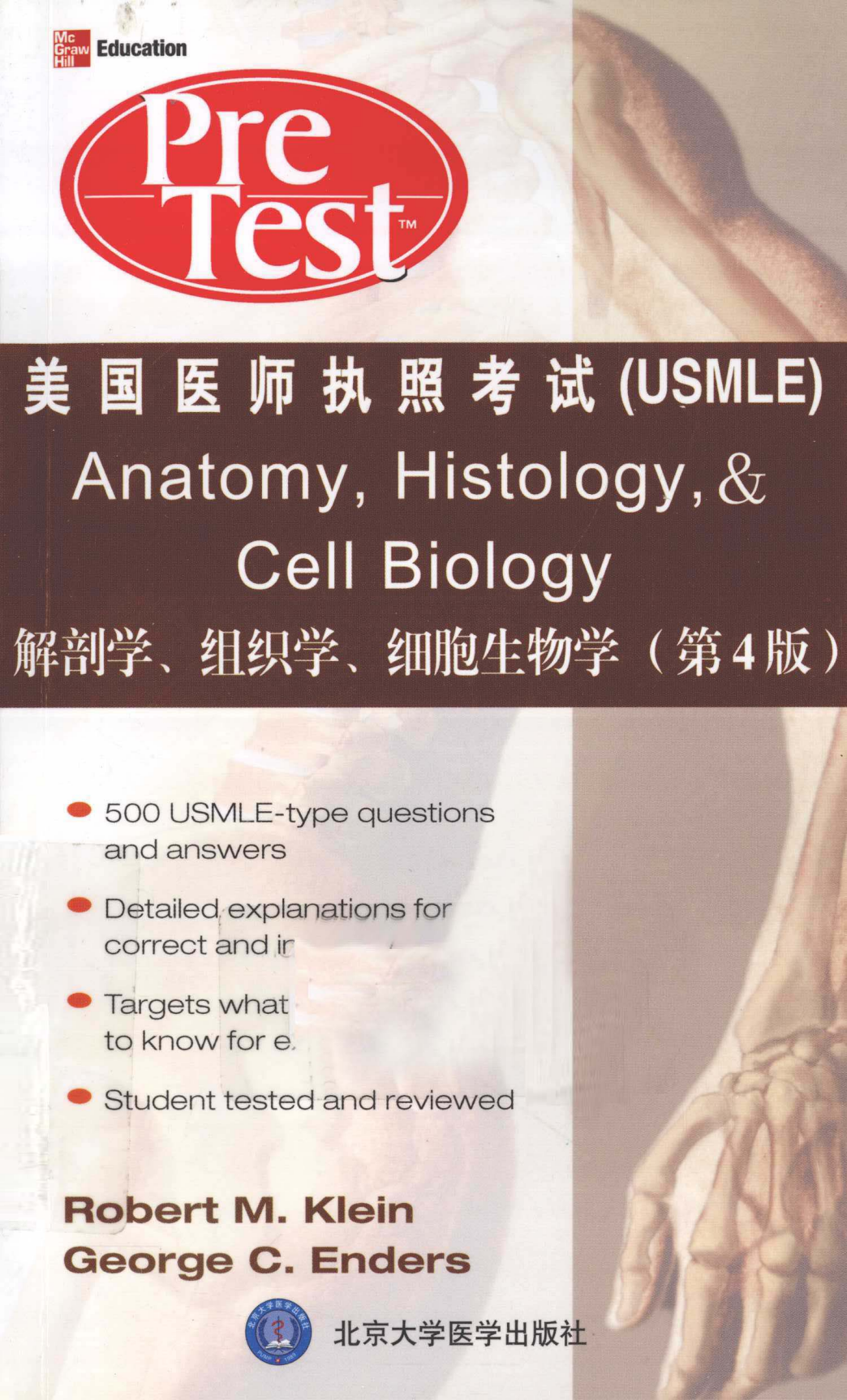
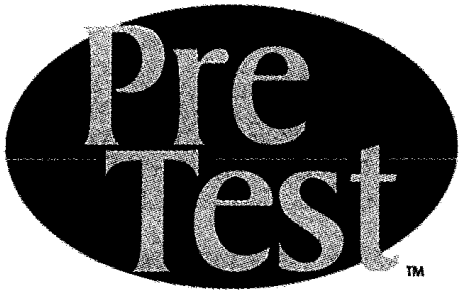

