# plant biology research topics

Plant Biology Research Topics: Exploring the Green Frontier

**plant biology research topics** are as diverse and fascinating as the plant kingdom itself. From understanding the intricate mechanisms of photosynthesis to exploring how plants respond to environmental stressors, the field offers a vast landscape for scientific inquiry. Whether you're a student, researcher, or simply an enthusiast of plant sciences, diving into these topics reveals the incredible complexity and importance of plants in sustaining life on Earth.

## Understanding Plant Physiology and Development

One of the foundational areas in plant biology research topics revolves around plant physiology—the study of how plants function internally. This includes how plants grow, develop, and respond to their surroundings.

### Photosynthesis and Energy Conversion

Photosynthesis remains a central topic. Researchers explore how plants convert sunlight into chemical energy, focusing on the efficiency of light absorption, electron transport chains, and carbon fixation. Recent studies aim to enhance photosynthetic efficiency to improve crop yields and address food security issues.

### Hormonal Regulation and Growth

Plant hormones like auxins, gibberellins, cytokinins, and ethylene regulate growth and development. Investigating how these hormones interact guides scientists in understanding plant responses such as flowering, fruiting, and seed germination. This knowledge is crucial for agricultural innovations and plant breeding.

### Root and Shoot Development

Roots and shoots are vital for nutrient uptake and photosynthesis. Research topics here include studying root architecture, nutrient absorption dynamics, and shoot branching patterns. These insights help in developing crops better adapted to soil conditions and climatic challenges.

# Plant Genetics and Molecular Biology

At the molecular level, plant biology research topics delve into the genetic makeup and gene expression patterns that dictate plant traits.

## Genomics and Gene Editing

With advancements in sequencing technologies, plant genomics has exploded as a field. Scientists analyze whole genomes to identify genes responsible for disease resistance, drought tolerance, and other desirable traits. Gene editing tools like CRISPR-Cas9 enable precise modifications, opening doors for creating improved plant varieties.

## Epigenetics in Plants

Epigenetics studies how environmental factors influence gene expression without altering DNA sequences. This area is gaining traction as it explains how plants adapt to changing environments and stressors across generations.

## Transcriptomics and Proteomics

Understanding which genes are active under certain conditions and how proteins function provides deeper insight into plant responses. Transcriptomic and proteomic analyses help identify pathways involved in defense mechanisms, growth, and metabolism.

# Plant Ecology and Environmental Interactions

Plants don’t exist in isolation—they interact continuously with their environment and other organisms. Research in this area addresses how plants adapt, survive, and thrive.

## Plant Responses to Abiotic Stress

Abiotic stresses like drought, salinity, and extreme temperatures challenge plant survival. Studying physiological and molecular responses helps develop crops with improved resilience. This is especially important in the context of climate change.

## Plant-Microbe Interactions

The relationship between plants and microorganisms, including beneficial bacteria and

fungi, influences nutrient uptake and disease resistance. Research topics include mycorrhizal associations and nitrogen-fixing bacteria, which can reduce the need for chemical fertilizers.

## Pollination Biology and Reproductive Ecology

Understanding how plants reproduce and interact with pollinators is vital for ecosystem health and agriculture. Studies in this domain examine pollination mechanisms, seed dispersal, and reproductive success under varying environmental conditions.

# Plant Biotechnology and Sustainable Agriculture

The application of plant biology research topics in biotechnology aims to address global challenges like food security, sustainability, and environmental conservation.

## Developing Stress-Resistant Crops

Biotechnological approaches focus on engineering plants that can withstand biotic and abiotic stresses, reducing crop losses. Techniques include gene editing, marker-assisted breeding, and transgenic methods.

## Biofuels and Renewable Resources

Plants are a renewable resource for biofuels and bioproducts. Research explores optimizing biomass production, improving conversion technologies, and identifying suitable plant species for sustainable energy solutions.

## Phytoremediation and Environmental Cleanup

Some plants possess the ability to absorb and detoxify pollutants from soil and water. Investigating these species and their mechanisms offers eco-friendly options for environmental remediation.

# Emerging Trends and Future Directions in Plant Biology

As technology advances, new research topics continue to emerge within plant biology.

