

# BLOOD CELLS

## AN ATLAS OF MORPHOLOGY

(WITH CLINICAL RELEVANCE)

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# Dedication and Acknowledgement

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Eugene P Cronkite, MD (in memory of)  
Allen J. Erslev, MD (in memory of)

Bong Hyun, MD, DSc (Retired)  
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Gene Gulati, PhD, SH(ASCP)

I would like to dedicate *Blood Cells* to the memory of Professor Allan J. Erslev, who was instrumental in my career as a Hematologist and Scientist and who was the mentor of so many Hematologists now working all around the world.

Jaime Caro, MD

# Preface

Blood cells come in different sizes and shapes in health and in disease. The degree of such a variation in health is relatively small but it may become significantly larger in certain conditions. To be successful in practice of Hematology, be it in a classroom, laboratory, clinician's office, outpatient clinic, or an inpatient unit of a hospital, it is important for every practitioner to be familiar with the characteristics and clinical relevance of individual normal and abnormal cells and with the morphologic findings associated with various clinical conditions. This atlas is designed to provide such information in a concise and clinically relevant manner for students, teachers, and practitioners of hematology at all levels.

Examination of an appropriately prepared and stained blood smear often provides information that is helpful in ruling in or out clinically suspected condition(s). At times, it may even provide a definite diagnosis not suspected from the clinical findings. In order to detect, identify, and relate all blood cell findings to specific clinical condition(s), the examiner should be either familiar with all features of all normal and abnormal cells along with those of artifacts which may mimic blood cell abnormalities and/or at least have available near the microscope a handy source of reference to guide him/her in such an endeavor. This manuscript describes in a concise, yet succinct, manner almost all blood smear findings a practitioner of hematology may encounter in his/her practice. The vast collection of photomicrographs presented in this manuscript represents the lifetime experience of the authors in their practice of Hematology, with significant contribution from Bong H. Hyun, MD, the mentor of the primary author. The authors have attempted to present the microphotographs in the form actually encountered in daily practice rather than selecting only the best appearing. The trainees in Hematology will find the basics provided in the manuscript invaluable in the learning process while the practitioners will find the entire atlas to be a useful resource for teaching and/or daily practice.

*Blood Cells* is organized into four sections. Artifacts, artifactual changes in blood cells, contaminants, and miscellaneous findings, along with an approach to blood smear examination, are covered in the first section. The morphology and clinical relevance of red cells, white cells, and platelets, and their respective precursors, both normal and abnormal, are described in the second section. The third section illustrates morphology of various organisms/parasites encountered in blood smears. Salient hematologic findings with emphasis on morphologic changes associated with various disorders/conditions are discussed in the last section. The fifth section compares and contrasts blood cells with their mimics, citing helpful distinguishing features throughout. The Comparative Reference Values and Features portion tabulates comparative laboratory findings and features of all blood cells, their precursors and various hematologic disorders.

A special feature of *Blood Cells* is the presentation of normal and abnormal morphology of individual cell types in proximity, wherever possible. Another exclusive feature of *Blood Cells* is that (in order to be all-inclusive to the extent feasible) the authors have, without worrying about redundancy, utilized multiple cases to illustrate morphologic features associated with individual clinical conditions. The chapters are organized in a logical manner thus making it easy for the reader to find and pursue a desired subject matter.