医学教育改革系列教材

LABORATORY MANUAL

Microbiology, Parasitology and Immunology

Chief Editor Liping Zhang

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Chief Editor

Liping Zhang

Associate Chief Editors

Jing Yang Qun Zheng Mingjie Wen

Reviewers

Yuanzhi Guan Siqi Lu

Contributors

Hui Chen	Yuan Gu	Xiujuan He	Qingli Kong
Yun Li	Jun Long	Shaohua Wang	Wei Wang
Yisong Wang	Junfei Wei	Mingjie Wen	Jing Yang
Yaping Yang	Liping Zhang	Xulong Zhang	Qun Zheng
Junping Zhu			

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医学教育改革系列教材编委会

《病原生物学与免疫学实验》编委会

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Foreword

Global developments in medicine and health shape trends in medical education. And in China education reform has become an important focus as the country strives to meet the basic requirements for developing a medical education system that meets international standards. Significant medical developments abroad are now being incorporated into the education of both domestic and international medical students in China, which includes students from Hong Kong, Macao and Taiwan that are taught through mandarin Chinese as well as students from a variety of other regions that are taught through the English language. This latter group creates higher demands for both schools and teachers.

Unfortunately there is no consensus as to how to improve the level and quality of education for these students or even as to which English language materials should be used. Some teachers prefer to directly use original English language materials, while others make use of Chinese medical textbooks with the help of English language medical notes. The lack of consensus has emerged from the lack of English language medical textbooks based on the characteristics of modern medical education in China.

In fact, most Chinese teachers involved in medical education have already attained an adequate level of English language usage. However, English language medical textbooks that reflect the culture of the teachers would in fact make it easier for these teachers to complete the task at hand and would improve the level and quality of medical education for international students. In addition, these texts could be used to improve the English language level of the medical students taught in Chinese. This is the purpose behind the compilation and publishing of this set of English language medical education textbooks.

The editors in chief are mainly experts in medicine from Capital Medical University (CCMU). The editorial board members are mainly teachers of a variety of subjects

from CCMU. In addition, teachers with rich teaching experience in other medical schools are also called upon to help create this set of textbooks. And finally some excellent scholars are invited to participate as final arbiters for some of the materials.

The total package of English medical education textbooks includes 63 books. Each textbook conforms to five standards according to their grounding in science; adherence to a system; basic theory, concepts and skills elucidated; simplicity and practicality. This has enabled the creation of a series of English language textbooks that adheres to the characteristics and customs of Chinese medical education. The complete set of textbooks conforms to an overall design and uniform style in regards to covers, colors, and graphics. Each chapter contains learning objectives, core concepts, an introduction, a body, a summary, questions and references that together serve as a scaffold for both teachers and students.

The complete set of English language medical education textbooks is designed for teaching overseas undergraduate clinical medicine students (six years), and can also serve as reference textbooks for bilingual teaching and learning for 5-year, 7-year and 8-year programs in clinical medicine.

We would like to thank the chief arbiters, chief editors and general editors for their arduous labor in the writing of each chapter. We would also like to acknowledge all the contributors. Finally, we would like to acknowledge Higher Education Press. They have all provided valuable support during the many weekends and evening hours of work that were necessary for completing this endeavor.

President of Capital Medical University
Director of English Textbook Compiling Commission
Zhaofeng Lu
August 1st, 2011

Preface

This laboratory text is used to guide the students' learning and training of microbiology, parasitology and immunology lab techniques, procedures and experiments. The outcome expected is students' capacity of doing research in laboratory of microbiology, parasitology and immunology.

The manual consists of two parts: Part Ⅰ—outlines the 8 basic experiments. Part Ⅱ—outlines the 21 comprehensive experiments of microbiology, parasitology and immunology. The involved experiments are designed to help enhance and deepen the students' understanding of microbiology, parasitology and immunology.

