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Current Topics in Membranes - Membranes in Pulmonary Vascular Disease: Volume 82

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Preface

The pulmonary circulation is unique among all other vascular beds. As a low flow, high capacity system it accommodates large changes in cardiac output and facilitates the vital function of blood oxygenation. The pulmonary vasculature is a dynamic tissue and the coordination of cellular, biophysical and chemical signals are necessary for efficient regulation of blood flow. The endothelial cell and its plasma membrane are key to sensing, integrating and responding to these various stimuli. Much more than simply a cell border, the endothelial membrane performs many roles such as housing numerous channels and receptors, formation of signaling mediators and contributing to the barrier between vascular and interstitial spaces. The pulmonary endothelial membrane is critical for normal physiologic function and a deeper understanding of its structure and regulation may hold the key to unlocking new therapies for a variety of pulmonary vascular diseases including pulmonary hypertension and acute lung injury. The previous decades have brought many advances in the field of lung vascular biology and recent developments in cell imaging and biochemical techniques are sure to expand our knowledge further.

The current volume highlights a number of important concepts in the biology of pulmonary endothelial membranes. Vascular barrier integrity is explored from several different perspectives. The membrane associated endothelial glycocalyx as reviewed in detail by LaRiviere and Schmidt is the most apical structure projecting into the vessel lumen and is an important regulator of endothelial integrity during the acute respiratory distress syndrome (ARDS). The notion of endothelial cell shape determining barrier function is described by numerous contributors. The lipid membrane itself serves as a substrate to generate sphingosine-1-phosphate and initiate the signaling cascades that determine barrier function as described in the chapter by Fu, et al. The role of membrane protrusions, or lamellipodia, in the regulation of cell junctions during inflammatory insults is summarized by Alves et al.

while Belvitch et al. examine the dynamic cytoskeletal events necessary to produce these structures.

Lipid membranes are vital to normal cell signaling and dysfunctional endothelial signaling is at the heart of many vascular diseases. The regulation of intracellular calcium and nitric oxide are essential to normal pulmonary endothelial function. The chapter by Zhang et al. illustrates the intricate role of cell membrane cholesterol content in mediating calcium entry during pulmonary hypertension. The endothelial membrane also forms discrete signaling platforms important for a variety of cell functions including endothelial nitric oxide production. Oliveira and Minshall describe this process in detail, including a role for the membrane scaffolding protein caveolin. Finally, the generation of extra cellular vesicles by the endothelial cell membrane are increasingly recognized as key mediators of vascular health and disease. Our rapidly expanding knowledge of these membrane-derived messengers including their formation, composition and contribution to pulmonary disease is the subject of a chapter by Letsiou and Bauer.

This volume of Current Topics in Membranes provides a detailed overview of the role of the pulmonary endothelium in health and disease. A focus on the endothelial membrane identifies a common link between varied cellular processes. We hope the integration of these individual concepts will inspire new investigations to eventually improve our overall understanding of the lung vasculature.