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Defense of Mucosal Surfaces: Pathogenesis, Immunity and Vaccines

Edited by J.-P. Kraehenbuhl and M.R. Neutra

With 30 Figures and 10 Tables



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Cover Illustration: The mouse Peyer's patch is of tissue from a ligated loop that was injected with reovirus Type 1 and collected 1 hour later. An M cell and adjacent enterocyte is shown. The photomicrograph is by Richard Weltzin.

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Preface

Mucosal surfaces of the gut, the airways and the urogenital tract are covered by epithelial tissues that form tight barriers between a highly regulated internal compartment and a rapidly changing external environment. To maintain the integrity of these vulnerable cellular barriers mucosal surfaces have acquired specialized innate and adaptive defense mechanisms, including a major branch of the immune system. The mucosal immune system is anatomically and functionally distinct from that found elsewhere in the body, in that it has developed specialized processes for antigen uptake, transport, processing and presentation as well as specialized immune effector mechanisms such as polymeric immunoglobulin secretion. Distinctive immune effector cells which are produced in response to antigens and pathogens sampled in mucosal lymphoid tissues acquire a specific homing program which allows them to return to mucosal sites. In addition, mucosal tissues act as primary lymphoid organs where lymphocytes develop *de novo* from immature precursors, undergo rearrangement of their antigen receptor genes, and differentiate into effectors involved in the protection of epithelia and modulation of immune functions.

The role of mucosal immunity in the defense against infectious agents has been recognized for decades, but progress in this field has been hampered by the technical difficulty of analyzing immune effectors in mucosal tissues, and by the lack of appropriate *in vitro* systems which include epithelial, lymphoid and antigen-presenting cells. The spatial organization of lymphoid tissue in mucosal surfaces of the gut or the airways is the result of complex interactions between the microorganisms, the mucosal epithelium, and the cells of the immune system. We are only beginning to understand the nature of the cross-talk.

Such information is essential for rational design of vaccines that can be targeted into mucosal tissues. To date, most studies in this area have been restricted to animal models, and the few reported clinical studies indicate that the mouse and human mucosal immune systems differ in their response to both subunit

and live mucosal vaccines. One message emerging from the overview of mucosal vaccines in this volume is that much more effort should be devoted to elucidating how antigens and vaccines are processed in mucosal tissues of humans.

Mucosal immunology encompasses a vast field that includes areas of developmental biology, epithelial cell and molecular biology, molecular and cellular immunology, microbiology, virology, and vaccinology. Since this body of information is rapidly expanding, an integration of current knowledge is needed for experts in each field and nonspecialists alike. This volume on mucosal immunity and vaccines presents up-to-date and concise discussions of the key components of the mucosal immune system, mechanisms of microbial-epithelial cell interactions, and basic science relevant to mucosal vaccination. The volume begins with chapters reviewing the organization of mucosal lymphoid tissue, epithelial antigen sampling and antigen presentation in mucosal tissues, induction of immune responses and/or tolerance in mucosal tissues, and the role of immune effectors in protecting mucosal sites. The next chapters review microbial-host interactions, focusing specifically on viruses and bacteria that infect mucosal tissues. Finally the role of mucosal adjuvants in promoting efficient mucosal responses and the properties of subunit and live mucosal vaccines are discussed.

It is our hope that the multidisciplinary effort represented by this volume will be a valuable resource for researchers, clinicians and students who need clear distillation of basic concepts and a guide to the wide-ranging literature in this very active research area.

Jean-Pierre Kraehenbuhl
and Marian Neutra

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