COST Action FP1105
Training School
4th -8th April, 2016
Venue: KONVENTA SĒTA HOTEL. Kalēju Str. 9/11, Riga, LV-1050, Latvia

The physical principles underpinning self-organization in plants.

FIRST CALL FOR REGISTRATION

The training school is a 5-day international event sponsored by COST Action FP1105. It is the final event of the COST Action with a focus on addressing key scientific challenges posed by the Action.

The document summarizes the subject matter of the training school. A more detailed program will be sent out to participants in due course.

Background

The objective of the training school is to address one of the key challenges of the Action: to facilitate a broader, multidisciplinary understanding of the fundamental science underpinning cell and plant development and to translate this knowledge into new developments in plant biology and materials sciences.

The training school is open to applicants across a range of disciplines interested in learning about the latest theoretical and experimental developments in physics/biophysics, cell biology and materials science. Developments will be presented at a conceptual level, in a way that is accessible to a multidisciplinary group of scientists. The target audience includes physicists/biophysicists, plant chemists, plant biologists and materials scientists.

The primary focus is to consider the fundamental mechanisms by which molecules assemble into the diverse range of structures that constitute plants. As suggested by Erwin Schrodinger in 1944 it should be possible to describe all these processes from first principles as pure physical processes. However, the complexity and dynamic interactions associated with these systems (Gene's, enzymes, hormones and environmental interactions at a range of scales), makes it currently impractical to identify the countless different individual processes and their interactions and distil them into simple mathematical descriptions. Even for relatively simple biological systems, where the entire genome has been mapped, there are still large gaps in our understanding of the role of genes in defining their structure.

Outline program

The physics of assembly

- An introduction to key concepts contained within the theory of scale relativity, which will include a conceptual discussions around the links between general relativity, standard quantum mechanics, macroscopic quantum mechanics and dissipative systems and their role in driving different types of structures at different scales within plants. Specific issues to be considered will include:

    1. The formation of a range of different structures, from amorphous, crystal, and dendritic morphologies, to more ordered structures such as cells, seeds, fruits, flowers, leaves, to whole plant structures.
    2. Molecular assembly into nanometer scale structures.
    3. The assembly of nanoscale structures into cell wall structures.
    4. Cell duplication and branching processes.
    5. Evidence based theory of the role of genes in controlling the physical processes that drive plant structures.
    6. How this new knowledge can be used to control molecular to nano meter scales of assembly in the development of new materials.

The biology of assembly

- Experimental studies in the field of plant cell differentiation in suspension as well as integrated in its tissular context which will include real-time live cell monitoring of the dynamic of biological

process, transcriptomics, quantitative proteomics and metabolomics specifically during wood cell formation in plants. Specific issues will include:

1. The spatio-temporal regulation of plant cell wall formation in wood plant cells to dissect cellulose, hemicelluloses and lignin deposition during plant cell differentiation (live cell imaging, 3D single cell reconstruction, *in situ* biopolymer detection and characterization, metabolomics..).
2. The mechanism regulating wood cell wall spatial organization with the cell endoskeletal microtubule scaffold (live cell imaging, 3D single cell reconstruction, genetic manipulation, transcriptomics, quantitative proteomics …).
3. The regulatory network controlling gene expression to enable the spatial organization and synthesis of cell wall in plant wood cells (transcriptomics, quantitative proteomics, metabolomics,…).

Interactive session

Our aim is to communicate the latest theoretical and experimental developments in biophysics and plant cell biology that can provide participants with new tools and knowledge to stimulate new thinking and avenues for research and development in their respective fields. As part of the program we intend to hold a half-day session where we will give participants the chance to raise open questions for consideration/discussion within the context of the program. The objective will be to consider the application of the basic principles to specific challenges that participants are attempting to resolve.

Actions

Register your interest in participation as soon as possible but no later than February 29th 2016.

There is COST Action financial support (following COST office rules) to cover transport, accommodation and subsistence costs for approximately 20 participants to attend the training school.

In the event of over subscription we will need to prioritize funded places. To assist us in this process, we request that anyone wishing to participate

in the training school should contact Dr Zurine Hernandez (FP1105GrantHolder@napier.ac.uk) with a short 1 page CV and brief summary (1 page maximum) of work/research activity and interests.

Presenters

Philip Turner, (PT) Edinburgh Napier University, UK.
Edouard Pesquet (EP) Stockholm University, Sweden.

Organisers

Latvia (Local)
Janis Gravitis
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