J Mammary Gland Biol Neoplasia
DOI 10.1007/s10911-014-9315-y

PREFACE

Preface

Craig R. Baumrucker · Christiane Albrecht

Biological transport across cellular structures is of great importance to many tissues and organs including the mammary gland. Epithelia are principal cellular barriers that can form single or multiple layers lining the internal and external surfaces of organs. Epithelial cells interact with two external environments, one at each side of the cell, which come in contact with different fluids. This unique arrangement allows epithelial cells to transport components selectively from one side of the epithelial cells to the other surface under specific endocrine and other forms of control. The mammary gland secretory cells are luminal epithelial cells that provide the barrier between components originating from the blood that are transported or secreted by the cells. As a consequence, certain blood constituents can reach much higher concentrations in milk than in blood during defined functional stages of the mammary gland while others are prohibited from leaving the blood circulation.

Fluid secretion has been a research focus of mammary gland biologists because of the secretory product it forms and its importance for neonatal nutrition as well as commercial milk production. As a secretion model, the mammary epithelial cells exhibit highly organized structures with many membrane bound compartments, vesicles and lipid droplets during the secretory phase of development/differentiation [1]. Each of these membrane bound compartments also act as intracellular barriers and are involved in transport of various components necessary for milk formation [2]. The arrangement of the mammary gland and its dynamic control by the endocrine system in its developmental and differentiation states, provides a unique and challenging situation to evaluate transport mechanisms [3].

Organization of this issue of the Journal of Mammary Gland Biology and Neoplasia titled Mammary Gland Biological Transport focused on a list of mammary gland precursors that are critical for function and the transport involved in a successful lactation. With that accomplished, we then had the goal to find researchers competent in the knowledge of these transport systems. Identification of individuals who have active research programs in these topic areas of basic physiology and transport in the mammary gland proved to be difficult, possibly due to the decrease in number of active lactation biologists. A number of factors have contributed to the decline in basic lactation researchers. A primary issue is the availability of funding for basic research, particularly in the mammary gland where the focus has been largely shifted to breast cancer research. As a result, research on the function of the normal mammary gland in various species has been neglected. It is discouraging that basic research has a diminished recognition in the light of its undisputed foundational contribution to research providing human impact. Recently, a publication in this journal reported on a conference that considered defining and refining critical questions of lactation and milk. One priority established that a focus should be centered on the training of future lactation biologists [4]. We concur with this recommendation.

We are delighted to highlight the various research areas that are included in this edition and to have the independent researchers describe their latest findings to a much broader audience than is typically available to them. We are hopeful that these topics will inspire others to follow in these research areas, because all suggest the need for continuation. Finally, we are confident that many researchers who read these chapters will find new ideas and "research gems" within these

C. R. Baumrucker (✉)
Department of Animal Science, Penn State University, 302 Henning Bldg, University Park, PA, USA
e-mail: crb@psu.edu

C. Albrecht
Institute of Biochemistry and Molecular Medicine, University of Bern, Bühlstr. 28, 3012 Bern, Switzerland
e-mail: christiane.albrecht@ibmm.unibe.ch

Published online: 11 February 2014

articles that will have impact upon their future work regardless of their topic area.

This edition of JMGB&N covers basic mammary gland nutrient transport which is necessary for the formation of milk nutrient components; glucose, aminonitrogen, and lipids. Zhao provides information on mammary glucose uptake that is passive or facilitated transport and the multiple transporters involved in lactation. Shennan and Boyd provide details of the knowledge of amino acid and peptide transports systems and question how the transport coordination is orchestrated to support lactation requirements. McManaman considers phospholipid and fatty acid transport and delineates the multiple and integrated lipid transport processes that occur in mammary cells during lactation. Ontsouka and Albrecht provide insights into cholesterol transport and the nature of ABC transporters, which provide evidence of a bi-directional process at the basal side of the mammary epithelial cell. The topics of mineral and vitamin transport demonstrate the ability of the mammary gland to transport these components, along with required components for function of the tissue. These manuscripts are supported by changes in cellular organization and maintenance of mammary cell capacity to provide transport functions with tight junctions and water channels. McCormick et al. focus on Zinc as one of the most abundant trace elements in biological systems. Zinc's role in multiple cellular processes are explored and the family of transporters and ion channels described. Montabetti et al. provide a general review of epithelial paracellular and transcellular pathways of transport, while considering trace minerals and vitamin transport, and focus on recent advances in calcium channels and transports systems. Mobasheri and Barrett-Jolley review aquaporins, differential expression in physiological states, and consider the entry of glycerol via the AQP3 protein. These previously described assessments of transport systems leads to manuscripts on biological systems that provide transport of various components into, out of, and across the mammary gland. Baumrucker and Bruckmaier provide new insights into the transcytosis process involved in colostrogenesis. Their new evidence challenges the current concepts of colostrum formation and its regulation. Truchet and Ollivier-Bousquet consider the role of SNARE proteins during lactation, and give insights on the pathways for exocytosis of secretory vesicles, milk fat globules and how SNARE and SNAP receptors regulate these processes. Stelwagen and Singh provide the basic function of tight junctions to act as a barrier, providing delineation between the basal and apical membranes of the luminal epithelial cells. The potential intracellular signaling role of tight junctions in mammary gland function is thought provoking. Finally,Marshall et al provide an interesting discussion of serotonin during pregnancy and lactation homeostasis. A recent link with serotonin and PTHrP connects mammary lactation regulation with calcium mobilization during the early lactation period.

We are grateful to the contributors for their willingness to contribute their expertise to this edition of the Journal of Mammary Gland Biology and Neoplasia.

Reference

1. Mather IH, Keenan TW. The cell biology of milk secretion: historical notes. J Mammary Gland Biol Neoplasia. 1998;3: 227–31.
2. Linzell JL. Mammary blood flow and methods of identifying and measuring precursors of milk. In: Larson BL, Smith VR, editors. Lactation, a comprehensive treastise. New York: Academic; 1974. p. 143–225.
3. Friedman MH. Principles and models of biological transport. New York: Springer; 2008.
4. Neville MC, Anderson SM, McManaman JL, Badger TM, Bunik M, Contractor N, et al. Lactation and neonatal nutrition: defining and refining the critical questions. J Mammary Gland Biol Neoplasia. 2012;17(2):167–88. doi: 10.1007/s10911-012-9261-5.