Module PLM1 - Plant signalling networks in growth and development

Organiser: Prof. Alex Webb

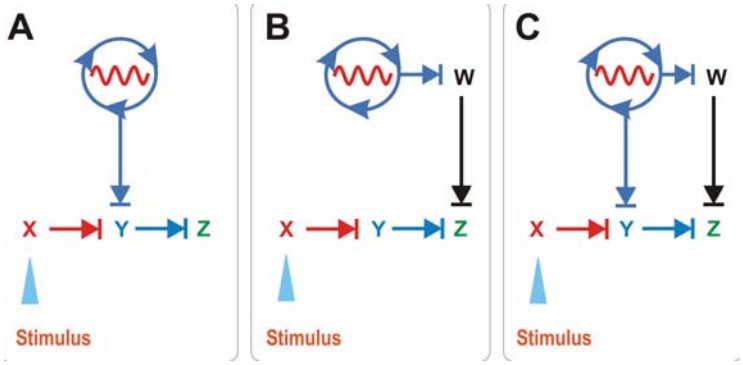
Contact details: aarw2@cam.ac.uk

Teaching Staff: *Julia Davies, Ottoline Leyser, Alexander Jones and Alex Webb.*

Plant survival depends on their extraordinary ability to respond to multiple environmental signals with the appropriate responses. Changes in physiology, gene expression, growth and development allow the plant to tolerate and exploit severe changes in the environment. Sensing and responding to environmental and hormonal signals is a result of sophisticated inter- and intra-cellular signalling networks. In this lecture course you will learn about the components of signalling systems involved in physiological and developmental responses to the environment and how these components are organised into elegant networks.

- The lecture material will introduce you to the elements that make up signalling networks and also place these elements in context.
- You will learn about different ways in which we can consider signalling networks at different scales from ion transport to whole organism.
- We will consider the signalling networks that generate calcium signatures, how they are formulated and decoded. We will also describe the properties of the signalling networks involved in ABA-induced stomatal closure, regulation of development by auxin and growth by gibberellin signalling. Lastly we will discover how plants measure time.
- We will describe how mathematical modelling is complementary to experimentation, providing insight and new approaches.

The course is made up of lectures, supervisions and a workshop. The workshop will comprise analysis of data from a calcium signalling experiment.



Module PLM2 - Microbes: Evolution, genomes and lifestyle

Organiser: Prof Alison Smith

Contact details: as25@cam.ac.uk

Teaching Staff: *Alison Smith, Uta Paszkowski, John Carr, Howard Griffiths, and Sebastian Schornack.*

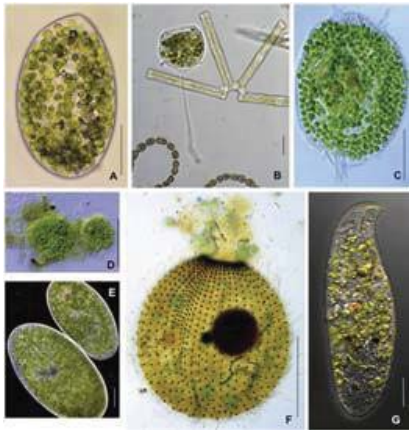
This course explores microorganisms with relevance to understanding plant biology including the major groups of microbes, the environmental and evolutionary transition of microbes to endosymbiotic organelles, as well as beneficial and detrimental interactions between plants and microbes.

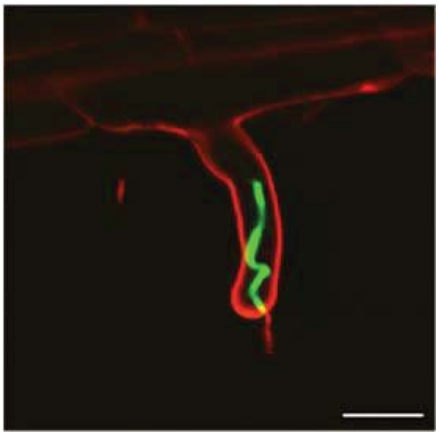
- The module starts by considering how the endosymbiosis of a cyanobacterium led to the evolution of chloroplasts, and then how secondary and tertiary endosymbiosis gave rise to the diversity of the algal kingdom, as well as interactions with other organisms

- This leads on to the role of photosynthetic organisms in the global carbon balance, and how environmental drivers such as changes in atmospheric CO_2 and O_2 have affected the evolution of today's plants and algae

- The remainder considers the evolution, genomes and lifestyles of viruses, fungi (saprophytic, mutualistic, and pathogenic), and of several major protista, including the Oomycetes. Many of these organisms have considerable influence on plant productivity.

As part of the module, two essay-writing workshops are included, incorporating approaches to search and assimilate information in the literature, and – using peer review – how to identify key features of a good essay.





Module PLM3 - Evolution and ecosystem dynamics

Organiser: Dr. Andrew Tanentzap

Contact details: ajt65@cam.ac.uk

Teaching Staff: *Andrew Tanentzap, Sam Brockington, David Coomes, Beverley Glover, Javier Igea, Lauren Gardiner.*

The phylogenetic progression of land plants allows us to relate palaeohistorical origins, from algae to bryophytes and lycopods, to their evolutionary progression through ferns and conifers to angiosperms. The module will examine the molecular basis to morphological advances, as compared to the physiological progression. The diversity engendered within, and beneath forest canopies, and the historical ecology of today's landscape, complete our review of vegetation history and dynamics.

- From an understanding of the phylogeny of land plants, when and where did the molecular homology of key higher plant traits originate in early land plant life forms?
- What are the ecological determinants of fern, conifer and angiosperm distribution?
- How predictable is evolution and what is the role of chance versus convergence in explaining the evolution of diversity across time and space?
- When conifer and angiosperm canopies diversified, were ferns and bryophytes able to proliferate in the shade?
- What is the evidence for evo-devo origins of the angiosperm flower, co-evolution of flower structure and associated pollinators?
- What determines diversity in modern forests, and how has man shaped the landscape we see in Europe today?

This module allows the molecular phylogenies and homologies of key plant traits to be mapped on to climatic limitations, throughout land plant evolution. It represents an exciting opportunity to study the ecological determinants of diversity and learn how we can integrate modern concepts of ecology and evolution using reproductive and physiological traits.

Bryophyte & whiskfern *Lycopod Huperzia* *Horsetail* *Fern* *Pine* *Orchid*