
Preface

The term “membrane trafficking” broadly describes selective transfer of proteins and lipids between membranous structures in both prokaryotes and eukaryotes. In principle this entails two different processes. The first is a myriad of membrane traversing events mediating the translocation of proteins *across* membranes. The other refers to vesicle/membranous carrier-mediated transport *between* eukaryotic organelles in the exocytic/secretory and endocytic pathways (the endoplasmic reticulum, Golgi apparatus, plasma membrane, endosome, and lysosome) as well as other membranous structures such as the nucleus and peroxisomes. Membrane trafficking research has been at the frontier of cell and molecular biology for the past 30–40 years, with easily recognized groundbreaking discoveries and top accolades to its researchers. One of the early greats, George Palade (Nobel Prize in Physiology and Medicine, 1974), had used electron microscopy to morphologically map the secretory pathway. Gunther Blobel (Nobel Prize in Physiology and Medicine, 1999) founded the concept of signal sequences in membrane targeting and transport. Membrane trafficking research in the past 20 years has also witnessed a remarkable convergence and synergism from information gained using genetic approaches in yeast cells and biochemical and molecular approaches in mammalian cells. As a result, the principle molecular components mediating membrane trafficking were identified, with the Lasker in 2002 jointly awarded to Randy Schekman and James Rothman and the Nobel in 2013 to Randy Schekman, James Rothman, and Thomas Südhof. Foundations laid down by studies in membrane trafficking have also aided advances of other fields, for example in understanding of disease conditions such as familial hypercholesterolemia and neurodegenerative diseases.

In 2008, an excellent volume in the *Methods in Molecular Biology* series on *Membrane Trafficking* was brought together by volume editor Ales Vancura and series editor John Walker. It included a compendium of articles describing the state-of-art methods and cutting-edge techniques to study macromolecular transport across and between membranes. The past few years have, however, witnessed many new directions, and importantly, new approaches, in membrane trafficking research. These include the discovery of novel, unconventional trafficking pathways as well as the intersections between the classical exocytic and endocytic pathways with other key cellular processes that are membrane-associated (such as autophagy). The advent of Omics-based technologies to perform genome-wide screens or correlative studies, expression profiling, and array-based interrogation of the genome or the functional transcriptome (e.g., sh/siRNA-based screens) has opened up new analytical dimensions that would allow clearer definition of components and deeper understanding of regulatory networks in membrane trafficking. Finally, technological advances in imaging and microscopy have now provided far greater resolution in space and time and facilitated observations in live cells, in ways that were not possible before. All these new advances, in both the science and the technologies, warrant the production of a new volume on *Membrane Trafficking*.

This new volume, with updates of previous chapters and the inclusion of a large number of new chapters, is divided into three parts. Part I includes biochemical and molecular genetics approaches and methods used in analyzing membrane traffic in both yeast and

mammalian cell models. Part II focuses on imaging and microscopy approaches and techniques, while Part III highlights the Omics-type approaches. We hope that this new volume of *Membrane Trafficking* will be a useful desk reference for both experienced researchers and graduate students/junior scientists in the field of membrane trafficking. Furthermore, we hope the wide coverage of the chapters would also be helpful to researchers in other fields who wish to make an excursion into looking at aspects of membrane trafficking as well as those simply wanting to familiarize themselves with the frontiers of this exciting field.

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