This laboratory manual is designed to meet the needs of foreign students at Capital Medical University(CMU) in Beijing. LABORATORY MANUAL Microbiology, Parasitology and Immunology is also a reference for all the students taking the pathogenic biology & immunology experiments.

Liping Zhang
May, 2012

Contributors

Hui Chen 陈辉

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 3, 13

Yuan Gu 顾园

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 11(Ⅳ), 17(Ⅳ, Ⅴ)

Xiujuan He 何秀娟

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiment 6

Qingli Kong 孔庆利

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 5(Ⅱ), 24

Yun Li 李蕴

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiment 25

Jun Long 龙军

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiment 5(Ⅲ)

Shaohua Wang 王少华

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiment 4

Wei Wang 王炜

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 5(Ⅰ), 7

Yisong Wang 王一松

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 2, 20, 22

Junfei Wei 魏骏飞

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 11(Ⅲ), 17(Ⅰ, Ⅱ, Ⅲ)

Mingjie Wen 温铭杰

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 23, 26

Jing Yang 杨静

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 11(Ⅰ, Ⅱ, Ⅴ), 17(Ⅵ)

Yaping Yang 杨雅平

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 14, 18, 19

Liping Zhang 张力平

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 1, 10

Xulong Zhang 张须龙

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 27, 28

Qun Zheng 郑群

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 8, 9, 12, 21

Junping Zhu 朱俊萍

School of Basic Medical Sciences

Capital Medical University, Beijing, China

Experiments 15, 16

Laboratory Safety and Laboratory Regulations

In the medical microbiological and parasitological laboratory, you will deal with potentially dangerous pathogens. For the safety and convenience of everyone working in the laboratory, the followed laboratory rules are important:

1. A lab coat should be worn and buttoned while in the laboratory. You must wear shoes that cover the tops of your feet to prevent injury from broken glass, spilled chemicals, and dropped objects. Sandals are not permitted in the lab! Long hair should be tied back.

2. No food, drinks are permitted to be carried into the laboratory at any time. Don't touch your mouth and nose with any object in laboratory. Mouth pipetting is strictly forbidden in the laboratory. Keep your hands away from your mouth and eyes.

3. Since some of the microorganisms used in this class are pathogenic or potentially pathogenic (opportunistic), it is essential to follow proper aseptic technique in handling and transferring all organisms.

4. Take only a laboratory manual, notebook and pen to the workbench. All other items should be safely stored in authorized clean areas in order to avoid damage or contamination.

5. Be very carefully when doing experiments. Avoid spilling material and contaminating your skin, eyes or clothing. Dispose of all used hazardous biological materials in the appropriate waste containers.

6. Return all chemicals, reagents, cultures, and glassware to their appropriate places. Slides, cultures or instruments are not allowed to carry out of the teaching room without authorization.

7. Clean the laboratory bench space and turn off all equipment, heat sources, light, water and close windows and doors before leaving the laboratory. Wash your hands thoroughly before leaving the laboratory.

8. In case of accident, report immediately to your lab instructor so that appropriate measures may be taken. If you are injured in the lab, immediately contact your course instructor.

I have read and understood the above rules and agree to follow them.

Signed _____ Date _____

Name (Please print) _____

CONTENTS

Part 1

Basic Experiments

Experiment 1

Observation of Bacterial Morphology

▪ Objectives

(1) To learn how to use oil immersion objective lens to observe the morphology of bacteria.

(2) To understand the basic shapes and special structures of bacteria.

Ⅰ. Using Oil Immersion Lens of the Microscope

▪ Principle

Bacteria are relatively small in size, usually on the order of 1 μm in diameter. Bacteria can be visible only under light microscope employed with a 100-power objective lens with 10-power ocular lens.

Normally, when light waves travel from one medium into another, they bend. Therefore, as the light travels from the glass slide to the air, the light waves bend and are scattered similar to the "bent pencil" effect when a pencil is placed in a glass of water. The microscope magnifies this distortive effect. Also, if high magnification is to be used, more light is needed.

