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Preface

Special section on "Protein translocation across or insertion into membranes"

A fundamental problem in molecular cell biology is to understand how newly synthesized proteins reach their proper intracellular address. In many cases, one or even two or three membranes separate the place of synthesis from the final destination. Thus, precursor proteins have to be translocated across or inserted into membranes, a process that is not trivial considering the relatively large size of protein molecules and the hydrophobic core of biological membranes. The protein translocation process is understood to involve information encoded in the protein sequence itself as well as the cellular machinery that decodes this information and delivers the protein to its correct location. Although this solution is rather general, Mother Nature provides many variations to this common theme.

One level of variability is provided by the fact that the cellular protein translocation machineries are actually multi subunit complexes that can adopt themselves to their substrate proteins. Some of these translocases thread precursor proteins across the membrane in their unfolded state while others allow or even require a folded substrate. Even more variability arises from differences in the structure of the actual translocation pore. Structural studies together with biochemical and genetic approaches provided detailed information on the structure–function relationship of some of these protein translocases. In some cases the translocation pore is built from transmembrane helices while in other systems it is composed mainly from one or several membrane embedded β-barrels. It seems that we are only starting to understand the complexity of the fascinating process of protein translocation.

The aim of this special issue on "Protein translocation across or insertion into membranes" is to provide an up-to-date view of the protein-translocation field. The issue includes review articles on the vast majority on the known protein import and membrane integration machineries in different organelles, as well as in different kingdoms and domains of life. The first section deals with protein translocation in prokaryotes and archeae while in the second one import of proteins into various compartments of the eukaryotic cell is discussed. Finally, the third section describes in some detail the biogenesis of proteins residing in various compartments of mitochondria. Among others, the articles in this special issue deal with the energetic aspects of the various translocation processes. The "driving force" for translocation of proteins across or their integration into membranes is discussed. Special emphasis is also given to the evolutionary relationship among the various import systems and to the involvement of membrane lipids in the translocation process.

Naturally, space limitations of this special issue prevent a comprehensive picture on this dynamic field. I hope that the included reviews will provide a general overview for both the specialist and the general reader. I would like to thank all the contributors to this issue for their commitment and enthusiasm, the reviewers for their productive and thoughtful comments and the journal office for the invaluable help.

Dr. Rapaport received his M.Sc. (1992) and Ph.D. (1995) at the Weizmann Institute of Science, Israel. He received a post-doctoral Fellowship with the European Molecular Biology Organization in the laboratory of Dr. Walter Neupert at the University of Munich. Dr. Rapaport spent a year (2000/1) as a Senior Lecturer at the Medical School of the Hebrew University, Jerusalem. Dr. Rapaport's research focuses on the biogenesis and dynamics of mitochondria. Since 2006 Doron Rapaport is a Professor of Biochemistry at the University of Tuebingen, Germany. He also teaches undergraduate and graduate level courses on Biochemistry and Molecular Cell Biology.

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