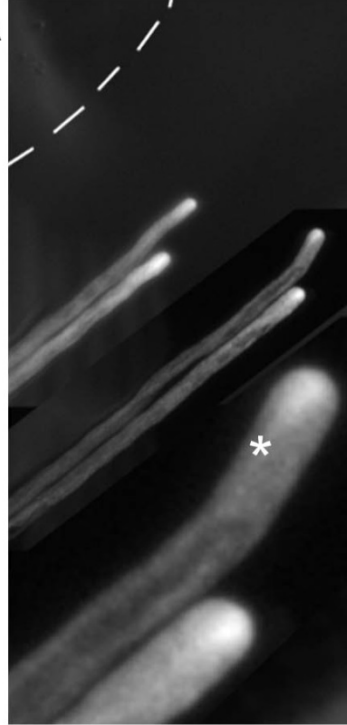
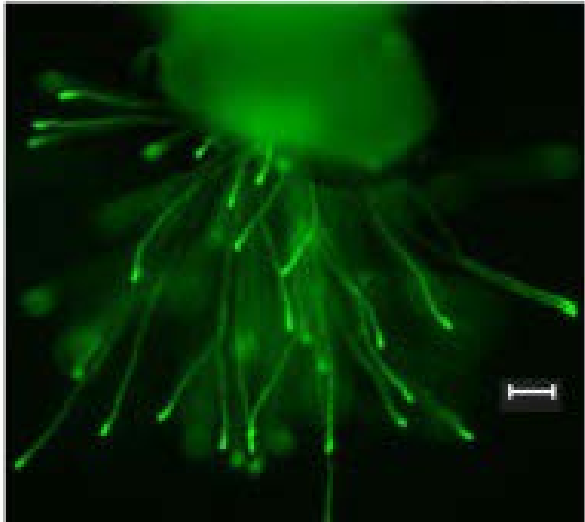
Ovules send LUREs to attract pollen tubes; pollen tubes grow and enter the female.

