Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids
Volume 1831, Issue 2, February 2013, Pages 448-458

Review

Regulation of lung surfactant phospholipid synthesis and metabolism

Victoria Goss [a], Alan N. Hunt [a, b], Anthony D. Postle [a, b]

[a] Southampton Centre for Biomedical Research, NIHR Respiratory Biomedical Research Unit, University Hospitals Southampton, UK
[b] Clinical & Experimental Sciences, Faculty of Medicine, University of Southampton, Southampton UK

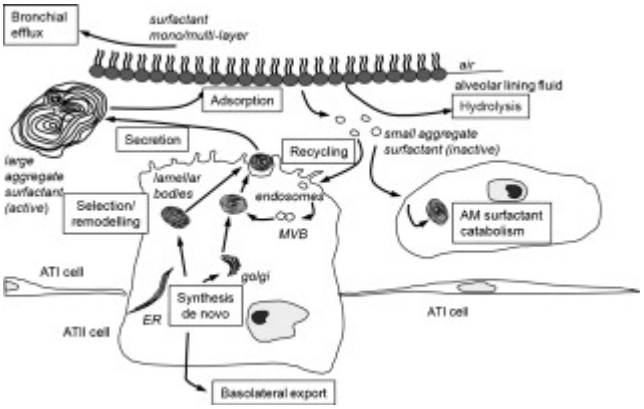
Received 21 June 2012, Revised 24 October 2012, Accepted 14 November 2012, Available online 27 November 2012.

Abstract

The alveolar type II epithelial (ATII) cell is highly specialised for the synthesis and storage, in intracellular lamellar bodies, of phospholipid destined for secretion as pulmonary surfactant into the alveolus. Regulation of the enzymology of surfactant phospholipid synthesis and metabolism has been extensively characterised at both molecular and functional levels, but understanding of surfactant phospholipid metabolism *in vivo* in either healthy or, especially, diseased lungs is still relatively poorly understood. This review will integrate recent advances in the enzymology of surfactant phospholipid metabolism with metabolic studies *in vivo* in both experimental animals and human subjects. It will highlight developments in the application of stable isotope-labelled

precursor substrates and mass spectrometry to probe lung phospholipid metabolism in terms of individual molecular lipid species and identify areas where a more comprehensive metabolic model would have considerable potential for direct application to disease states.

Graphical abstract



Download : Download high-res image (195KB) Download : Download full-size image

Highlights

▸ Normal lung surfactant phosphatidylcholine homeostasis is tightly regulated. ▸ Regulated steps include synthesis, molecular selection, intracellular transport, secretion, reuptake and recycling. ▸ Aberrant regulation is involved in many surfactant pathologies. ▸ Dynamic lipidomic analyses using stable isotopes provide novel insights into the underlying mechanisms. ▸ Lung phospholipid synthesis and turnover are integrated with extra-pulmonary whole body phospholipid metabolism.

Previous Next

Abbreviations

AM, alveolar macrophage; ATII cell, alveolar type II epithelial cell; ABC, ATP binding cassette; BMP, bis(monoacylglycerol)phosphate; CDH, congenital diaphragmatic hernia; CCT, CTP: cholinephosphate cytidylyltransferase; CPT, cholinephosphotransferase; DPPC, dipalmitoyl PC PC16:0/16:0; ESI MS, electrospray ionisation mass spectrometry; GMCSF, granulocyte macrophage colony stimulation factor; INSIG, insulin induced gene; LB, lamellar bodies; C12, laurate; LPCAT1, lysoPC acyltansferase 1; PC16:0/14:0, palmitoylmyristoyolPC; PC16:0/16:1, palmitoylpalmitoleoylPC; PPARγ, peroxisome

proliferator activated receptor gamma; PC, phosphatidylcholine; PE, phosphatidylethanolamine; PEMT, PE-*N*-methyltransferase; PG, phosphatidylglycerol; PI, phosphatidylinositol; PLA_2, phospholipase A_2; RDS, respiratory distress syndrome; SCAP, SREBP cleavage activating protein gene; SREBP, sterol responsive element binding protein; SP, surfactant protein

Keywords

Pulmonary surfactant; Phospholipid synthesis; Stable isotopes; Mass spectrometry