Immersion oil has the same refractive index (1.515) as glass (1.52), therefore, provides an optically homogeneous path between the slide and the lens of the objective. Light waves thus travel from the glass slide, into glass-like oil, into the glass lens without being scattered or distorting the image (Fig. 1-1). In other words, the immersion oil "traps" the light and prevents the distortion effect that is seen as a result of the bending of the light waves.

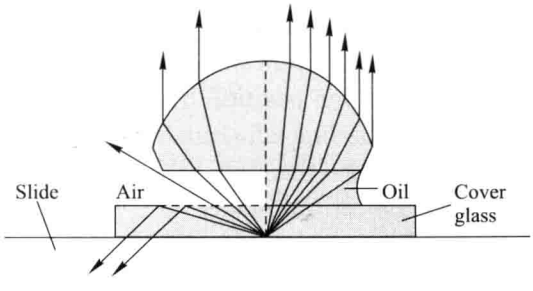

Fig. 1-1 The working principle of oil immersion objective lens

▪ Procedures

1. The identification of oil immersion objective lens(Fig. 1-2)

(1) The oil immersion objective lens is the longest.

(2) There are some marks on oil lens, such as objective magnification "100×", the numeric aperture "NA 1. 25"and "Oil".

(3) Oil immersion objective lens has a black and white band.

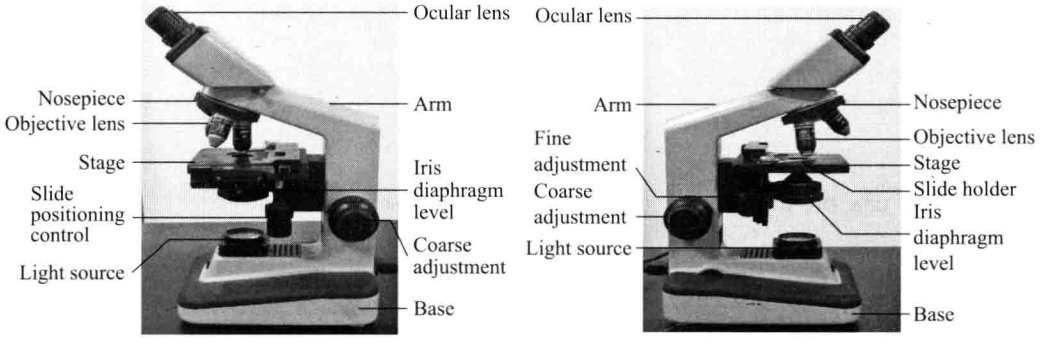

Fig. 1-2 An Olympus microscope

2. The procedure for using oil immersion objective lens

(1) Setting the focus

To switch on the power and open the aperture fully. Raise condenser to the same high level as the stage. Rotating the revolving nosepiece to make sure that the low power objective lens is clicked into place. Adjustment of light intensity may be necessary. The light should be strong when stained samples are observed, whereas the light should be weak when the unstained samples are observed.

(2) Observation of specimens using low-power objective lens

Lower the stage to its lowest position using the coarse focusing knob. Place the slide on the stage and hold it with a pair of stage clips. Locate desired portion of specimen in the center of the field. Rotate the coarse adjustment knob to raise the stage to the highest. While looking through the eyepiece, use the coarse-adjustment knob to lower the stage slowly to focus on the slide. After the outline of the specimens appear, turn the fine-adjustment knob until the object is in sharp focus. If there is no specimen visible, it is probably not in the field of view. Move the slide so that the specimen is directly over the condenser lens. Center the specimen in the field of view.

(3) Observation of specimens using high-power objective lens

Rotate the high-power objective into the position over the slide. While looking through the eyepieces, use only the fine adjustment knob to obtain a sharp image. Moving the stage clips to make the slide around until the area you wish to examine to be located at the central stage.

(4) Observation of slide using oil immersion objective lens

Rotate the objectives so that there is not a lens directly over the slide.