



Interdisciplinary Conference Report

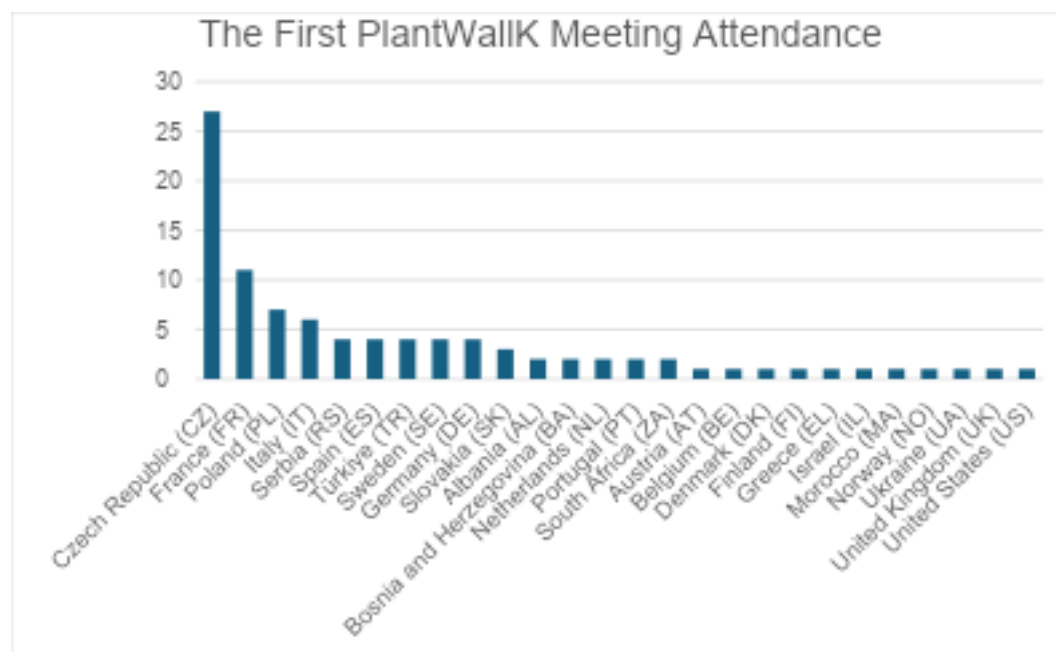
The First PlantWallK Meeting – Kick-off Conference of COST Action CA24116 PlantWallK

Overview

The kick-off meeting of COST Action CA24116 PlantWallK, entitled **The First PlantWallK Meeting**, was held in **Prague, Czech Republic**, on **25–26 May 2026**, and provided an **impressive overview of contemporary plant cell wall research**, illustrating how the field has evolved into a highly interdisciplinary and technology-driven discipline.

Who joint

The meeting brought together approximately **80 participants on site**, selected through an abstract evaluation process, while **around 16 additional participants joined online** via live streaming. The hybrid format was intentionally adopted to maximize participation and broaden the Action's reach across the European research community. The strong representation of the **Czech Republic**, **France**, and **Poland** reflects the long-standing tradition and active research communities in plant science within these countries.



Objectives

The primary objectives of the meeting were to:

- highlight the research directions, current topics, and the diversity of approaches
- enable members of the newly established network to meet in person and initiate collaborations and foster interdisciplinarity
- identify the expertise available within the consortium
- better understand participants' expectations from the COST Action
- evaluate whether the planned activities described in the Technical Annex adequately reflect the needs of the community
- use these findings to align the implementation of the Action with both the Technical Annex and the emerging priorities identified by participants.

Scientific Scope, Community Building and Selection Process

The Core group was instrumental in selecting the talks and drafting the scientific program. As PlantWallK is a highly multidisciplinary COST Action, **the selection of abstracts was carefully balanced to ensure that all three Working Groups (WG1–WG3) were represented as evenly as possible while maintaining high scientific quality.** All participants were encouraged to present their scientific work as a poster. The program of the First PlantWallK Meeting is available [here](#). The Book of Abstracts is available [here](#).

The topics of oral and poster presentations moved well beyond traditional studies of cell wall composition and biosynthesis, bringing together researchers working at the interface of plant biology, physics, engineering, chemistry, computational sciences, and materials science to address fundamental questions in plant development, biomechanics, environmental adaptation, and sustainable agriculture.