Mc Graw Hill Education
Pre Test™
美国医师执照考试(USMLE)
Anatomy, Histology, & Cell Biology
解剖学、组织学、细胞生物学（第4版）
500 USMLE-type questions and answers
Detailed explanations for correct and ir
Targets what to know for e
Student tested and reviewed
Robert M. Klein
George C. Enders
北京大学医学出版社



解剖学、组织学、细胞生物学

（第4版）

Anatomy, Histology, and Cell Biology

New York Chicago San Francisco Lisbon London Madrid Mexico City
Milan New Delhi San Juan Seoul Singapore Sydney Toronto

北京大学医学出版社

图书在版编目（CIP）数据

解剖学、组织学、细胞生物学＝Anatomy，Histology and Cell Biology：英文/（美）克林（R. M. Klein），（美）恩德尔斯（G. C. Enders）编写．—影印本 —北京：北京大学医学出版社，2010. 5
（美国医师执照考试丛书）
ISBN 978-7-81116-938-6

Ⅰ.①解… Ⅱ.①克… ②恩 Ⅲ.①人体解剖学—医师—资格考核—美国—自学参考资料—英文 ②人体组织学—医师—资格考核—美国—自学参考资料—英文 ③人体胚胎学—医师—资格考核—美国—自学参考资料—英文 ④人体细胞学：细胞生物学—医师—资格考核—美国—自学参考资料—英文 Ⅳ.①R32

中国版本图书馆 CIP 数据核字（2010）第 079170 号

北京市版权局著作权合同登记号：01-2010-2404

Robert M. Klein，George C. Enders
Anatomy，Histology and Cell Biology：PreTest™ Self-Assessment and Review，Fourth Edition
ISBN 978-0-07-162343-8

解剖学、组织学、细胞生物学（第 4 版）

编　　写：Robert M. Klein，George C. Enders
出版发行：北京大学医学出版社（电话：010-82802230）
地　　址：（100191）北京市海淀区学院路 38 号　北京大学医学部院内
网　　址：http://www.pumpress.com.cn
E - mail：booksale@bjmu.edu.cn
印　　刷：北京东方圣雅印刷有限公司
经　　销：新华书店
责任编辑：冯智勇　**责任校对**：齐　欣　**责任印制**：张京生
开　　本：889mm×1194mm　1/32　**印张**：21　**字数**：543 千字
版　　次：2010 年 6 月第 1 版　2010 年 6 月第 1 次印刷
书　　号：ISBN 978-7-81116-938-6
定　　价：76.00 元

出版说明

美国医师执照考试（United States Medical Licensing Examination，USMLE）是针对全世界各国医学院的学生或毕业生，欲到美国从医的执照考试，考试全部为选择题，采用计算机考试。考试分为：

Step 1（第一阶段）：考察医学基础学科知识，包括解剖学 Anatomy，生理学 Physiology，生物化学 Biochemistry，微生物学 Microbiology，病理学 Pathology，药理学 Pharmacology，遗传学 Genetics，营养学 Nutrition，神经科学 Neuroscience 等。

Step 2（第二阶段）：

（1）临床医学知识（Clinical Knowledge，CK）：包括内科学 Medicine，外科学 Surgery，妇产科学 Obstetrics and Gynecology，儿科学 Pediatrics，神经病学 Neurology，家庭医学 Family Medicine，急诊医学 Emergency Medicine，预防医学 Preventive Medicine 等。

（2）临床技能（Clinical Skill，CS）：要通过 Step 1、Step 2 及 TOEFL 之后才能报考，主要是考察考生的临床实践操作知识。

Step 3（第三阶段）：测试考生的实际工作能力。内容包括采集病史、体格检查、诊断、治疗措施，以及医疗法规等。

USMLE 在北京、上海和广州设有考点，在中国大陆可参加 USMLE Step 1 和 USMLE Step 2 CK 的考试。考试介绍及报名情况可参见 http：//www. ecfmg. com

为了帮助有志于参加 USMLE 的考生更好地复习，北京大学医学出版社全面引进了 McGraw Hill 公司的两个著名 USMLE 复习品牌丛书：PreTest 系列、FIRST AID 系列。这两套丛书经过多次再版，受到世界各地考生的欢迎。本次引进的均为其最新版本。

