
Preface

All eukaryotic cells, including plants, possess an endomembrane system with multiple membrane-bound organelles of distinct functions. These include the endoplasmic reticulum (ER), the Golgi apparatus, *trans*-Golgi network (TGN), an endosome usually called a prevacuolar compartment (PVC) or alternatively multivesicular body (MVB), and vacuole. It is generally believed that protein secretion in eukaryotes is achieved via a conventional protein secretion (CPS) pathway that involves a COPII-mediated transfer between the ER and the Golgi apparatus, followed by transport through the Golgi stack and finally a secretory vesicle-mediated transfer from the TGN to the plasma membrane (PM). However, recent studies also point to the operation and function of an unconventional protein secretion pathway (UPS) bypassing the above-mentioned secretory organelles and transport vesicles. In addition, recent multiple studies on plants have demonstrated that the secretory system of plants has some unique features. For example, and distinct from yeast and animal cells, the plant TGN and PVC/MVB have been shown to also serve as early and late endosomes respectively. Moreover, multiple unique mechanisms in both CSP and UPS pathways have now been described in plant cells, including a special Golgi-derived secretory vesicle for polar secretion in growing pollen tubes or towards the enlarging cell plate, as well as an exocyst-positive organelle (EXPO) for a unique form of UPS in plant cells.

All these new exciting findings could not have been achieved without the development of new methodologies and their application to various unique plant systems. In order to move the research forward in this area, there is an urgent need for sharing the most up-to-date and detailed experimental protocols for use in future studies. Therefore, the major aims of this book are, first, to provide a general overview and an update on recent developments in protein secretion studies in plants versus yeast and mammalian systems and, second, to provide detailed protocols or methods as well as case studies on the analysis of plant protein secretion using various tools and systems. Included are some unique examples, e.g., modeling of ER protein export, *in vivo* interaction studies using FRET/FLIM, and analysis of pH in the plant secretory organelles, just to name a few.

It has been a great privilege for me to invite a number of experts working in the field of protein secretion, to contribute their protocols or reviews for their collation in a timely book *Plant Protein Secretion*. Their insightful contributions are greatly appreciated, as has been the helpful guidance of the series Editor Prof. John Walker. Lastly, I thank all the graduate students and researchers in my laboratory who have made valuable contributions to our research programs at the Chinese University of Hong Kong (CUHK) since 2000. I am also very grateful for the strong support of supervisors, mentors, collaborators, colleagues, friends, and family.

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