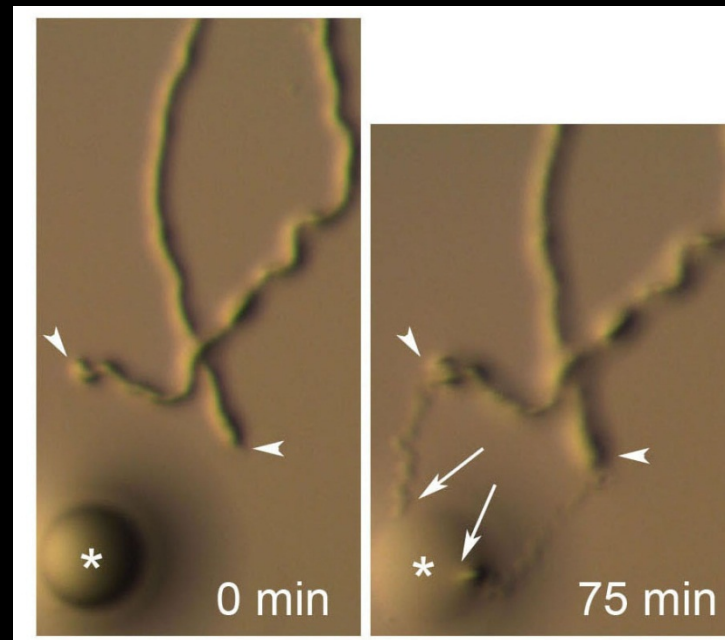
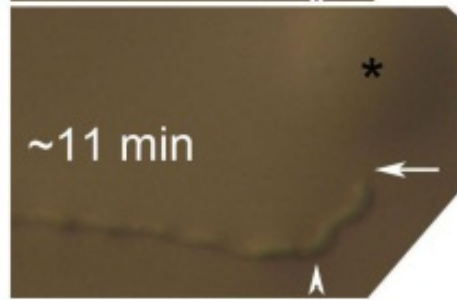
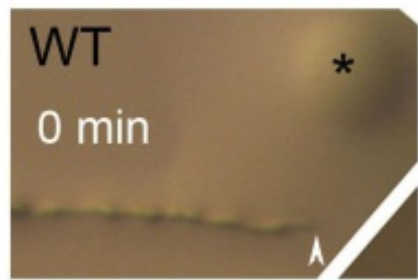
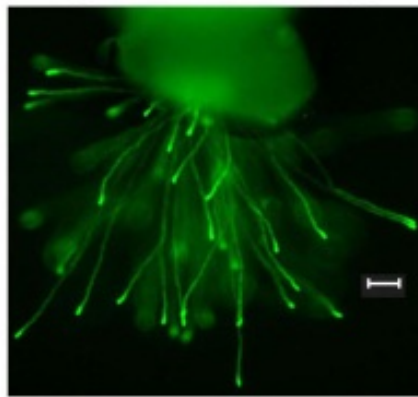
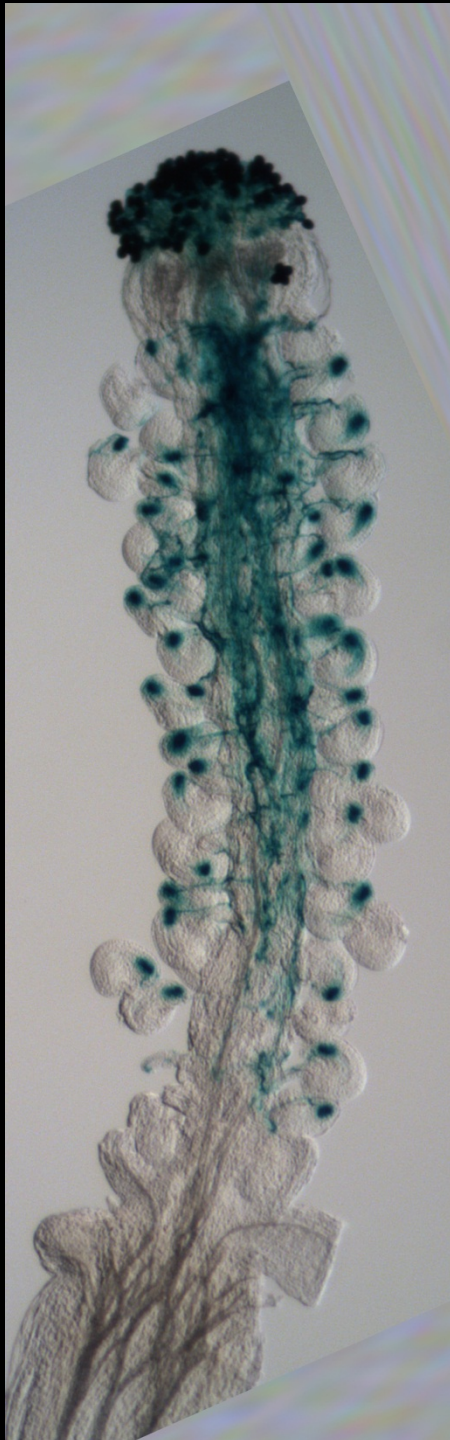


