

**MEDICAL
INTELLIGENCE
UNIT**

Molecular Mechanisms of Phagocytosis

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MOLECULAR MECHANISMS OF PHAGOCYTOSIS

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For Roberto and Arturo

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Chapter 3

PREFACE

Phagocytosis, the internalization of large particles by cells, is present in unicellular organisms, which use phagocytosis to eat, all the way to complex pluricellular animals in which special phagocytic cells represent a fundamental part of defense mechanisms. Phagocytosis was first described by the Russian scientist Elie Metchnikoff in the late 1800s, nearly 120 years ago, and it has been studied ever since. In spite of this, only in recent times we began to really understand the molecular basis of this cell function. Because phagocytosis is a very complex process, research about it is done in multiple fronts. So our current knowledge about phagocytosis is found in many different places, mainly articles in scientific journals. This book represents an effort to bring together much of the recent information available about this important cell function. To achieve this, I invited several brilliant scientists who actually investigate phagocytosis on a daily basis, to write chapters. Their contributions resulted in this book, which now puts their knowledge in a single place.

This book describes the various steps of the phagocytic process from initial cell contact, through internalization of the foreign particle, to the final phagosome formation where the phagocytosed particle is destroyed. Each chapter deals with one of these steps and emphasizes the molecules that participate at each step of the process. We begin by providing a general overview of phagocytosis in the chapter "Diversity in phagocytic signaling". Next the chapter "Phagocytosis in immunity" talks about the important role of this cell function in the immune system. The chapters "Fc Receptors and phagocytosis" and "Complement receptors, adhesion, and phagocytosis" describe the major groups of phagocytic receptors, namely receptors for antibodies and complement. Then the chapter "Adding complexity to phagocytic signaling" points out that phagocytosis is not an all-or-nothing response, but rather a function that varies according to the cell and molecules involved. The following chapters deal with specific groups of molecules that have been identified as important regulators of phagocytosis. The chapter "GTPases in phagocytosis" tells us about these molecules and their role in changing the cytoskeleton to bring about the changes in cell shape needed during phagocytosis. The chapter "Role of FcRIIb and phosphatases in phagocytosis" describes the negative effect of this receptor and phosphatases on this process. The chapter "Phospholipases and phagocytosis" indicates how these enzymes participate in activating phagocytic signals and in remodeling the cell membrane. The chapter "Calcium signaling in phagocytosis" describes all that we know today about the role of this ion during the phagocytic process. Finally, the chapter "Phagosome maturation" tells us how phagocytosis continues far beyond the internalization of the particle and describes how the phagosome is formed.

Each chapter can be read independently, but all chapters are connected to bring together several points of view on the same biological function. The book provides in this way a complete modern vision of phagocytosis.

Carlos Rosales
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