GEUPIL JANG, Ph.D.

Professor of Plant Biology

School of Biological Sciences and Technology, Chonnam National University, Republic of Korea

RESEARCH & COLLABORATION PROFILE |

KEY WORDS: Chloroplast Development, Stress Tolerance, Root Development, Phytohormone Crosstalk



Research Snapshot. Prof. Jang investigates the molecular and genetic mechanisms governing chloroplast biogenesis, root development, and phytohormone crosstalk, with a particular focus on how these processes regulate plant growth and environmental responses. His laboratory also applies CRISPR/Cas-based genome editing to functional genomics and crop improvement. By integrating molecular genetics, cell biology, genomics, and plant physiology, his research aims to elucidate developmental and stress-response pathways and translate this knowledge into strategies for improving crop productivity, stress tolerance, and environmental adaptation.

RESEARCH EXPERTISE

1. Molecular Mechanisms Underlying Chloroplast Development

Chloroplasts are essential organelles for photosynthesis, plant growth, productivity, and adaptation to environmental stresses. Their development depends largely on plastid gene transcription mediated by the plastid-encoded RNA polymerase (PEP). Because PEP requires nuclear-encoded PEP-associated proteins (PAPs) to form a functional transcriptional complex, PAP-mediated regulation plays a central role in chloroplast biogenesis. Our laboratory investigates the molecular functions and regulatory mechanisms of PAPs and other chloroplast-associated factors to understand chloroplast development and to provide a basis for improving crop productivity and stress tolerance.

2. Developmental Mechanisms Controlling Root Development

Roots are essential for water and nutrient uptake and play critical roles in plant growth, productivity, and environmental stress tolerance. Their functions depend on the coordinated development of specialized tissues, including the epidermis, cortex, endodermis, xylem, and phloem. Our laboratory investigates key regulatory genes controlling the development of root cell types and tissues and elucidates their molecular functions using genetic, molecular, and cell biological approaches. Through these studies, we aim to establish molecular models that explain how root development contributes to plant performance and agricultural productivity.

RECENT RESEARCH HIGHLIGHTS

1. **Chloroplast development & stress tolerance (Plant Biotechnology Journal 2026):** OsFeSOD3 coordinates chloroplast development and stress tolerance by coupling PEP-dependent plastid transcription with chloroplastic ROS homeostasis.
2. **Jasmonic acid & chloroplastic ROS metabolism (Rice Science 2026):** Jasmonic acid enhances drought tolerance in rice by regulating chloroplastic ROS metabolism and coordinating stress-induced cellular ROS dynamics.
3. **Endodermal cell division & root development (Plant Physiology 2021):** Auxin regulates endodermal cell division to control root tissue patterning and coordinate proper root development.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: phytohormone signaling | plant development | stress adaptation | genome editing & crop improvement

1. **Hormone crosstalk and plant development:** joint investigation of molecular interactions among auxin, cytokinin, jasmonic acid, and other phytohormones regulating plant growth, development, and stress responses.
2. **Growth-defense regulation and stress adaptation:** collaborative studies on hormonal signaling networks and regulatory genes that balance plant growth, defense, and environmental adaptation.
3. **CRISPR/Cas-based functional genomics:** application of genome editing to characterize genes involved in chloroplast development, root architecture, hormone signaling, and plant stress responses.
4. **Crop improvement:** collaborative development of genome-edited crops with improved yield, stress tolerance, growth performance, and resilience by integrating molecular genetics, genomics, and plant physiology.

SELECTED RECENT PUBLICATIONS

- **Plant Biotechnol J. 2026, 24, 2475-2491 —** OsFeSOD3 coordinates chloroplast biogenesis and stress tolerance by regulating PEP activity and chloroplastic ROS metabolism.
- **Rice Sci. 2026, 33, 531-544 —** Jasmonic acid enhances drought tolerance by regulating chloroplast-derived ROS dynamics and suppressing stress-induced cellular ROS accumulation in rice.
- **Plant Physiol. 2024, 194, 805-818 —** OsPAP3 regulates chloroplast biogenesis through its role in the PEP complex, thereby controlling tiller formation and grain yield in rice.
- **Plant Physiol. 2021, 187, 1577-1586 —** Auxin regulates root endodermal cell division through PGP1/PGP19-mediated centripetal auxin transport and endodermis-specific auxin responses.

CONTACT

yk3@jnu.ac.kr | +82-62-530-0513

REPRESENTATIVE RESEARCH FIGURES / SCHEMES