Yanjiao Zou



Pollen cytoplasm
inside an ovule

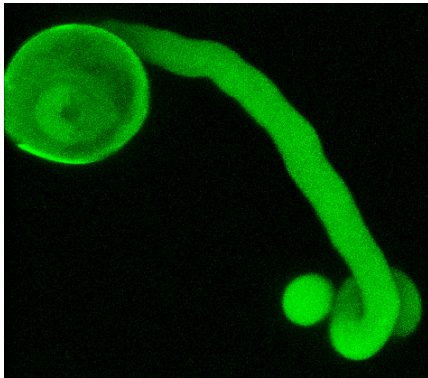




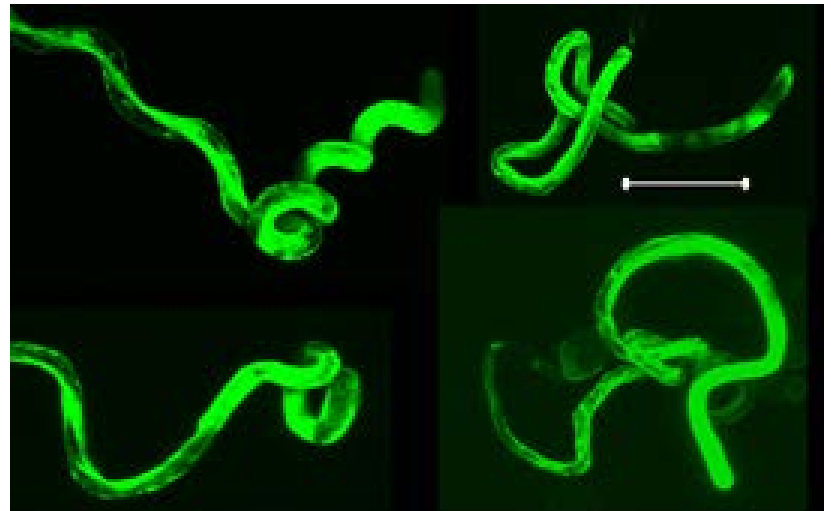
Subapical actin structure



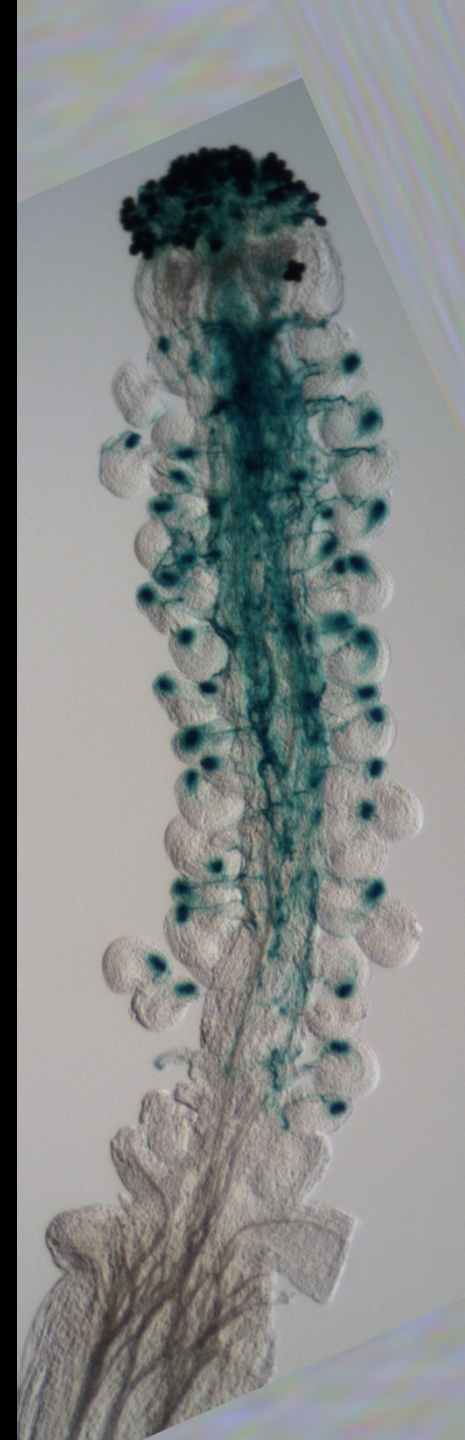
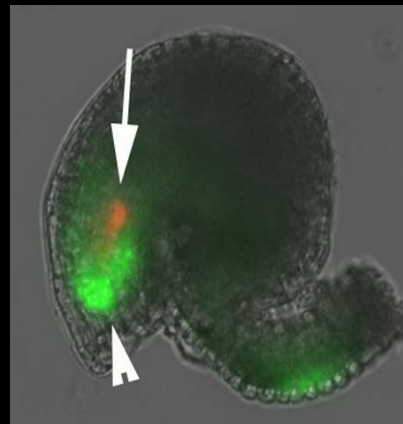