当前，我国很多医学院校在进行英文授课、考试的改革，本书对国内从事英语授课、考试的教师和学生也有重要的参考价值。为广大的医学生和医务工作者比较中美医学教育和自己掌握的知识提供参考。同时，该书也是学习专业英语的好教材。

北京大学医学出版社

Student Reviewers

Jodie Bachman
UMDNJ School of Osteopathic Medicine
Class of 2011

Benjamin Chidester
Eastern Virginia Medical School
Class of 2011

Monique Cunningham-Lindsay
UMDNJ School of Osteopathic Medicine
Class of 2011

Jeffrey A. Klein
University of Kansas, School of Medicine
Class of 2010

Andrew Schlachter
University of Kansas, School of Medicine
Class of 2009

J. Eva Selfridge
University of Kansas, School of Medicine
Class of 2012

Gustaf Van Acker III
University of Kansas, School of Medicine
Class of 2012

To my wife, Beth, and our children Melanie, Jeffrey, and David, for their support and patience during the writing and revision of this text; and to my parents, Nettie and David, for their emphasis on education and the pursuit of knowledge.

—RMK

To Sally Ling, MD, an incredibly hard working and considerate person whom I am lucky enough to call my wife. She has given us three great children, Carolyn, Tyler, and Robert who keep me on my toes; and to my mother and my father who always encouraged "the boys" to do our best.

—GCE

Preface

In this fourth edition of *Anatomy, Histology, and Cell Biology: PreTest® Self-Assessment and Review*, a significant number of changes and improvements have been made. This PreTest® reviews the anatomical disciplines encompassing early embryology, cell biology, histology of the tissues and organs, as well as regional human anatomy of the head and neck, thorax, abdomen, pelvis, extremities, and spine. Major neuroanatomical tracts are outlined in the High-Yield Facts section, but most pathway questions have been eliminated in favor of more high-yield topics in embryology, histology, and human anatomy. Extensive neuroanatomical tract and pathway-related questions can be found in the new seventh edition of *Neuroscience: PreTest® Self-Assessment & Review*.

This new edition of *Anatomy, Histology, and Cell Biology: PreTest®* represents a comprehensive effort to integrate the anatomical disciplines with clinical scenarios and cases. The development of numerous clinical vignettes, integrating basic science disciplines with clinical medicine, will benefit students enrolled in medical schools with integrated curricula, as well as students in discipline-based programs of study. The sections on cell biology and microscopic anatomy have been updated to include important new knowledge in cell and tissue biology and to focus on cell biological principles relevant to clinical medicine. New and improved light micrographs have been added. Also new for this fourth edition is the addition of more radiographs and MRIs. Those radiological methods have become an important part of medical practice. It is imperative that students be able to recognize structures and relationships as part of their radiological anatomy knowledge base. This fourth edition is designed to help students prepare for USMLE Step 1, Subject Exams in Human Anatomy and Histology, and even USMLE Step 2 in which the NBME plans to integrate more basic science questions.

An updated High-Yield facts section is provided to facilitate rapid review of specific areas of anatomy that are critical to mastering the difficult concepts of each subdiscipline: embryology, cell biology, histology of tissues and organs, regional human (gross) anatomy, pathology, and a brief review of neuroanatomical tracts. Most tables and figures have been moved from individual question feedback to the High-Yield facts section so that all review information is available in one concise location instead of dispersed throughout the book.

Introduction

Anatomy, Histology and Cell Biology: PreTest® Self-Assessment and Review allows medical students to comprehensively and conveniently assess and review their knowledge of anatomy, histology, embryology, and cell biology. The 500 questions provided here in have been written with the goal to parallel the topics, format, and degree of difficulty of the questions found in the United States Medical Licensing Examination (USMLE) Step 1. Although the main emphasis of this PreTest is preparation for Step 1, the book will be very beneficial for medical students during their preclinical courses whether they are enrolled in a medical school with a problem-based, traditional, or integrated curriculum. This *PreTest®* focuses on an interdisciplinary approach incorporating numerous clinical scenarios so it will also be extremely valuable for students preparing for USMLE Step 2 who need to review their anatomical knowledge. Practicing physicians who want to hone their basic science skills and supplement their knowledge base before USMLE Step 3 or recertification will also find this book to be an outstanding resource for their review of the anatomical disciplines.

