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
         \textit{In vitro} pollen germination,
         \textit{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

10:45 am 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

Arabidopsis
~8 mm in 8-12 hours
(~11 µm/min)

Maize
~30 cm in 30 hours
(~170 µm/min)

Tobacco ~4 cm in
~24-30 hours
(~28 µm/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

Arabidopsis
~8 mm in 8-12 hours
(~11 µm/min)

Maize
~30 cm in 30 hours
(~170 µm/min)

Tobacco ~4 cm in
~24-30 hours
(~28 µm/min)

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)

Arabidopsis

~8 mm in 8-12 hours

(~11 µm/min)
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-\textit{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
A single pollen enters the ovule and ruptures once it penetrates the female gametophyte.

Targeting of ovules
Show *in vitro* pollen tube growth movie
Pollen tube growth cell biology
Pollen tube growth cell biology
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
Disrupts apical vesicle recycling (e.g. disrupt Rab11 GTPase)

Diminishes subapical actin structure, e.g. reduce apical actin polymerization
Pollen-Ovule Interaction

A single pollen enters the ovule

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

Subapical actin structure

Diminishes subapical actin structure, e.g. reduce apical actin polymerization
The pollen tube explodes once inside the female gametophyte (egg’s home).

A pollen tube -- two sperm cells piggy-back inside.
and discharges the sperm cells for fertilization
Plant sperm don’t swim; they are delivered to the female by the pollen tube.
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