## Systems Biology and Computational Modeling

Integrating data from genomics, proteomics, and metabolomics allows researchers to model plant systems comprehensively. This holistic approach helps predict plant behavior and responses under various scenarios.

## Synthetic Biology in Plants

Synthetic biology aims to design and construct new biological parts or redesign existing ones. In plants, this could mean creating novel metabolic pathways or improving photosynthetic efficiency beyond natural limits.

## Climate Change and Plant Adaptation

With shifting climate patterns, understanding how plants will adapt or migrate is a pressing research focus. Studies include examining genetic diversity, phenotypic plasticity, and assisted migration strategies.

Exploring plant biology research topics reveals a world of intricate and essential processes that sustain ecosystems and human life. From the molecular dance within cells to the vast interactions within ecosystems, plants continue to captivate scientists and offer solutions to some of the planet's most urgent challenges. Whether you're considering a career in plant sciences or simply curious about the green world around us, these topics provide a rich tapestry of knowledge waiting to be unraveled.

# Frequently Asked Questions

## What are the latest advancements in CRISPR technology for plant genetic engineering?

Recent advancements in CRISPR technology have enabled more precise and efficient genome editing in plants, allowing researchers to develop crops with improved traits such as disease resistance, drought tolerance, and enhanced nutritional content.

## How is plant microbiome research impacting sustainable agriculture?

Plant microbiome research is revealing how beneficial microbes interact with plants to promote growth, enhance nutrient uptake, and protect against pathogens, leading to sustainable agricultural practices that reduce the reliance on chemical fertilizers and pesticides.

## What role do epigenetic modifications play in plant adaptation to environmental stress?

Epigenetic modifications, such as DNA methylation and histone modification, regulate gene expression in plants without altering the DNA sequence, enabling plants to adapt rapidly to environmental stresses like drought, salinity, and temperature changes.

## How are advancements in plant phenotyping accelerating crop improvement?

High-throughput plant phenotyping technologies, including imaging and sensor-based methods, allow researchers to rapidly and accurately assess plant traits, facilitating the selection of superior genotypes and accelerating breeding programs for crop improvement.

## What are the emerging research trends in understanding plant root system architecture?

Emerging research focuses on the genetic and molecular mechanisms controlling root development, exploring how root architecture influences nutrient and water uptake, and employing imaging techniques to study root growth dynamics, which is critical for developing crops with enhanced resilience and resource use efficiency.

# Additional Resources

Plant Biology Research Topics: Exploring the Frontiers of Botanical Science

**plant biology research topics** encompass a wide and dynamic range of scientific inquiries that drive our understanding of plant life, ecology, genetics, and their applications in agriculture and environmental sustainability. As global challenges such as climate change, food security, and biodiversity loss intensify, the importance of plant biology research has never been greater. This article delves into some of the most compelling and cutting-edge topics in plant biology, offering an analytical perspective on current trends, methodologies, and their broader implications.

# Understanding Plant Physiology and Development

At the heart of plant biology research lies the study of plant physiology—the mechanisms by which plants grow, reproduce, and respond to their environment. Investigations into photosynthesis, nutrient uptake, and hormonal regulation remain central, informing both basic science and practical applications.

## Photosynthesis Efficiency and Carbon Fixation

Improving photosynthesis efficiency is a critical area of research given its direct impact on crop yields and carbon sequestration. Scientists examine the biochemical pathways of carbon fixation, specifically the Calvin cycle and the role of enzymes like RuBisCO, to identify potential genetic modifications that could enhance photosynthetic rates. Recent studies employing CRISPR gene-editing technologies aim to optimize these pathways, potentially allowing plants to convert sunlight and $CO_2$ into biomass more efficiently.

## Plant Hormone Signaling and Growth Regulation

Another pivotal topic involves understanding plant hormones such as auxins, gibberellins, cytokinins, and abscisic acid, which regulate developmental processes and stress responses. Research often focuses on signal transduction pathways and gene expression patterns triggered by these hormones. Insights here can lead to innovations in agriculture, such as developing crops with improved drought tolerance or accelerated growth cycles.