As anticipated, **Working Group 3** was less represented than WG1 and WG2. This outcome was expected because one of the strategic objectives of PlantWallK is to progressively increase multidisciplinary by attracting researchers from disciplines that are traditionally underrepresented in plant cell wall research, including mathematical modelling or computational biology.

Gender and seniority balance

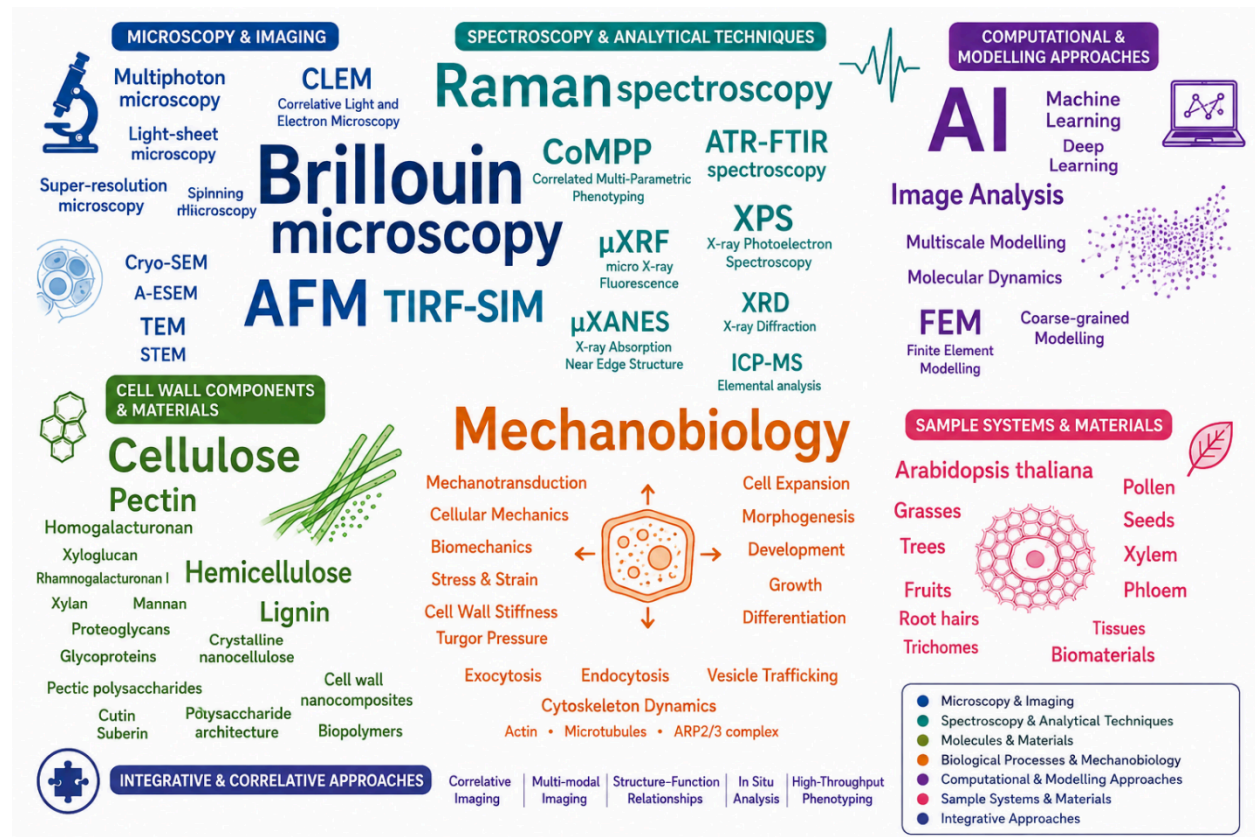
The list of conference participants demonstrates a healthy balance of gender and scientific seniority. Internationally recognized leaders in the field, including the keynote speakers Peter Ulvskov and Eva Deinum, are complemented by numerous emerging group leaders, postdoctoral researchers, and doctoral students presenting both oral communications and posters. Gender representation is similarly encouraging. Women contribute a substantial proportion of keynote lectures, invited talks, and posters, leading research across virtually all thematic areas, from biomechanics and microscopy to genetics, chemistry, modeling, and crop biology, resulting in a program that appears notably more balanced than many traditional conferences in plant sciences.

