Vacuolar processing system responsible for programmed cell death in plants.

Ikuko Hara-Nishimura
(Kyoto University, Graduate School of Science, Professor)

【Outline of survey】

Apoptotic cell death in animals is regulated by cysteine proteinases called caspases. Recently, we identified vacuolar processing enzyme (VPE) as a plant caspase. However, recent works remind us that a functional homolog of animal caspases does not lead to any homologous way to die in plants. Plants use the vacuole-mediated system that is not seen in animals. VPE is a clue to unravel the molecular mechanism of the vacuole-mediated cell death for both defence and development. Identification of the target proteins of VPE is necessary to solve the proteolytic cascade underlying the cell death. In addition, identification of upstream components of VPE will lead to the detailed the plant-specific signaling pathway. In this project, we plan to do such analysis on the vacuolar proteinase VPE for unraveling the mode of action of the enzyme in both developmental cell death and hypersensitive cell death in plants.

【Expected results】

VPE was originally discovered as a novel cysteine proteinase responsible for the maturation of seed storage protein. Plant VPE is responsible for the maturation or activation of vacuolar proteins. *Arabidopsis* has four *VPE* genes, which are separated into seed type and vegetative type. Up-regulation of the vegetative *VPE* genes during cell death in association with leaf senescence and lateral root formation of *Arabidopsis* implies that VPE is involved in various types of plant cell death. VPE that is induced in dying cells might be involved in various types of vacuole-mediated cell death. Because plants do not have macrophages, dying cells must degrade their materials by themselves. VPE plays an essential role in regulation of the lytic system of plants during the processes of defence and development. VPE is localized in the vacuoles, unlike animal caspases which are localized in the cytosol. Thus, plants might have evolved a regulated cellular suicide strategy that, unlike animal apoptosis, is mediated by VPE and the vacuoles. Evidence from the studies in this project will provide us a new insight into the VPE-mediated cell death.

【References by the principal researcher】

Hatsugai, N., Kuroyanagi, M., Yamada, K., Meshi, T., Tsuda, S., Kondo, M., Nishimura, M. and Hara-Nishimura, I. (2004) A plant vacuolar protease, VPE, mediates virus-induced hypersensitive cell death. **Science** 305: 855-858.

Nakaune, S., Yamada, K., Kondo, M., Kato, T., Tabata, S., Nishimura, M. and Hara-Nishimura, I. (2004) A novel-type VPE, dVPE, is involved in seed coat formation at the early stage of seed development. **Plant Cell,** 17: 867-887.

【Term of project】 FY 2005 - 2009

【Budget allocation】 87,100,000 yen

【Homepage address】 http://smsb.bot.kyoto-u.ac.jp/Reports/4_saibou/index.html