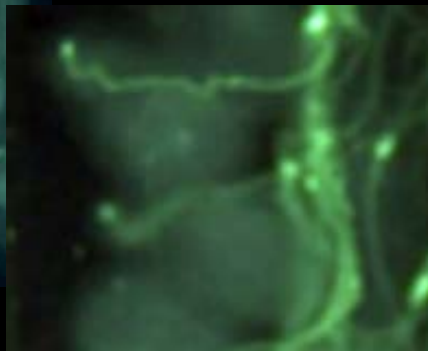
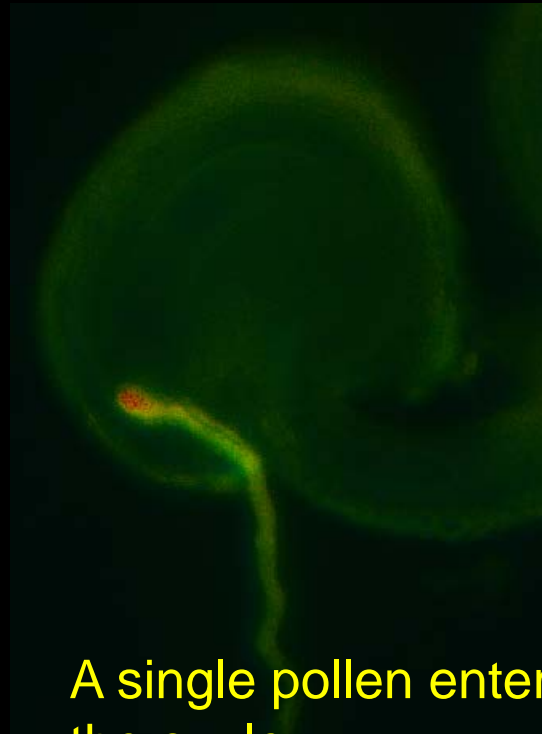
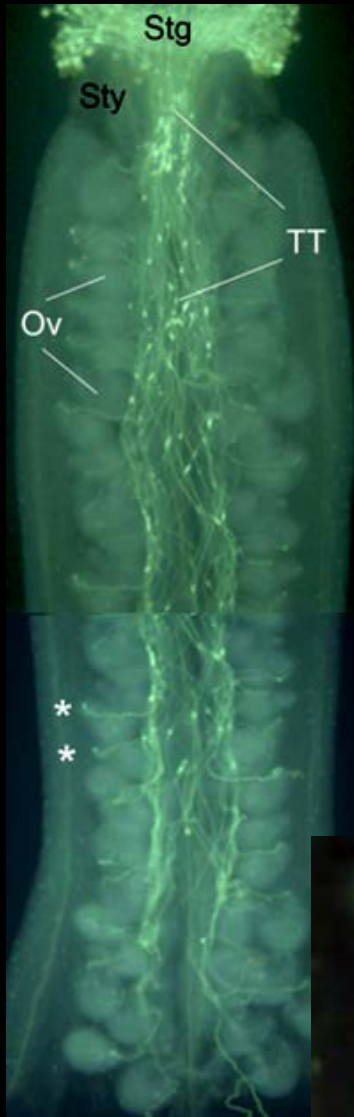
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(e.g. disrupt Rab11 GTPase)



