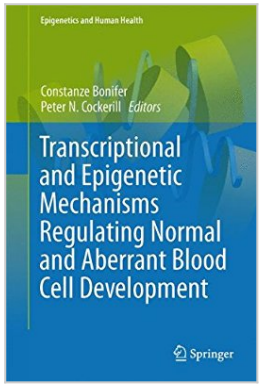

Transcriptional and Epigenetic Mechanisms Regulating Normal and Aberrant Blood Cell Development (Epigenetics and Human Health)

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During vertebrate hematopoiesis many specialized cell types are formed with vastly different functions such as B cells, T cells, granulocytes, macrophages, erythrocytes and megakaryocytes. To tightly control the enormous proliferative potential of developing blood cells, an intricately balanced signaling and transcription network has evolved that ensures that the different cell types are formed at the right time and in the right numbers. Intricate regulatory mechanisms ensure that blood cells function properly and have a determined life span. Moreover, in the adaptive immune system, long-lived memory cells have evolved that ensure that when pathogens have been seen once they will never cause a problem again. In this book we will therefore make a journey from asking how more primitive organisms use the epigenetic regulatory machinery to balance growth with differentiation control towards digging deep into what controls the function of specialized cells of the human immune system. We will first discover that flies make blood but exist without blood vessels, why fish make blood cells in the kidney and which precise genetic circuitries are required for these developmental pathways. We will then learn the regulatory principles that drive the differentiation of mature blood cells from stem cells and what controls their function in mammals. In the process, we will find out what unites hematopoietic stem cells and endothelial cells. Finally, we will shed light on the molecular mechanisms that either alter hematopoietic cell differentiation or lead to the development of cells with impaired function.

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Editorial Review

From the Back Cover

In recent years, great progress has been made in the identification of the molecular players involved in the epigenetic control of gene expression during development. The work of many laboratories has established that regulating the interplay of transcription factors with chromatin components is the major driver of cellular differentiation. Because of their single cell nature and ease of purification, much of what we have learnt about these processes in animals has been delivered based on cellular models within the hematopoietic system. The blood cell system evolved from a few simple cell types in more primitive organisms that provide oxygen transport and carry out phagocytosis into the complex hematopoietic system of mammals, containing many specialized cells types with vastly different functions, such as B cells, T cells, granulocytes, macrophages, erythrocytes, and megakaryocytes. This book describes the intricate processes involved in the development of blood cells across a range of organisms from drosophila and fish at one end, and mammals at the other end. It contains individual chapters devoted to describing the epigenetic and transcriptional mechanisms regulating hematopoiesis in the different organisms and orchestrating the differentiation of a wide variety of cell types. Different chapters describe the function of lymphocytes, macrophages and red blood cells and the molecular players, i.e. transcription factors and the epigenetic regulatory machinery driving their differentiation. Most importantly, the book not only describes normal processes, such as the rearrangements of antigen receptor genes, and the regulation of genes by various mechanisms such as DNA methylation, but also outlines what happens when these processes function abnormally to precipitate diseases such as leukemia and immune disorders.

Users Review

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