# Genetics and Genomics in Plant Biology

Advancements in genetic sequencing and bioinformatics have revolutionized plant biology research, enabling the exploration of plant genomes at unprecedented scales.

## Genomic Mapping and Functional Genomics

Genomic mapping projects, such as the sequencing of model organisms like Arabidopsis thaliana and economically important crops like rice and maize, provide foundational data for identifying genes responsible for desirable traits. Functional genomics employs techniques like transcriptomics and proteomics to understand gene functions and interactions, facilitating the development of genetically engineered plants with enhanced nutritional profiles or resilience.

## Epigenetics and Plant Adaptation

Epigenetic mechanisms—heritable changes in gene expression without alterations in DNA sequence—are gaining traction as a research topic. They play a crucial role in how plants respond to environmental stresses such as salinity, temperature fluctuations, and pathogen attacks. Investigating DNA methylation patterns and histone modifications offers new avenues to breed or engineer plants that can better withstand changing climates.

# Plant-Microbe Interactions and Ecology

The study of symbiotic relationships between plants and microorganisms is an intriguing and rapidly expanding field within plant biology research topics.

## Rhizosphere Dynamics and Soil Health

Research into the rhizosphere—the soil region influenced by root secretions—focuses on understanding how microbial communities affect plant health and nutrient uptake. Beneficial bacteria and mycorrhizal fungi can enhance phosphorus absorption and nitrogen fixation, reducing the need for chemical fertilizers. This area is pivotal for sustainable agriculture practices.

## Plant Pathology and Disease Resistance

Plant biology research also prioritizes combating diseases caused by pathogens such as fungi, bacteria, and viruses. Molecular studies on plant immune responses, including the identification of resistance (R) genes, help in developing disease-resistant cultivars. Techniques like RNA interference (RNAi) and gene editing are increasingly applied to bolster plant defenses without relying heavily on pesticides.

# Environmental Stress Responses and Climate Change

Given the accelerating pace of climate change, understanding how plants respond to environmental stresses is vital.

## Drought and Heat Stress Tolerance

Plant biology research investigates physiological and molecular adaptations that enable plants to survive drought and high temperatures. Studies explore osmoprotectants, antioxidant enzymes, and gene networks that mitigate oxidative stress. Identifying and transferring these traits into crops could safeguard food production under adverse climatic conditions.

## Impact of Elevated $CO_2$ and Pollution

Another growing research area examines how elevated atmospheric $CO_2$ levels and pollutants affect plant growth and ecosystem dynamics. While increased $CO_2$ can stimulate photosynthesis, nutrient imbalances and reduced protein content in crops have been

observed. Understanding these complex interactions helps predict future agricultural productivity and devise mitigation strategies.

# Innovations in Plant Biotechnology

Biotechnological approaches continue to transform plant biology research, merging traditional botany with cutting-edge technology.

## CRISPR and Gene Editing Technologies

The precision and versatility of CRISPR-Cas systems have opened new frontiers in plant genetics. Researchers are now capable of editing genes responsible for yield, pest resistance, and nutritional value with greater efficiency. The ethical considerations and regulatory frameworks surrounding genetically modified organisms (GMOs) remain a topic of active discussion in the scientific community.

## Synthetic Biology and Metabolic Engineering

Synthetic biology aims to redesign plants’ metabolic pathways to produce valuable compounds like pharmaceuticals, biofuels, or specialty chemicals. Metabolic engineering can enable plants to synthesize novel molecules or enhance the production of existing ones, offering sustainable alternatives to traditional manufacturing processes.

# Emerging Technologies and Future Directions

Plant biology research topics increasingly incorporate interdisciplinary technologies such as artificial intelligence (AI), remote sensing, and advanced imaging.

## Phenotyping and High-Throughput Screening

Automated phenotyping platforms use imaging and machine learning to analyze plant traits rapidly across large populations. This accelerates breeding programs by linking genotypes to phenotypes efficiently.

## Remote Sensing and Precision Agriculture

Satellite and drone-based remote sensing technologies provide real-time data on crop health, soil conditions, and environmental stresses. Integrating these tools with plant biology research promotes precision agriculture, optimizing resource use while minimizing

environmental impacts.

