Preface

Introduction: Peroxisomes

Research on peroxisomes is at an interesting stage. The list of functions attributed to these organelles continues to grow, emphasizing the role of peroxisomes as multipurpose organelle.

It has been well established that the biogenesis of peroxisomes exhibits unique features very different from those of mitochondria and chloroplasts, two organelles that were thought for a long time to be role models, especially for peroxisomal protein sorting. This is illustrated by the post-translational import of folded and even oligomeric proteins into the peroxisomal lumen facilitated by import receptors shuttling between the cytosol and the peroxisome. More than 10 peroxisomal membrane proteins assembled in large dynamic complexes participate in the various steps of the extended receptor cycle.

Although much less is known about the biogenesis of the peroxisomal membrane, there is a substantial amount of evidence that this process follows a very different mechanism than matrix protein import, requiring a different set of proteins. Some key components have been identified. Recent data regarding the longstanding question of whether the endoplasmic reticulum is involved in the biogenesis of the peroxisomal membrane tend to favour a positive answer.

Another especially interesting aspect is the involvement of peroxisomes in health and diseases. Substantial progress has been achieved in analysing the molecular basis for these issues. Human inborn errors in either metabolic or biogenetic pathways of peroxisomes lead to diseases with mostly extremely severe clinical symptoms, reflecting the functional significance of these pathways.

Despite this recent progress, several central issues of peroxisomal protein sorting are not well understood at the molecular level. Understanding how folded proteins of very different sizes cross the peroxisomal membrane whilst it maintains its permeability barrier is a key challenge in the field. Despite the characterisation of many participating proteins, a translocon has not been identified. How proteins are inserted into the peroxisomal membrane and to what extent the endoplasmic reticulum is involved are unclear. The methodological gap largely responsible for this situation has now been closed by the recent development of in vitro assays for the import and export parts of the receptor cycle, as well as the insertion of peroxisomal membrane proteins. The notion that the peroxisomal translocon is a structure of demand with import receptors as integral components is still speculative but opens a new avenue for experiments. The data which have accumulated in recent years from different uni- and multicellular organisms (mammals and plants) regarding these various aspects are discussed in detail in the 41 articles in this special BBA issue summarising the state of the art of peroxisome research.

I am indebted to the many colleagues who contributed to this issue, to those colleagues who acted as reviewers, and especially to those colleagues who collaborated on articles even though their laboratories are sometimes in competition. I am also thankful to the staff of Elsevier for their interest and support in the assembly and timely production of this issue.

All the authors would like to dedicate this special issue to Helmut Kindl on the occasion of his 70th birthday, in honour of his contribution to peroxisomal research in plants. I personally would like to thank him for his continued interest in our peroxisomal research in Bochum, and his much valued advice.

Wolf Kunau
Bochum, Germany
E-mail address: wolf-h.kunau@ruhr-uni-bochum.de.