

PROCEEDINGS - PART I

SEVENTH INTERNATIONAL CONGRESS OF BIORHEOLOGY
NANCY, FRANCE, 18-23 JUNE 1989

SYMPOSIUM: CELLULAR AND MOLECULAR ASPECTS OF MUCUS AND CILIA

INTRODUCTION

Edith Puchelle

Unité 314 INSERM, Reims, FRANCE

It is a great honor and pleasure to have been asked by Jean-François STOLTZ, President of the International Society of Biorheology, to organize a Symposium on "Cellular and Molecular Aspects of Mucus and Cilia", during the Seventh International Congress of Biorheology in Nancy.

This Symposium aims to be a continuation of the Symposium that our friend Pedro VERDUGO organized on "Cellular and Molecular Basis of Mucus Rheology", held during the Sixth International Congress of Biorheology, in Vancouver, Canada, in 1986. Pedro VERDUGO had the idea of covering a wide range of themes, from the physical and biochemical to the cellular and molecular aspects of the mucus, collected from a spectrum of different species ranging from slugs to human subjects. During the Vancouver Symposium, the structure of mucins had been largely discussed and cell culture had already appeared as a promising path to the knowledge of the secretory products released by the epithelial cells.

Although mucins from different epithelia are generally considered as a unitary system, involving a multitude of carbohydrate chains linked to a peptidic backbone, questions still remain, regarding not only the diversity of the carbohydrate chains, but also the real unity of the peptidic backbone. There are current hypotheses and supporting evidence that the diversity of mucin carbohydrate chains is not the result of hazard, and that such a diversity may reflect the extraordinary adaptive capacity of the secretory epithelial cells. Because of the complexity of the epithelial cells, the mechanisms of regulation, as well as the specific functions of the different cells (either ciliated, non-ciliated or secretory cells) remain poorly understood. New cellular approaches and new molecular tools have to be used for advancing knowledge of mucus mechanisms of synthesis and release.



DANIEL SANDOZ
1941 - 1990

Two Plenary Lectures, related to this Symposium, were presented. One was given by Alex SILBERBERG (Israel) on "Mucociliary transport". The other Plenary Lecture, by Daniel SANDOZ (France), was on the "Organization of the cytoskeleton in mucociliary epithelium".

Just when this Symposium is going to press, I have learned with great sadness of the death of Daniel SANDOZ. He was Professor of Cell Biology in Paris, Head of the Cellular Biology Centre, CNRS, at Paris/Ivry and Chief Editor of the Journal "Biology of the Cell"

Daniel SANDOZ was a pioneer in his field of research. His research group published numerous well-known papers on ciliogenesis, as well as on the organisation and function of the cytoskeleton in metazoan ciliated cells. He was hospitalized a few months after this Symposium.

Daniel SANDOZ gave an excellent Plenary Lecture on the "Organization of cytoskeleton in mucociliary epithelium", but was unable to complete it for publication.

This Symposium is dedicated to his memory.

The first part of the Symposium is devoted to molecular biophysics and biochemistry of mucin secretion, the mucin precursors and the regulation of mucin gene expression. Although the mucins represent the main macromolecular fraction present in mucus, we should be aware that other constituents, such as proteins, low molecular glycoproteins and lipids, are also present. The lipids have recently been identified in culture medium, where respiratory epithelial cells were cultured. Several questions still remain unanswered : Do specific secretions synthesize lipids and which lipids are secreted ? Are these lipids bound to other molecules and when does this association take place ? What is their potential role in the surface properties of mucus and, in particular, do they interfere in the transport of mucus ? All these questions are dealt with in the second part of the Symposium. The maturation of the mucociliary clearance in relation to the maturation of airway bioelectric function, as evaluated by the transepithelial potential difference, will also be discussed.

The second part of the Symposium concerns the cilia-mucus interaction. Several questions are considered in the presentations as well as in their discussions : 1) How do ciliated cells adapt for the propulsion of mucus ? 2) What are the factors (physical properties of mucus, mechanical stimulation, diffusible messengers) controlling the metachronal wave of cilia ? 3) How may calcium concentration

regulate both mucus secretion and ciliary activity ? It is likely that the function of the ciliated cells is not limited to the ciliary beating and transport of mucus, but that it may participate in a secretory function. Cell culture, either organotypic or primary culture, represents a very promising tool for studying epithelial cell differentiation, secretion release, as well as ciliary movement and cilia-mucus interaction. Time-lapse videomicroscopy and automated image analysis undoubtedly furnishes additional information in the analysis of mucin kinetic hydration, as well as in the analysis of the ciliary metachronism and movement.

Finally, I thank all colleagues for their participation in this Symposium. My particular thanks go to SYNTHELABO for its financial support.