
Preface

Immunology has made significant progress in the past decade, driven forward by rapidly advancing technology and a renewed interest in the vast realm of innate immunity. As the understanding of immune mechanisms matures, so too does the perception of the biological purpose to which these systems are directed; immunity not only provides a check on pathogenesis, but also serves as a primary regulator of all forms of microbial symbiosis, the necessity, complexity, and ubiquity of which is becoming increasingly apparent. The receptors that mediate these functions are at the front lines of both the protective and regulative roles of the immune system, and the techniques used to characterize these proteins are the subject of this volume.

In the strictest sense, immune receptors are those proteins that form the link between the immune system and the outside world. These molecules either make direct contact with nonself or are evolutionarily tuned to respond indirectly to the presence of microbes by their sensitivity to correlative cellular disturbances. The repertoire of many of these recognition proteins can be viewed as an evolutionary snapshot of an ever-changing and unstable process in which pathogenic microbes are constantly breaking the receptor – nonself linkage in order to evade detection. Other immune receptors may form more evolutionarily stable associations with conserved microbial targets (e.g., interactions between microbial pattern molecules and TLRs). Links to commensal microbes are possibly a primary force in maintaining and containing these interactions. The most dynamic versions of nonself receptors are those of the adaptive immune system (e.g., T cell receptors and immunoglobulins) which diversify on the time-scale of the individual.

Immune receptors mediate biological decisions with acute and dire consequences. Activation can elicit a cascade of cytotoxic events that require tight control. An immune response may be the “lesser of two evils” when appropriately activated or catastrophic when inappropriately launched. As such, immune decisions are the end results of complex processes of signal integration. This integration takes place both on the level of multireceptor complexes positioned at the initiation of signal generation and through coalescence of inputs at control points that are further downstream. The logic of signal integration lends specificity and flexibility to immunity that is only beginning to be understood.

The contributions to this volume address a variety of experimental approaches to the characterization of immune receptors and the cell biology that mediates their functions. These include imaging techniques that aim to understand receptor localization and trafficking, techniques to measure receptor–ligand interactions, techniques to identify novel ligands, methods for the analysis of downstream signaling, as well as strategies for comprehensive genomic and proteomic characterization of immune receptors. Some of these techniques are specific for particular receptor subjects while others are broadly applicable to entire categories of proteins. The intent of the volume is that each of these technical descriptions and protocols will be useful both to investigators who are interested in carrying out these procedures and to those who seek a deeper understanding of the bench science that lies behind the immunology literature.

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<http://www.springer.com/978-1-61779-138-3>

Immune Receptors

Methods and Protocols

Rast, J.P.; Booth, J.W.D. (Eds.)

2011, XI, 301 p. 64 illus., Hardcover

ISBN: 978-1-61779-138-3

A product of Humana Press