This book is a comprehensive review of early embryology, cell biology, histology (tissue and organ biology), and human (gross) anatomy with some neuroanatomical topics reviewed in the High-Yield facts section. In keeping with the latest curricular changes in medical schools, as much as possible, questions integrate macroscopic and microscopic anatomy with cell biology, embryology, and neuroscience as well as physiology, biochemistry, and pathology. This *PreTest®* begins with early embryology, including gametogenesis, fertilization, implantation, the formation of the bilaminar and trilaminar embryo, and overviews of the embryonic and fetal periods. This first section is followed by a review of basic cell biology, with separate chapters on membranes, cytoplasm, intracellular trafficking, and the nucleus. There are questions included to review the basics of mitosis and meiosis as well as regulation of cell cycle events. Tissue biology is the third section of the book, and it encompasses the tissues of the body: epithelium, connective tissue, specialized connective tissues (cartilage and bone), muscle, and nerve. Organ biology includes separate chapters on respiratory, integumentary (skin), digestive (tract and associated glands), endocrine, urinary, and male and female reproductive systems, as well as the eye and the ear. The topics in tissue and organ histology and cell biology include light and electron micrographs of appropriate structures that students should be able to

identify. The last section of the book contains questions reviewing the basic concepts of regional anatomy of the head and neck, thorax, abdomen, pelvis, and extremities. For each section, appropriate x-rays, including MRIs, are included to assist the student in reviewing pertinent radiological aspects of the anatomy. Where possible, information is integrated with development and histology of the organ system.

Each question in the book is followed by five or more answer options to choose from. In each case, select the one best response to the question. Each answer is accompanied by a specific page reference to a text that provides background to the answer, and a short discussion of issues raised by the question and answer. A bibliography listing all the sources can be found following the last chapter.

Acknowledgments

The authors express their gratitude to their colleagues who have greatly assisted them by providing light and electron micrographs as well as constructive criticism of the text, line drawings, and micrographs. They also acknowledge Eileen Roach and Phillip Shafer for their painstaking care in the preparation of photomicrographs. Thanks to Drs Gregory A. Ator, Amy Klion, Ann Dvorak, Anne W. Walling, Christopher Maxwell, Dale R. Abrahamson, Daniel Friend, David A. Sirois, David F. Albertini, Don W. Fawcett, Linda R. Nelson, Erik Dabelsteen, George Varghese, Giuseppina Raviola, H. Clarke Anderson, J.E. Heuser, John K. Young, Julia Neperud, K. Hama, Kristin M. Leiferman, Kuen-Shan Hung, Louis Wetzel, Michael J. Werle, Nancy E.J. Berman, Per-Lennart Westesson, Robert P. Bolender, Ronal R. MacGregor, Stanley L. Erlandsen, WenFang Wang, Christopher J. Wilbert, Wolfram Sterry, and Xiaoming Zhang for their contribution of micrographs and ideas for question development. Also, thanks to the Jeffrey Modell Foundation and The Primary Immunodeficiency Resource Center for use of the Martin Causubon case. Thanks to Debra Collins for her genetics consult. The authors remain indebted to their students and colleagues at the University of Kansas Medical Center, past and present, who have challenged them to continuously improve their skills as educators.

—RMK

—GCE

Contents

Integumentary System

Gastrointestinal Tract and Glands

Endocrine Glands

Reproductive Systems

Urinary System

Eye and Ear

Head and Neck

Thorax

Abdomen

Pelvis

Extremities and Spine

High-Yield Facts

Embryology

Embryological development is divided into three periods:

The **first stage** consists of **gamete formation** and maturation, ending in fertilization.

The **embryonic period** begins with fertilization and extends through the **first 8 weeks** of development. It includes implantation, germ layer formation, and organogenesis. This is the critical period for susceptibility to **teratogens.**

The **fetal period** extends from the **third month** through birth.

THE PRENATAL PERIOD

The **development of gametes** begins with the duplication of chromosomal DNA followed by two cycles of nuclear and cell division **(meiosis).**

Genetic variability is assured by **crossing over** of DNA, **random assortment** of chromosomes, and **recombination** during the first meiotic division. Errors can result in duplication or deletion of all or part of a specific chromosome, often with serious developmental consequences.

Spermatogenesis

The process of spermatogenesis is **continuous** after puberty and each cycle lasts about 2 months.