Broad multidisciplinary topics, novel advanced technologies and diverse plant species

The scientific scope of the meeting was exceptionally broad, and the contributions spanned every level of plant cell wall organization, from molecular architecture and polysaccharide biosynthesis to tissue mechanics, developmental regulation, mechanotransduction, plant immunity, and crop improvement. Rather than focusing on individual wall components in isolation, many presentations integrated chemistry, mechanics, and signaling into unified biological frameworks, reflecting the increasing adoption of systems-level approaches. Likewise, the diversity of biological models was remarkable. While *Arabidopsis* remained an important reference species, studies extended to wheat, tomato, maize, cotton, aspen, barley, tobacco, pea, grapevine, persimmon, pine, poplar, pepper, soybean, moss (*Physcomitrium*), the green alga *Chara*, the resurrection plant *Ramonda serbica*, hyperaccumulator plants, and several additional crop species. This diversity demonstrates a clear commitment to comparative biology and to translating fundamental discoveries into agriculturally relevant systems.

Emerging technologies as a highlight of the conference

Perhaps the most striking feature of the program is the breadth of advanced technologies employed. The conference highlighted a clear trend toward the integration of advanced imaging, as well as analytical and computational approaches in plant cell wall research. Particular emphasis was placed on **quantitative mapping of cell wall mechanics** using Brillouin microscopy and AFM nanoindentation, enabling mechanical measurements in native living tissues. Another prominent direction was the development of **correlative microscopy**, combining complementary imaging modalities (e.g. confocal microscopy, TIRF-SIM, TIRFM, and advanced environmental scanning electron microscopy), together with novel **synthetic fluorescent probes** (CarboTag and LipoTag) for functional imaging of cell wall properties, including pH, porosity, and lipid order. Significant advances were also presented in the chemical and structural characterization of cell walls through **resonant X-ray scattering**, **μ XRF/ μ XANES tomography**, advanced ICP-MS-based approaches, and CoMPP microarrays for polysaccharide profiling. Computational approaches occupy an equally prominent position, with multiple presentations employing finite-element modeling, multiscale mechanical simulations, molecular dynamics, continuum mechanics, artificial intelligence, and deep learning to understand plant cell wall organization across scales. **Several presentations also introduce entirely new experimental platforms**, including synthetic fluorescent probes tailored for plant tissues, peptide probes for live-cell imaging of homogalacturonan, biomimetic synthetic plant cell walls, and AI-assisted comparative experimental design. Many of these methodologies remain uncommon in plant biology and have the potential to become transformative tools for the wider research community.



Key technologies and methodological approaches represented at the PlantWallK conference. Curated word cloud based on the conference presentations, highlighting major techniques, materials, molecules, and methodological concepts in plant cell wall research.

Some notable scientific breakthroughs

Among the many excellent presentations, several stand out as particularly innovative. The discovery of flexible pectin nanopatterning coupled to cellulose organisation provides new insight into nanoscale cell wall architecture and may reshape current understanding of plant wall mechanics. Equally noteworthy are the demonstrations of Brillouin microscopy as a quantitative platform for non-invasive mechanical phenotyping across diverse plant systems, and the presentation of Shape2Fate, an artificial intelligence framework capable of analyzing membrane trafficking events with unprecedented precision. Particularly visionary is the development of biomimetic synthetic plant cell walls that not only provide experimental platforms for mechanobiology but also offer potential applications in development of sustainable, pesticide-free crop protection. Similarly, the proposal to employ artificial intelligence as an adaptive partner in experimental design rather than merely a data analysis tool presents an exciting perspective for the future of biological research. On the biological side, new mechanistic insights into stress-regulated cellulose biosynthesis through the

BIK1–TTL3 signaling module represent an important advance in understanding how plants maintain cell wall integrity under adverse environmental conditions.

Multi- and interdisciplinarity as a cornerstone of the modern cell wall research

Overall, the meeting convincingly demonstrates that modern plant cell wall research is no longer confined to classical plant biology but has become an inherently multidisciplinary endeavor. Throughout the program, biological questions are addressed using concepts and methodologies originating from physics, chemistry, engineering, mathematics, computational science, and materials research. Mechanical modeling is routinely integrated with genetic and biochemical experiments, while advanced imaging is combined with quantitative analysis, machine learning, and structural characterization. This convergence of disciplines positions the PlantWallK COST Action to become an important catalyst for collaboration across traditionally separate research communities. The program therefore reflects not only the diversity of current plant cell wall research but also a clear transition toward predictive, quantitative, and systems-level biology that will be essential for addressing future challenges in sustainable agriculture, climate resilience, and the development of bio-based materials.