The diversity and depth of plant biology research topics underline the field’s critical role in addressing global challenges. From molecular genetics to ecosystem ecology, the ongoing studies not only expand scientific knowledge but also pave the way for innovations that can sustain human populations and preserve natural habitats for future generations.

## Plant Biology Research Topics



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**plant biology research topics: Stomatal Biology and Beyond** Wenxiu Ye, Juan Dong, Toshinori Kinoshita, 2022-03-08

**plant biology research topics: Frontiers of Sulfur Metabolism in Plant Growth, Development, and Stress Response** Stanislav Kopriva, Dibyendu Talukdar, Hideki Takahashi, Rüdiger Hell, Agnieszka Sirko, Stanislaus F. D' Souza, Tulika Talukdar, 2016-09-07 Growing plants have a constitutive demand for sulfur to synthesize proteins, sulfolipids and other essential sulfur containing molecules for growth and development. The uptake and subsequent distribution of sulfate

is regulated in response to demand and environmental cues. The importance of sulfate for plant growth and vigor and hence crop yield and nutritional quality for human and animal diets has been clearly recognized. The acquisition of sulfur by plants, however, has become an increasingly important concern for the agriculture due to the decreasing S-emissions from industrial sources and the consequent limitation of inputs from atmospheric deposition. Molecular characterization involving transcriptomics, proteomics and metabolomics in Arabidopsis thaliana as well as in major crops revealed that sulfate uptake, distribution and assimilation are finely regulated depending on sulfur status and demand, and that these regulatory networks are integrated with cell cycle, photosynthesis, carbohydrate metabolism, hormonal signaling, uptake and assimilation of other nutrients, etc., to enable plant growth, development, and reproduction even under different biotic and abiotic stresses. This knowledge can be used to underpin approaches to enhance plant growth and nutritional quality of major food crops around the world. Although considerable progress has been made regarding the central role of sulfur metabolism in plant growth, development and stress response, several frontiers need to be explored to reveal the mechanisms of the cross-talk between sulfur metabolism and these processes. In this research topic the knowledge on plant sulfur metabolism is reviewed and updated. Focus is put not only on molecular mechanisms of control of sulfur metabolism but also on its integration with other vital metabolic events. The topic covers 4 major areas of sulfur research: sulfate uptake, assimilation and metabolism, regulation, and role in stress response. We hope that the topic will promote interaction between researchers with different expertise and thus contribute to a more integrative approach to study sulfur metabolism in plants.

**plant biology research topics: Model Organisms in Plant Developmental Biology — their effectiveness and limitations** Neelima Roy Sinha, Verónica S. Di Stilio, 2024-09-26 Model organisms represent an invaluable resource for fundamental and applied research, allowing the identification of the mechanistic basis of evolutionary innovations. This article collection will showcase studies of established as well as emerging Model Organisms in Plant Developmental Biology - their effectiveness and limitations, that have significance to the field broadly, including EvoDevo. Classically used for genetic and molecular studies in Plant Biology, model organisms are progressively entering many subdisciplines within Plant Development and EvoDevo. Recent advancements in the fast-growing field of plant model organisms, and their hugely increased phylogenetic breadth and availability of genomes and transgenic techniques, have led to a burst of innovative ideas and synthesis in recent publications spanning the range from an analysis of fossils to single-cell sequencing. However, it also raises the question of how broad is the application of knowledge gained from these studies, and its relevance to the field of Plant Development and EvoDevo. To address those questions, this research topic focuses on new insights, latest discoveries, current challenges, and future perspectives in the study of model organisms and how much knowledge gained from them can be extrapolated broadly. Authors are encouraged to identify the greatest unifying concepts in their sub-disciplines, and the challenges, emerging from the use of model plants, as well as to put forward potential solutions to address those challenges.