Spermatogonia in the walls of the seminiferous tubules of the testes undergo mitotic divisions to replenish their population and form a group of spermatogonia that will differentiate to form spermatocytes.

Primary spermatocytes are spermatogenic cells that have duplicated their DNA (4N) and enter meiosis.

Secondary spermatocytes result from the first meiotic division (2N).

Spermatids are formed by the second meiotic division (1N).

Spermiogenesis

During this phase, spermatids mature into sperm by losing extraneous cytoplasm and developing a head region consisting of an **acrosome** (specialized secretory granule) surrounding the nuclear material and grow a tail.

Oogenesis

Oogenesis begins in the fetal period in females and is a discontinuous process involving mitosis, meiosis, and maturation.

Oogonia undergo mitotic division and duplicate their DNA to form **primary oocytes,** but stop in the prophase of the first meiotic division until puberty.

The second meiotic division is not concluded until fertilization occurs.

Maturational events include retention of protein synthetic machinery in the surviving oocyte, formation of **cortical granules** that participate in events at fertilization, and development of a protective glycoprotein coat, the **zona pellucida.**

Fertilization

Fertilization occurs when sperm and oocyte cell membranes fuse. Following coitus, exposure of sperm to the environment of the female reproductive tract causes **capacitation,** removal of surface glycoproteins and cholesterol from the sperm membrane, enabling fertilization to occur.

Binding of the first sperm initiates the **zona reaction.** Release of **cortical granules** from the oocyte causes biochemical changes in the zona pellucida and oocyte membrane that prevent polyspermy.

EMBRYONIC DEVELOPMENT

The embryo forms one **germ layer** during each of the first 3 weeks. During the first week the **cleavage** divisions form a **morula.** The **blastocyst** forms by **compaction** and precursors of the **inner cell mass (embryoblast)** and **trophoblast** are segregated. The blastocyst must "hatch" or exit the investment of the zona pellucida. Implantation is initiated during the first week of development.

During the second week, the **blastocyst** differentiates into two germ layers, the **epiblast** and the **hypoblast.** This establishes the dorsal (epiblast)–ventral (hypoblast) body axis of the **bilaminar embryonic disc.** Week 2 is the "week of 2s:"

- Two major cell groups exist: embryoblast and trophoblast.
- The embryoblast (inner cell mass) forms the hypoblast layer adjacent to the blastocyst cavity and the epiblast adjacent to the amniotic cavity.

- The trophoblast differentiates into two layers: cytotrophoblast (an inner mononuclear cell layer) and syncytiotrophoblast (an outer multinuclear cell layer).
- Two cavities are established: the amniotic cavity and the primitive yolk sac.
- Uteroplacental circulation develops. Two structures are involved: sinusoid (capillary) = maternal blood vessel in endometrium and lacuna = embryonic blood vessel in syncytiotrophoblast.

During the third week, the process of **gastrulation** occurs, by which epiblast cells migrate toward the **primitive streak** and ingress to form the **endoderm** and **mesoderm** germ layers below the remaining epiblast cells **(ectoderm). Somite formation** begins at day 20.

The fourth week of development is characterized by organogenesis as the **primordia of most organ systems** are established. The body tube is formed by **embryonic folding. Lateral body folding** at the end of the third week causes the germ layers to form three concentric tubes with the innermost layer being the **endoderm**, the **mesoderm** in the middle, and the **ectoderm** on the surface. **Neurulation** also occurs during the fourth week, leading to the formation of a **neural tube** with overlying surface ectoderm.

GERM LAYER DERIVATIVES

Mesoderm Derivatives

The mesoderm is divided into four regions (from medial to lateral): axial, paraxial, intermediate, and lateral plate.

Chordamesoderm is located in the midline and forms the notochord.

Paraxial mesoderm forms **somites.** Somites are divided into **sclerotomes** (bone and cartilage precursors), **myotomes** (muscle precursors), and **dermatomes** (precursor of dermis).

Intermediate mesoderm gives rise to components of the genitourinary system.

Lateral plate mesoderm forms bones and connective tissue of the limbs and limb girdles (**somatic layer,** also known as **somatopleure**) and the smooth muscle lining viscera and the serosae of body cavities (**splanchnic layer,** also known as **splanchnopleure**).

Intermediate mesoderm is *not found* in the head region, and the lateral plate mesoderm is *not divided* into layers there (Table 1).