AI in Plant Cell Wall Research

One of the strongest discussion topics concerned the opportunities, limitations, and potential misuse of **artificial intelligence (AI)** in scientific research.

Based on the discussions held during the conference and in accordance with the objectives of PlantWallK, a dedicated **AI webinar series** was launched in **August 2026**. [The first webinar](#) introduced participants to the fundamentals of AI-assisted image analysis and presented the outcomes of the completed Horizon Europe project **AI4Life**, which focused specifically on implementing artificial intelligence in bioimage analysis.

These webinars established the foundations for educating Early Career Researchers in the responsible use of AI, introduced existing infrastructures and resources available to researchers, and demonstrated where participants can obtain support for implementing AI-based image analysis workflows.

The following webinars in the series will focus on practical applications of AI in participants' own research projects and on promoting best practices for AI-supported scientific workflows. These initiatives were also highlighted in **PlantWallK Newsletter No. 2**.

Developing a Common Language Across Disciplines

A second major conclusion of the meeting was that a strongly multidisciplinary community requires a **shared scientific language** to enable efficient communication between researchers from different backgrounds.

Future PlantWallK meetings will therefore include activities specifically designed to facilitate communication across disciplines. One proposal discussed during the conference was to organize focused workshops bringing together experimental biologists working on the biomechanics of plant cell walls with mathematical modelers studying the same biological processes. Such highly focused meetings would provide opportunities to explain terminology, methodologies, and conceptual approaches, thereby helping establish a common framework for communication within the community.

Identification of Research Gaps

Several structured discussion sessions were organised to determine whether important research gaps exist that are not currently addressed in the Technical Annex.

The outcomes differed between Working Groups.

Within **WG1**, discussions focused primarily on defining the future PlantWallK inventory, including its scope, structure, content, and intended applications. Within **WG2**, participants identified limited access to advanced research infrastructure—particularly state-of-the-art microscopy platforms—as one of the major barriers to progress.

Both topics will be addressed during **Grant Period 2 (GP2)**. Planned activities will include strategic discussions on the future development of the PlantWallK database, as well as a strong emphasis on **Training Schools** and **Short-Term Scientific Missions (STSMs)** to improve access to advanced technologies and facilitate knowledge transfer across the network.

In **WG3**, participants specializing in computational modelling emphasized that the primary challenge lies in identifying the most relevant biological processes and structures to model. Consequently, future efforts will focus on building a communication platform and strengthening collaboration between experimental biologists and modellers to facilitate the identification and formulation of biologically meaningful modelling questions.

Community Survey

A substantial part of the discussions was devoted to the design of the **PlantWallK community survey**, intended to identify the most important priorities for future Action activities. Based on feedback collected during the kick-off meeting, the survey was revised before its launch. The complete survey results will be presented in a separate report.

One of the clearest outcomes of the survey was that researchers perceive a significant lack of networking opportunities at scientific conferences. In addition to the positive experience from the kick-off meeting, this confirmed that multidisciplinary face-to-face meetings are among the most valuable activities of the Action.

Consequently, PlantWallK will continue to prioritize the organization of multidisciplinary conferences throughout future Grant Periods. The long-term strategy is to organize **at least one multidisciplinary conference each year**, each dedicated to a specific topic of strategic importance for the community. In **Grant Period 2**, this objective will be addressed through a multidisciplinary conference focused on **molecular recognition tools for plant cell wall research**.

Conclusions

The First PlantWallK Meeting successfully established the foundations of the COST Action by bringing together researchers from diverse disciplines, identifying community priorities, and validating several strategic directions for future activities. The discussions directly influenced the implementation of new initiatives, including the AI webinar series, the development of focused multidisciplinary workshops, the strategic planning of the PlantWallK database, increased emphasis on Training Schools and STSMs, and the long-term commitment to annual multidisciplinary conferences. Together, these outcomes ensure that the implementation of PlantWallK remains responsive to the needs of its growing scientific community while fulfilling the objectives defined in the Technical Annex.

Overall, the conference successfully achieved its multidisciplinary character. Participants highly appreciated the scientific quality of the presentations and welcomed the opportunity to interact with researchers from different disciplines. Several important themes emerged during the meeting and have subsequently become priorities for future activities of the Action