Diminishes subapical actin structure, e.g. reduce apical actin polymerization



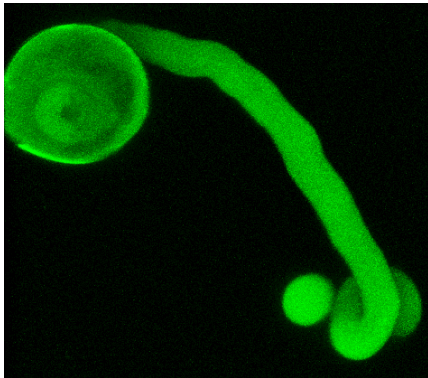
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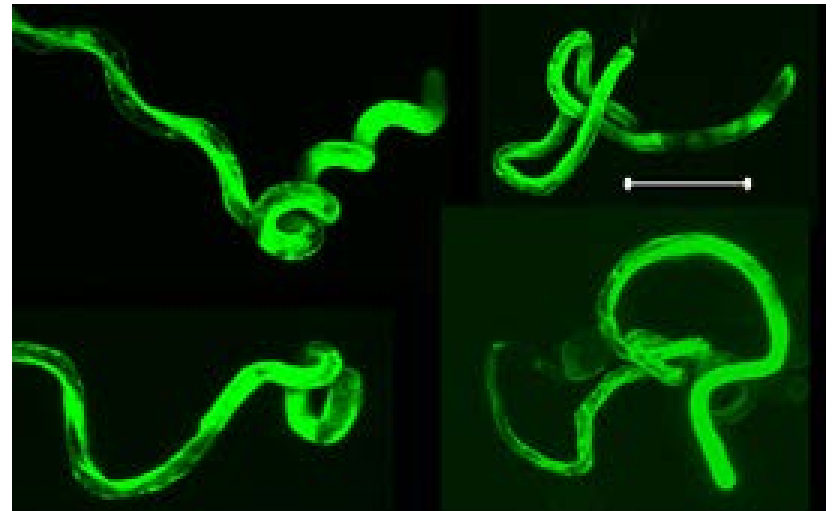
Subapical actin structure



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Female gametophyte (egg's home)



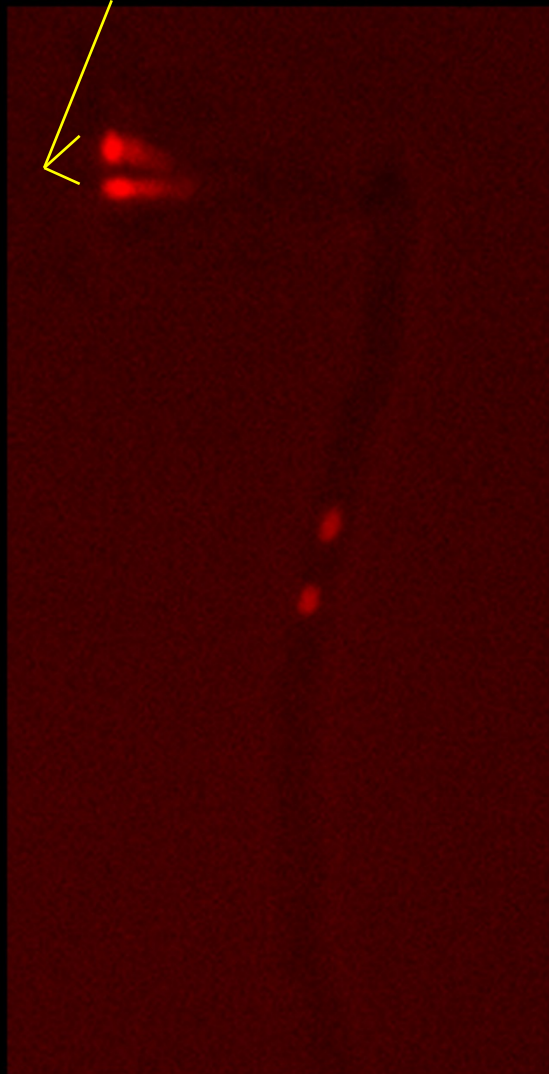
A pollen tube --
two sperm cells
piggy-back inside



