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Introduction to Protein Targeting and Transport

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The impetus for putting together this special issue entitled "Protein Targeting and Transport" is the recent passing of Günter Blobel in 2018. Günter was one of the pioneers in the protein transport field and opened up the protein transport field with his landmark Signal Hypothesis in 1972. Günter was awarded the Nobel Prize in 1999 for his work on "the discovery that proteins have intrinsic signals that govern their transport and localization in the cell".

Protein transport is a very important field because greater than 25% of all proteins in the cells must cross at least one membrane to arrive at their final location. Elucidating protein transport has a fundamental impact on human health where there are many diseases associated with transport defects. The field is also very influential for the biotechnology industry where the goal is to enhance secretion of a soluble protein or enhance production of an integral membrane protein. In the present health science research area, the key drug and antibiotic targets are integral membrane proteins, so understanding their biogenesis is very crucial. Developments in the protein transport field are also important for scientists studying protein folding since typically proteins are transported across membranes in an unfolded conformation and their transport depends on unfolding and folding processes where chaperones play key roles.

Since the first report of Blobel's Signal Hypothesis, there have been huge developments in the field. Now the structures of many of the molecular machines that function in protein transport are known at atomic resolution. This includes the devices for protein targeting, the translocation machines for transport across the membrane, and ATPases that energize transport through the membrane channels. The three dimensional structures have been solved by X-ray crystallography, NMR and cryo-EM. Real-time imaging techniques now show the features and the dynamics of protein trafficking in living cells.

In this special issue, we will describe the recent advances that have been made in the protein transport area. The first part of the issue will start with the targeting signals that allow proteins to be selected for transport and then concentrate on different methods and approaches that have been used to identify the machineries used for protein transport, the interactions between the components, and the structures of the translocases in the bacterial system. The second part will discuss the molecular mechanisms how proteins are translocated across the inner membrane of the bacterial inner membrane. The third part will focus on insertion of proteins into the ER and quality control events on translocating and folding proteins in the ER lumen. The fourth part will be on protein import into the mitochondria, chloroplasts, and peroxisomes. In the August issue, there will be additional reviews on trafficking of proteins in and out of the nucleus, and on the secretion systems in Gram-negative bacteria.

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