
Preface

The lipopolysaccharide (LPS) is the major component of the outer leaflet of the outer membrane of Gram-negative bacteria. It contributes essentially to the integrity and stability of the outer membrane, represents an effective permeability barrier towards external stress factors, and is thus indispensable for the viability of bacteria in various niches, including animal and plant environment. On the other hand, the presence of the LPS on the cell surface is beneficial for the host as it serves as a pathogen-associated molecular pattern recognized by, and thus activates, the host immune system resulting normally in elimination of the pathogen. Being unable to get rid of the LPS, bacteria evolved various mechanisms for LPS structure modification to make them invisible for the immune system and resistant to defense factors such as complement and antibiotics. This highlights the LPS as the most variable cell wall constituent.

Since its discovery in the late 19th century the LPS, then named endotoxin, has attracted the curiosity of many researchers virtually in all fields of life science such as medicine, microbiology, pharmacology, chemistry, biochemistry, biophysics, immunology, cell biology, and genetics. Attesting this in part, more than 71,000 and 79,000 publications are cited in PubMed at the beginning of 2011 using LPS and endotoxin as queries, respectively. LPS has also attracted interest in biotechnology and the pharmacological industry for the development of diagnostic and therapeutic methods and reagents.

Early in the history of endotoxin, it was appreciated by Peter L. Panum in 1874 that putrid fluids contained a water-soluble, alcohol-insoluble, heat-resistant, non-volatile substance, which was lethal to dogs. Later, Richard Pfeiffer, a disciple of Robert Koch, showed that *Vibrio cholerae*, the cause of cholera, produced a heat-stable toxic substance that was associated with the insoluble part of the bacterial cell, coining the name “endotoxin” (from the Greek ‘endo’ meaning ‘within’). Through pioneer discoveries by Otto Westphal, Otto Lüderitz, Hiroshi Nikaïdo and Mary J. Osborn in the mid 1950s, we learned that the endotoxin corresponds to the LPS. Efficient purification protocols of the LPS were elaborated and principles of its structural organization, genetics and biochemistry were then established. These early studies propelled a long and productive road of chemical and biochemical research to reveal the details of structure and biosynthesis of each of the components of the LPS molecule. In parallel a large body of work resulted in the biological

characterization of the LPS in terms of its function as a potent elicitor of innate immune responses. This work culminated with the discovery by Bruce Beutler of the mouse gene encoding the TLR4 receptor molecule and the subsequent elucidation of the structural basis of the activation of the immune system by the LPS.

The purpose of this book is not to provide a comprehensive examination of all aspects related to the LPS but rather to give an up to date overview of research that applies to its chemistry, biosynthesis, genetics, and activities toward eukaryotic cells from structural and mechanistic perspectives.

Yuriy A. Knirel
Miguel A. Valvano

Bacterial Lipopolysaccharides
Structure, Chemical Synthesis, Biogenesis and
Interaction with Host Cells

Knirel, Y.A.; Valvano, M.A. (Eds.)

2011, XI, 440 p., Hardcover

ISBN: 978-3-7091-0732-4