**plant biology research topics: Functional Imaging in living Plants - Cell Biology meets Physiology** Alex Costa, Markus Schwarzländer, George R Littlejohn, Tobias Meckel, 2015-05-08 The study of plant cell physiology is currently experiencing a profound transformation. Novel techniques allow dynamic in vivo imaging with subcellular resolution, covering a rapidly growing range of plant cell physiology. Several basic biological questions that have been inaccessible by the traditional combination of biochemical, physiological and cell biological approaches now see major progress. Instead of grinding up tissues, destroying their organisation, or describing cell- and tissue structure, without a measure for its function, novel imaging approaches can provide the critical link between localisation, function and dynamics. Thanks to a fast growing collection of available fluorescent protein variants and sensors, along with innovative new microscopy technologies and quantitative analysis tools, a wide range of plant biology can now be studied in vivo, including cell morphology & migration, protein localization, topology & movement, protein-protein interaction, organelle dynamics, as well as ion, ROS & redox dynamics. Within the cell, genetic targeting of fluorescent

protein probes to different organelles and subcellular locations has started to reveal the stringently compartmentalized nature of cell physiology and its sophisticated spatiotemporal regulation in response to environmental stimuli. Most importantly, such cellular processes can be monitored in their natural 3D context, even in complex tissues and organs – a condition not easily met in studies on mammalian cells. Recent new insights into plant cell physiology by functional imaging have been largely driven by technological developments, such as the design of novel sensors, innovative microscopy & imaging techniques and the quantitative analysis of complex image data. Rapid further advances are expected which will require close interdisciplinary interaction of plant biologists with chemists, physicists, mathematicians and computer scientists. High-throughput approaches will become increasingly important, to fill genomic data with 'life' on the scale of cell physiology. If the vast body of information generated in the -omics era is to generate actual mechanistic understanding of how the live plant cell works, functional imaging has enormous potential to adopt the role of a versatile standard tool across plant biology and crop breeding. We welcome original research papers, methodological papers, reviews and mini reviews, with particular attention to contributions in which novel imaging techniques enhance our understanding of plant cell physiology and permits to answer questions that cannot be easily addressed with other techniques.

**plant biology research topics:** *When Chemistry Meets Biology – Generating Innovative Concepts, Methods and Tools for Scientific Discovery in the Plant Sciences* Erich Kombrink, Markus Kaiser, 2016-08-12 Biologically active small molecules have increasingly been applied in plant biology to dissect and understand biological systems. This is evident from the frequent use of potent and selective inhibitors of enzymes or other biological processes such as transcription, translation, or protein degradation. In contrast to animal systems, which are nurtured from drug research, the systematic development of novel bioactive small molecules as research tools for plant systems is a largely underexplored research area. This is surprising since bioactive small molecules bear great potential for generating new, powerful tools for dissecting diverse biological processes. In particular, when small molecules are integrated into genetic strategies (thereby defining "chemical genetics"), they may help to circumvent inherent problems of classical (forward) genetics. There are now clear examples of important, fundamental discoveries originating from plant chemical genetics that demonstrate the power, but not yet fully exploited potential, of this experimental approach. These include the unraveling of molecular mechanisms and critical steps in hormone signaling, activation of defense reactions and dynamic intracellular processes. The intention of this Research Topic of Frontiers in Plant Physiology is to summarize the current status of research at the interface between chemistry and biology and to identify future research challenges. The research topic covers diverse aspects of plant chemical biology, including the identification of bioactive small molecules through screening processes from chemical libraries and natural sources, which rely on robust and quantitative high-throughput bioassays, the critical evaluation and characterization of the compound's activity (selectivity) and, ultimately, the identification of its protein target(s) and mode-of-action, which is yet the biggest challenge of all. Such well-characterized, selective chemicals are attractive tools for basic research, allowing the functional dissection of plant signaling processes, or for applied purposes, if designed for protection of crop plants from disease. New methods and data mining tools for assessing the bioactivity profile of compounds, exploring the chemical space for structure–function relationships, and comprehensive chemical fingerprinting (metabolomics) are also important strategies in plant chemical biology. In addition, there is a continuing need for diverse target-specific bioprobes that help profiling enzymatic activities or selectively label protein complexes or cellular compartments. To achieve these goals and to add suitable probes and methods to the experimental toolbox, plant biologists need to closely cooperate with synthetic chemists. The development of such tailored chemicals that beyond application in basic research can modify traits of crop plants or target specific classes of weeds or pests by collaboration of applied and academic research groups may provide a bright future for plant chemical biology. The current Research Topic covers the breadth of the field by presenting original research articles,

methods papers, reviews, perspectives and opinions.