The pollen tube explodes
once inside the female



and discharges the
sperm cells for
fertilization



Plant sperm don't swim;
they are delivered to the
female by the pollen tube

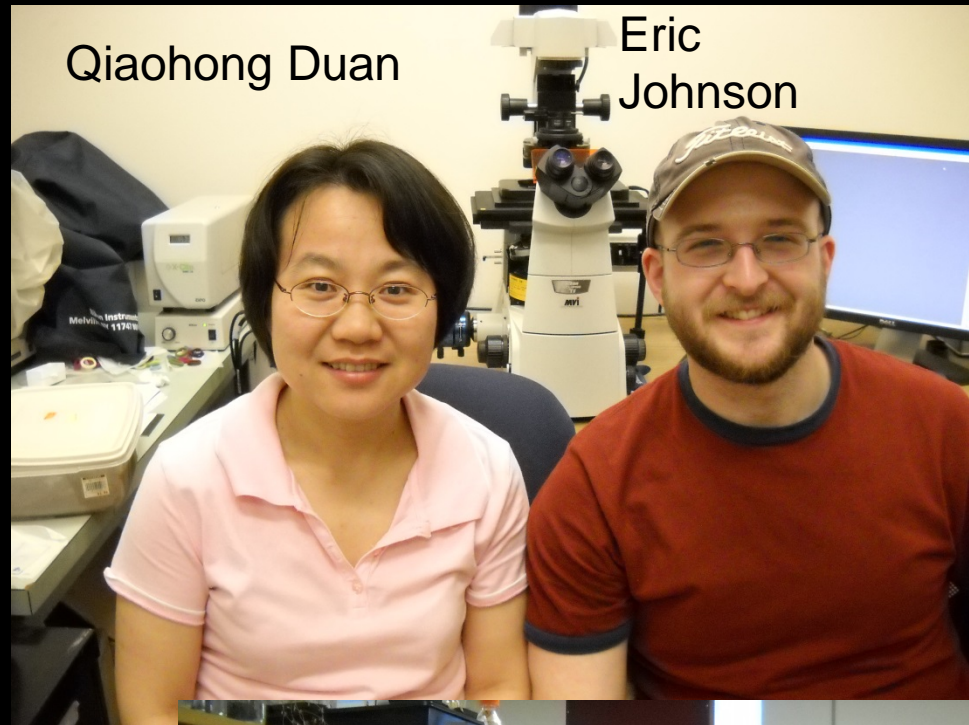
