

Guest Editorial

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Highlight: structure and function of the peroxisomal translocon

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Peroxisomes are single membrane-bound organelles of almost all eukaryotic cells that exhibit features, which clearly distinguish them from most other cellular organelles, including their capability to form *de novo* and their ability to import folded, even oligomeric proteins. Special features of the peroxisomal protein import machinery are cycling import receptors, which shuttle between the cytosol and peroxisomal membrane during protein import. These import receptors recognize and bind their cargo in the cytosol and direct them to a docking complex at the peroxisomal membrane. The current view on the import process is based on the concept of a transient pore, which assembles at the peroxisomal membrane and is disassembled after import, with its components being recycled for further rounds of protein import. At the membrane the receptors insert into the lipid bilayer and assemble with components of the docking complex to form the peroxisomal translocon, which as a transient pore allows translocation of the folded proteins across the membrane. The elucidation of the molecular mechanism of protein transport across the peroxisomal membrane was in the focus of the research unit 1905 ‘Structure and Function of the Peroxisomal Translocon’ (PerTrans), which was supported by the DFG over two funding periods until 2023. This consortium brought together a task force of the German scientists Bettina Warscheid (Würzburg), Christian Eggeling (Jena), Christos Gatsogiannis (Münster), Michael Meinecke (Heidelberg), Stefan Raunser (Dortmund), Michael Sattler (Munich), Harald Platta (Bochum), Richard Wagner (Bremen), Matthias Wilmanns (Hamburg), and Ralf Erdmann (Bochum), who teamed up to explore the structure, function, and dynamics of the peroxisomal protein import machinery. The major aim of this consortium was the elucidation of the basic principle of the

molecular mechanism of peroxisomal protein import. Along this line, the research unit has made substantial contributions to our current understanding of peroxisomal protein import, including the discovery that PTS1- and PTS2-proteins are imported via distinct import pores (Montilla-Martinez et al. 2015), the first STED-microscopy of peroxisomes (Galiani et al. 2016), the discovery of novel peroxisomal import pathways in yeast (Effelsberg et al. 2015, 2016), the suitability of the import machinery as drug target against parasite diseases (Dawidowski et al. 2017), and the structure of the peroxisomal docking complex (Lill et al. 2020).

This Highlight Issue of *Biological Chemistry* covers several aspects of the research of the PerTrans consortium. The eight topics in this issue allude different angles of peroxisomal protein import and highlight the progress that has been made. The topics range from the identification of the human peroxisomal translocon, structural and mechanistic aspects of recognition of cargo proteins by the import receptors, membrane docking of the cargo-loaded receptors, the prominent role of the import receptors in the formation of the translocon, the application of advanced live-cell microscopy and spectroscopy techniques to dynamics of peroxisomal protein import, to the generation of a human knock-out cell library of components of the peroxisomal protein import machinery. The collection of articles published in this Highlight Issue nicely reflects the research interests that are covered by the research in this consortium. The authors in this Highlight Issue all identify challenges to peroxisomal protein import, and in so doing provide several new and exciting opportunities for future research.

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