Chapter

Introductory Chapter: Background Summary Regarding Neutrophils

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1. Neutrophils: important immune cells in health and diseas

Neutrophils are key players in the innate and the adaptive immunity and contribute to the pathogenesis of various infectious and noninfectious conditions. These cells have the capability of performing various effector functions and therefore are considered an important therapeutic target for many conditions. They are considered the fastest immune cells in our body and the first to arrive to the inflammatory site. This occurs in response to a wide variety of chemoattractive agents, such as CXC chemokines [keratinocyte-derived cytokine (KC), macrophage inflammatory protein-2 (MIP-2)], lipid mediators [leukotriene B_4 (LTB_4) and platelet-activating factor (PAF)], the complement split product (C5a), and the bacterial toxin formyl-met-leu-phe (fMLP)] [1]. Neutrophils use different intracellular signaling pathways in their migrative behavior which are dependent on the type of chemoattractant they encounter [1–3].

These immune cells also play an important role in the recognition of various pathogens through specific cell surface and cytoplasmic receptors including toll-like receptors (TLRs) and nucleotide oligomerization domains (NODs). In addition, they can also recognize opsonized particles through the complement receptors and mediate antibody-dependent cell cytotoxicity (ADCC) through their interaction with immunoglobulin receptors [4–6]. They can also mediate microbial killing through oxygen-dependent and oxygen-independent mechanisms. In response to various ligands, this results in a dramatic increase in oxygen consumption due to the activation of nicotinamide adenine dinucleotide phosphate (NADPH) oxidase system leading to the generation of various reactive oxygen (e.g., superoxide anion radical) [7] and nitrogen (through nitric oxide synthase; NOS) intermediates [8]. This can not only aid in microbial killing but also contribute to the pathogenesis of various inflammatory and cancerous conditions (through the generation of peroxynitrite). The non-oxidative arm of neutrophil killing is mediated through the action of antimicrobial peptides and proteases present in various compartments of azurophilic (primary), specific (secondary), gelatinase, and secretary granules [9–13].

This book provides recent evidence regarding the role of cannabinoid receptors (CR-1 and CR-2) and different subtypes of the immunoglobulin receptor FcγRs in the pathogenesis, diagnosis, and treatment of various diseases of infectious and noninfectious origin. Furthermore, the differential expression pattern of CD16 + CD11b + receptors on the surface of neutrophils and their role in the diagnosis of acute viral and bacterial infections will also be highlighted. Finally, the utility of using different chemiluminigenic probes for the detection of NADPH activity for the circulating blood neutrophils and their role in determining the in vivo state of host inflammatory activation will be highlighted in this book.

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