Female

Pollen tube —

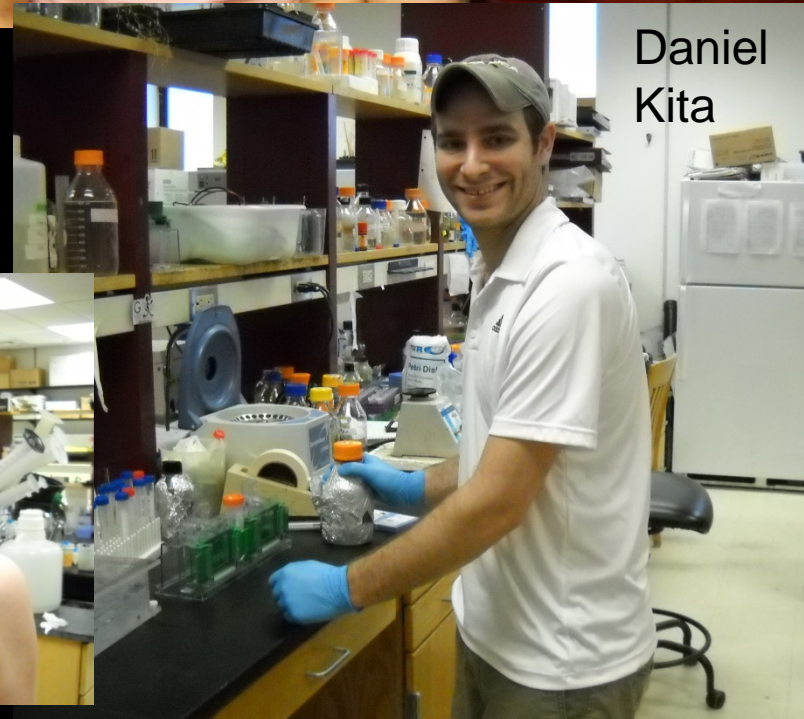
Laura Gates

Qiaohong Duan

Eric
Johnson

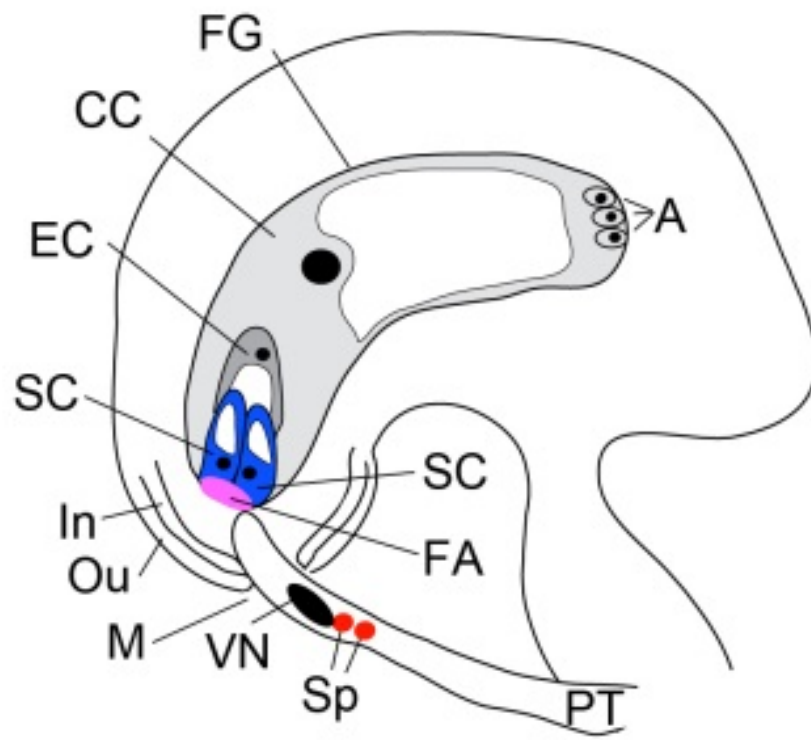
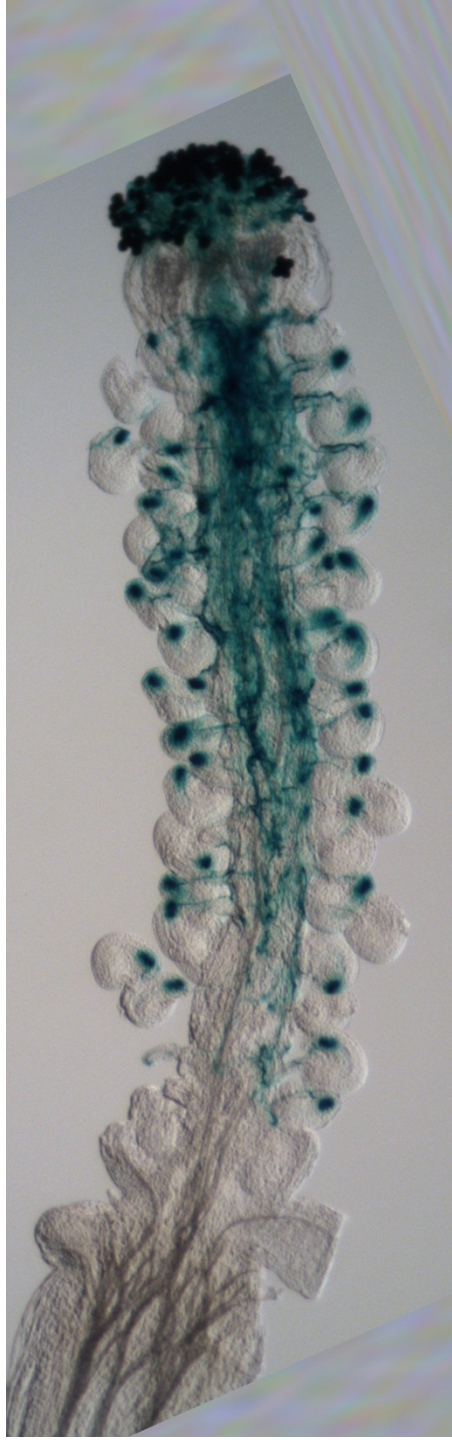