**plant biology research topics:** *International Plant Proteomics Organization (INPPO) World Congress 2014* Joshua L. Heazlewood, Jesús V. Jorrín-Novo, Ganesh Kumar Agrawal, Silvia Mazzuca, Sabine Lüthje, 2017-02-08 The field of proteomics has advanced considerably over the past two decades. The ability to delve deeper into an organism's proteome, identify an array of post-translational modifications and profile differentially abundant proteins has greatly expanded the utilization of proteomics. Improvements to instrumentation in conjunction with the development of these reproducible workflows have driven the adoption and application of this technology by a wider research community. However, the full potential of proteomics is far from being fully exploited in plant biology and its translational application needs to be further developed. In 2011, a group of plant proteomic researchers established the International Plant Proteomics Organization (INPPO) to advance the utilization of this technology in plants as well as to create a way for plant proteomics researchers to interact, collaborate and exchange ideas. The INPPO conducted its inaugural world congress in mid 2014 at the University of Hamburg (Germany). Plant proteomic researchers from around the world were in attendance and the event marked the maturation of this research community. The Research Topic captures the opinions, ideas and research discussed at the congress and encapsulates the approaches that were being applied in plant proteomics.

**plant biology research topics: Concepts in Photobiology** G.S. Singhal, G. Renger, S.K. Sopory, K.D. Irrgang, Govindjee, 2012-12-06 Photobiology is an important area of biological research since a very large number of living processes are either dependent on or governed by light that we receive from the Sun. Among various subjects, photosynthesis is one of the most important, and thus a popular topic in both molecular and organismic biology, and one which has made a considerable impact throughout the world since almost all life on Earth depends upon it as a source of food, fuel and oxygen. However, for growth of plants, light is equally essential, and research on photomorphogenesis has revealed exciting new developments with the application of newer molecular biological approaches. The present book brings together and integrates various aspects of photosynthesis, biology of pigments, light regulation of chloroplast development, nuclear and chloroplast gene expression, light signal transduction, other photomorphogenetic processes and some photoecological aspects under one cover. The chapters cover biochemical and molecular discussions of most of the above topics in a comprehensive manner and include a wide range of `hot topics' that are currently under investigation in the field of photobiology of cyanobacteria, algae and plants. The authors of this book are selected international authorities in their fields from USA, Europe, Australia and Asia. The book is designed primarily to be used as a text book by graduates and post-graduates. It is, however, also intended to be a resource book for new researchers in plant photobiology. Several introductory chapters are designed as suitable reading for undergraduate courses in integrative and molecular biology, biochemistry and biophysics.

**plant biology research topics:** *Office of Science and Technology policy* United States. Congress. House. Committee on Appropriations. Subcommittee on HUD-Independent Agencies, 1985

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**plant biology research topics:** Plant Biology Research and Training for the 21st Century National Research Council, Division on Earth and Life Studies, Commission on Life Sciences, Committee on Examination of Plant Science Research Programs in the UnitedStates, 1992-02-01 Faster progress in plant biology research could benefit agriculture, the environment, medicine, and our understanding of basic biological processes. This book clearly and directly describes the impediments to greater achievements in plant science and suggests solutions. It presents an innovative plan that would create a comprehensive federal system of management and financial support for plant biology research and training.

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**plant biology research topics:** Physiological Growth Responses to Light in Controlled Environment Agriculture Jason Lanoue, 2024-12-24 Light is the primary driving force for photosynthesis and thus dictates carbon assimilation, biomass production, and yield in plants. Light also plays an important role in a myriad of physiological and biochemical processes in plants, from eliciting specific gene responses to whole-plant phenomics. The lighting environment is especially important in controlled environment agriculture (CEA) as it supplements or fully replaces natural light to improve growth and quality. Due to the advancements in lighting technologies and the rapid growth of the CEA industry, lighting research has been propelled into the forefront of the plant science field. Unlike organisms in the animal kingdom, plants are sessile. The inability to move has forced plants to evolve mechanisms to deal with the lighting environment they are in. For example, in environments that are rich in far-red light, leaf expansion and stem elongation are promoted in an effort to orient themselves in a more advantageous position to absorb photosynthetically active radiation (PAR). We have yet to fully understand the physiological and biochemical implications of plants under all forms of light, from ultraviolet to far-red. The goal of this Research Topic is to collect studies which further our knowledge of how plants interact with their light environment.

