

# Studies on Bioorganic Chemistry Focusing on Plant Peptide Hormones

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Plant peptide hormones, biosynthesized from their corresponding precursors, are now known to regulate many aspects of plant development. A series of research was conducted to identify mature and bioactive plant peptide hormones derived from genes that encode their corresponding precursors, and to clarify their structure-activity relationship.

At the center of shoot apical meristems (SAM), stem cells in higher plants proliferate and supply new cells destined to become various organs while its undifferentiated state is maintained. The *CLV3* gene is expressed specifically in those stem cells, and encodes a 96-amino-acid small protein with N-terminal signal peptide. Genetic studies indicated that its transcript will be processed to become a bioactive peptide that represses the size of SAM. Slices of *CLV3*-overexpressing calli were subjected to “*in situ* MALDI-TOFMS” experiments to identify a dodecapeptide in which two proline residues were hydroxylated. The peptide was designated as MCLV3. Chemically synthesized MCLV3 showed significant bioactivity against shoot and root meristems of *Arabidopsis*. A large series of peptides and their derivatives were synthesized and evaluated those bioactivity and receptor-binding aspects to clarify the structure-activity relationship, and the residues important for receptor binding and/or bioactivity were identified.

Stomata are leaf epidermal structures composed of a pair of specialized cells (guard cells) with a pore between them. The *STOMAGEN* gene encodes a small peptide with a putative secretory-signal sequence at its N-terminus and is expressed preferentially in mesophyll cells of younger leaves in which stomata are differentiated from its precursor cells. A sequence of purification was designed to purify the mature form of the bioactive peptide derived from the gene, and it was purified from apoplastic extract of *Arabidopsis*. Chemical synthesis and structure analyses revealed that the mature peptide (stomagen) is 45-amino-acid peptide with three intra-molecular disulfide bonds.

These findings provide the structural basis for the future studies on the peptide hormones and those related (family) peptides to control the organization of plant organs, capacity of photosynthesis, and drought tolerance.

## References

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