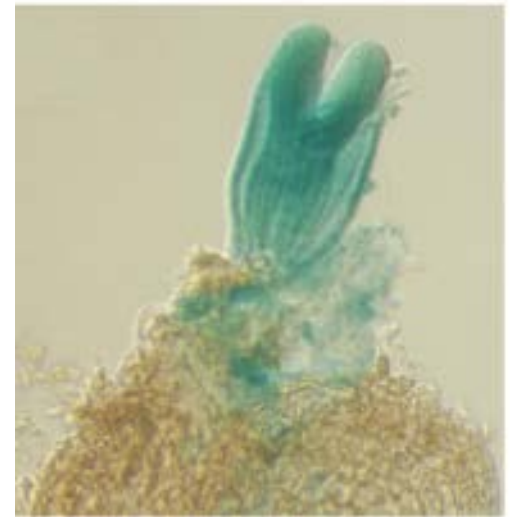
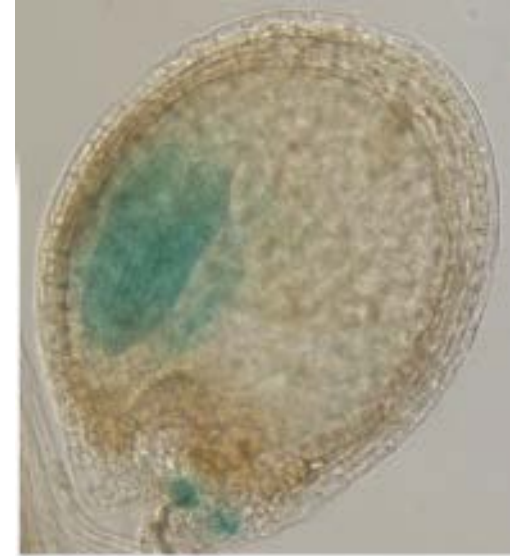
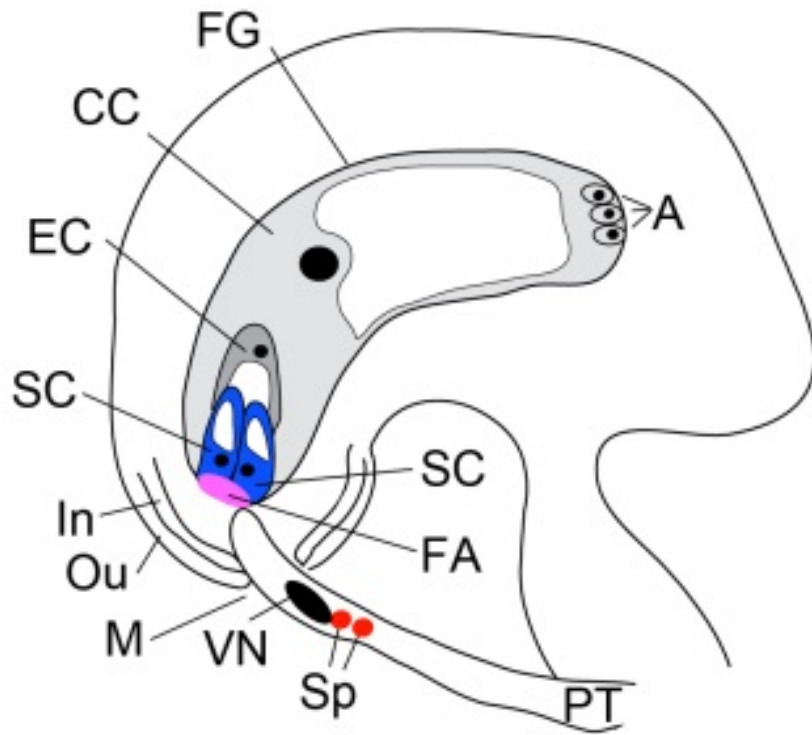
Daniel
Kita



Acq. Time: 0:00:57.904







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