**plant biology research topics: Branching and Rooting Out with a CT Scanner: The Why, the How, and the Outcomes, Present and Possibly Future** Pierre Dutilleul, Jonathan A. Lafond, 2016-04-13 Until recently, a majority of the applications of X-ray computed tomography (CT) scanning in plant sciences remained descriptive; some included a quantification of the plant materials when the root-soil isolation or branch-leaf separation was satisfactory; and a few involved the modeling of plant biology processes or the assessment of treatment or disease effects on plant biomass and structures during growth. In the last decade, repeated CT scanning of the same plants was reported in an increasing number of studies in which moderate doses of X-rays had been used. Besides the general objectives of Frontiers in Plant Science research topics, “Branching and Rooting Out with a CT Scanner” was proposed to meet specific objectives: (i) providing a non-technical update on knowledge about the application of CT scanning technology to plants, starting with the type of CT scanning data collected (CT images vs. CT numbers) and their processing in the graphical and numerical approaches; (ii) drawing the limits of the CT scanning approach, which because it is based on material density can distinguish materials with contrasting or moderately overlapping densities (e.g., branches vs. leaves, roots vs. non-organic soils) but not the others (e.g., roots vs. organic soils); (iii) explaining with a sufficient level of detail the main procedures used for graphical, quantitative and statistical analyses of plant CT scanning data, including fractal complexity measures and statistics appropriate for repeated plant CT scanning, in experiments where the research hypotheses are about biological processes such as light interception by canopies, root disease development and plant growth under stress conditions; (iv) comparing plant CT scanning with an alternative technology that applies to plants, such as the phenomics platforms which target leaf canopies; and (v) providing current and potential users of plant CT scanning with up-to-date information and exhaustive documentation, including clear perspectives and well-defined goals for the future, for them to be even more efficient or most efficient from start in their research work.

**plant biology research topics:** *Nitrogen Use Efficiency and Sustainable Nitrogen Management in Crop Plants* Nandula Raghuram, Susanne Schmidt, Tariq Aziz, Surya Kant, Jianbin Zhou, 2022-04-26

**plant biology research topics:** Department of Housing and Urban Development-independent Agencies Appropriations for 1986: Office of Science and Technology policy United States. Congress. House. Committee on Appropriations. Subcommittee on HUD-Independent Agencies, 1985

**plant biology research topics:** *Multi-omics and Computational Biology in Horticultural Plants: From Genotype to Phenotype, Volume II* Yunpeng Cao, Hui Song, Muhammad Abdullah, Xiaoxu Li,

Muhammad Aamir Manzoor, 2024-02-13 This Research Topic is part of the article collection series - Multi-omics and Computational Biology in Horticultural Plants: From Genotype to Phenotype. Horticultural plants play an important role for humans by providing herbal medicines, beverages, vegetables, fruits, and ornamentals. High-throughput technologies have revolutionised the time scale and power of detecting insights into physiological changes and biological mechanisms in plants. All sequencing data and tools have helped us better understand the evolutionary histories of horticultural plants and provide genotype and phenotype resources for molecular studies on economically important traits. The integration of these -omics technologies (e.g., genomics, transcriptomics, proteomics, metabolomics, lipidomics, ionomics, and redoxomics) is currently at the forefront of plant research. The genomes of horticultural plants are highly diverse and complex, often with a high degree of heterozygosity and polyploidy. Novel computational methods need to be developed to take advantage of state-of-the-art genomic technologies. As a result, the mining of multi-omics data and the development of new computational biology approaches for the reliable and efficient analysis of plant traits is necessary.

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