



Investigative Workshop

Morphological Plant Models

Unleashing geometric and topologic potential within the plant sciences



Organizers: Alexander Bucksch and Dan Chitwood

Knoxville, TN, September 2-4, 2015

Day 1 - September 2, 2015

8:00 Breakfast

9:00 NIMBioS – Welcome Talk (Colleen Jonsson, NIMBioS, USA)

9:20 **Morphological Plant Models at the Interface - Workshop Introduction** (Alexander Bucksch, Georgia Tech, USA and Dan Chitwood, Danforth Center for Plant Science, USA)

9:45 Introduction of participants

10:00 **Modeling the root phenome**

Jonathan Lynch (<http://plantscience.psu.edu/research/labs/roots>)

Roots Lab, Penn State University, USA

10:30 Coffee break

10:45 **Multiscale topological and geometrical representation of plant architecture**

Christophe Pradal (<https://team.inria.fr/virtualplants/christophe-pradal/>)

Virtual Plant Lab, INRIA, France

11:15 Q&A with both speakers

11:40 General discussion: Which scales of plant morphology are covered by multi-scale approaches?

12:15 Lunch break

13:30 Chalk talk: **Modeling developmental processes with graph operations**

Alexander Fletcher (<http://www.maths.ox.ac.uk/people/alexander.fletcher>)

Mathematical Institute, University of Oxford, UK

13:50 Chalk talk: **Generation of cell shape in plants by the cell wall: separating magnitude and complexity**

Sioban Braybrook (<https://braybrookgroup.wordpress.com/>)

Sainsbury Laboratory, University of Cambridge, UK

14:10 Q&A with both speakers

14:30 Coffee break

14:45 Intro to problem of the day and brainstorming techniques

15:00 Brainstorming session for problem finding and limitations

15:40 Collection and weighting of the results

16:30 Reception

18:30 Social event (Bistro at the Bijou - <http://www.thebistroatthebijou.com>)

Day 2 - September 3, 2015

8:00 Breakfast

9:30 Introduction talk of the day

9:45 **Title: Geometric and Topological Methods in Plant Morphology**

Washington Mio (<http://www.math.fsu.edu/~mio/>)
Department of Mathematics Florida State University, USA

10:15 Coffee break

10:30 **MetaPhenomics: deriving general dose response curves of plant form and function**

Hendrik Porter (http://www.fz-juelich.de/ibg/ibg-2/DE/Mitarbeiter/_jppc/Poorter_Hendrik/Poorter.html)
IBG-2, Forschungs Zentrum Jülich, Germany

11:00 Q&A with both speakers

11:30 General discussion: Do geometric features of plant morphology matter?

11:55 Group Photo

12:15 Lunch break

13:30 Chalk talk: **Determination of overnight birch branch movement with single wavelength and hyperspectral terrestrial laser scanning data**

Eetu Puttonen (<http://www.fgi.fi/fgi/contact/person/eetu-puttonen>)
Department of Remote Sensing and Photogrammetry, Finnish Geospatial Research Institute, Finland

13:50 Chalk talk: **Stress compensation in tree form, structure and hydraulic function**

Achebat Atta-Boateng (<https://acheboate.wordpress.com/>)
Yale School of Forestry & Environmental Studies, Yale University, USA

14:10 Q&A with both speakers

14:30 Coffee break

14:45 Intro to problem of the day

15:00 Brainstorming session for problem finding and limitations

15:40 Collection and weighting of the results

16:30 End

18:30 Social event (Preservation Pub - <http://scruffycity.com/preservation-pub/>)

Day 3 - September 4, 2015

8:00 Breakfast

9:30 Introduction talk of the day

9:45 **Adding time to the genetic architecture of a dynamic root trait with automated image analysis**

Edgar Spalding (<http://www.botany.wisc.edu/spalding.htm>)

Department of Botany, University of Wisconsin/Madison, USA

10:15 Coffee break

10:30 **Reconfiguration of broad leaves to reduce drag and flutter**

Laura Miller (<http://miller.web.unc.edu/>)

Departments of Biology and Mathematics, University of North Carolina/Chapel Hill, USA

11:00 Q&A with both speakers

11:30 General discussion: Do we need specialized methods to handle morphology transforming processes?

12:15 Lunch break

13:30 Chalk talk: **The forgotten dimension: 3D imaging approaches to investigate the genetic basis and developmental trajectory of leaf thickness patterning**

Viktoriya Coneva (<http://www.chitwoodlab.org/#!lab-members/c1mpo>)

Danforth Center for Plant Science, USA

13:50 Chalk talk: **Terrestrial LiDAR: a diagnostic tool to determine the physiological state of plants?**

Mathilde Balduzzi (<http://mathilde-balduzzi.com/?lang=en>)

Department of Computer Science, University of Montpellier, France

14:10 Q&A with both speakers

14:30 Coffee break

14:45 Workshop Conclusions - Moving Forward in Morphological Plant Models

15:30 End of Workshop

Additional Information:

- The workshop has a accompanied Frontiers Research Topic. The call for papers can be found under <http://journal.frontiersin.org/researchtopic/4300/plant-morphological-modeling-unleashing-geometric-and-topologic-potential-within-the-plant-sciences> .
The abstract is due to October 16, 2015. The final manuscript is expected on March 18, 2016.
- All talks are broadcasted as a live stream on the internet. The link to the live stream can be found on September 2nd 2015 at 9:00 am under <http://www.nimbios.org/videos/livestream>
- We use the hashtag [#PlantMath2015](#)
- Places for the social events are vegetarian and vegan friendly. Additional restaurants with vegan and vegetarian food in walking distance from the event are The Sunspot (<http://www.sunspotrestaurant.com>) and Tomato Head (<http://thetomatohead.com>)
- Knoxville offers lots of live music and amazing outdoors all around. Contact Jennifer Spar (jspar@nimbios.org) for information.