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## Preface

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Histology is the science of tissues and as such histology studies cells and tissues of organs using a variety of techniques. Histology goes back more than 200 years when the French surgeon Bichat used the term “tissues,” followed by the introduction of the term “histology” by Karl Meyer in the early nineteenth century. Among the early histologists were Camillo Golgi and Santiago Ramon y Cajal who presented the wonders of cellular building blocks to the world and started to elaborate the structure of cell and tissue specimens, specifically nerve cells. From their time to today’s most sophisticated analysis of cell structure and function, microscopes and imaging techniques have undergone an exciting evolution that allows us to understand microscopic details and cellular function at the molecular level. Histological techniques are used in different disciplines: research, teaching, and clinical applications. This book explores the research currently being carried out at the molecular, subcellular, and cellular levels, both in normal and pathological processes, from genetic mechanisms to intra- and intercellular signaling. This book includes cutting-edge research reviews and descriptions of technological advances to modify bodily cells and tissues. Targeted at students and researchers in biological, medical, and related disciplines, this book will provide an overview of the work being done in this field, and will highlight any gaps and areas that would benefit from further exploration.

The book contains eight chapters in four sections and presents reviews in different areas of histology written by experts in their respective fields. Basic histology, cell biology, histopathology, and histological techniques are featured prominently as a recurring theme throughout several chapters. This book will be a most valuable resource for histologists, cell biologists, pathologists, and other scientists alike. In addition, it will contribute to the training of current and future biomedical scientists who find histology and its associated disciplines as fascinating as many generations before them.

Chapter 1 introduces the topic of this book by discussing histological processing and preparation of tissues. Thereby, the chapter familiarizes the reader with histological microtechniques, including tissue acquisition, fixation, dehydration, clearing, infiltration, embedding, microtomy, section acquisition, and staining.

In Chapter 2, authors discuss the histological, cellular, and molecular mechanisms that govern early epithelium development in the thymus. The authors emphasize the resemblance of the thymus with the process of branching morphogenesis and tubulogenesis that occurs in other epithelial organs such as those derived from the gut such as the mammary gland, salivary glands, lungs, kidneys, and pancreas. These organs repeatedly fold to reach an enlarged area, which is necessary to perform their major functions, namely, gas exchange, excretion,

nutrient transport, and others. It is epithelial–mesenchyme interactions that determine the tissue patterning through specific combinations of common molecular signaling pathways.

Chapter 3 reviews the umbilical cord as one of the most important anatomical structures in the development of animals due to its participation in the exchange of nutrients and protection of structural vessels. The author describes research on histological characteristics of the constituents of the umbilical cord to improve our understanding of the main histological differences found among mammals. The chapter is of benefit not only to veterinary medicine but also to all pathologists and surgeons studying reproduction.

Chapter 4 addresses the secretion of one of our bodily fluids, saliva, by the salivary glands in the oral cavity. The authors review the tubuloacinar structure of salivary glands and the acini as their functional units. The authors explore the duct system of salivary glands and compare the three major salivary glands, namely, the parotid, submandibular, and sublingual gland. In addition, the authors describe various minor salivary glands. A discussion of the functional role of saliva for oral and general health is included in the chapter.

In Chapter 5, authors address a major health problem, namely, that a bacterium, *Helicobacter pylori*, leads to the most common chronic bacterial infections in the world. About half of the world's population is infected with the bacterium. The bacteria move into the digestive tract where they can cause ulcers in the lining of the stomach or upper part of the small intestine or even cause stomach cancer. In the clinic, correct diagnosis and effective treatment of *H. pylori* gastric infection are essential in controlling this infection. The authors review available diagnostic methods, the eradication therapy of *H. pylori* infection, antibiotic resistance, and antimicrobial susceptibility tests. The authors describe a prospective study to analyze patients with *H. pylori* gastric infection with positive histology and positive culture versus positive histology and negative culture.

In Chapter 6, authors explore remodeling of the periodontal ligament (PDL). The authors describe remodeling of the PDL with bone marrow-derived cells (BMCs) through BMC migration into the PDL using a green fluorescent protein (GFP) bone marrow-transplanted model mouse. The authors review how BMCs have the ability to migrate and differentiate into tissues and organs in the body. The authors include immunohistochemical data for the GFP-positive cells in the PDL.

In Chapter 7, author combines histology, morphology, and pathology to explore an abnormality of the lateral meniscus of the knee, the discoid meniscus. The author focuses on the microstructure of the discoid meniscus with respect to content and arrangement of collagen fibers. The cartilage portion of the meniscus is different in shape, thickness, and collagen proportion. Even though this abnormality was first described over 130 years ago, the origin is still unknown. Given that the discoid meniscus is typically asymptomatic, little is known about its epidemiology. This chapter helps to understand its histological and cell biological basis.

In Chapter 8, authors review histological research techniques, specifically mass spectrometry. It is used for the identification of biomarkers using pathologic samples such as blood and urine analyses. It has limited use for tissue analysis. The authors describe several recent technological developments such as matrix-assisted laser desorption/ionization, which has been applied to mass spectrometry analysis for the identification of diagnostic markers and pharmacological monitoring for drug delivery systems. In this chapter, the authors introduce mass spectrometry imaging using formaldehyde-fixed paraffin-embedded tissues. As

the authors point out, these new strategies and analytical methods are useful for the study of drug pharmacokinetics, metabolism, discovery of biomarkers, and treatment-specific effects on the proteome.

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