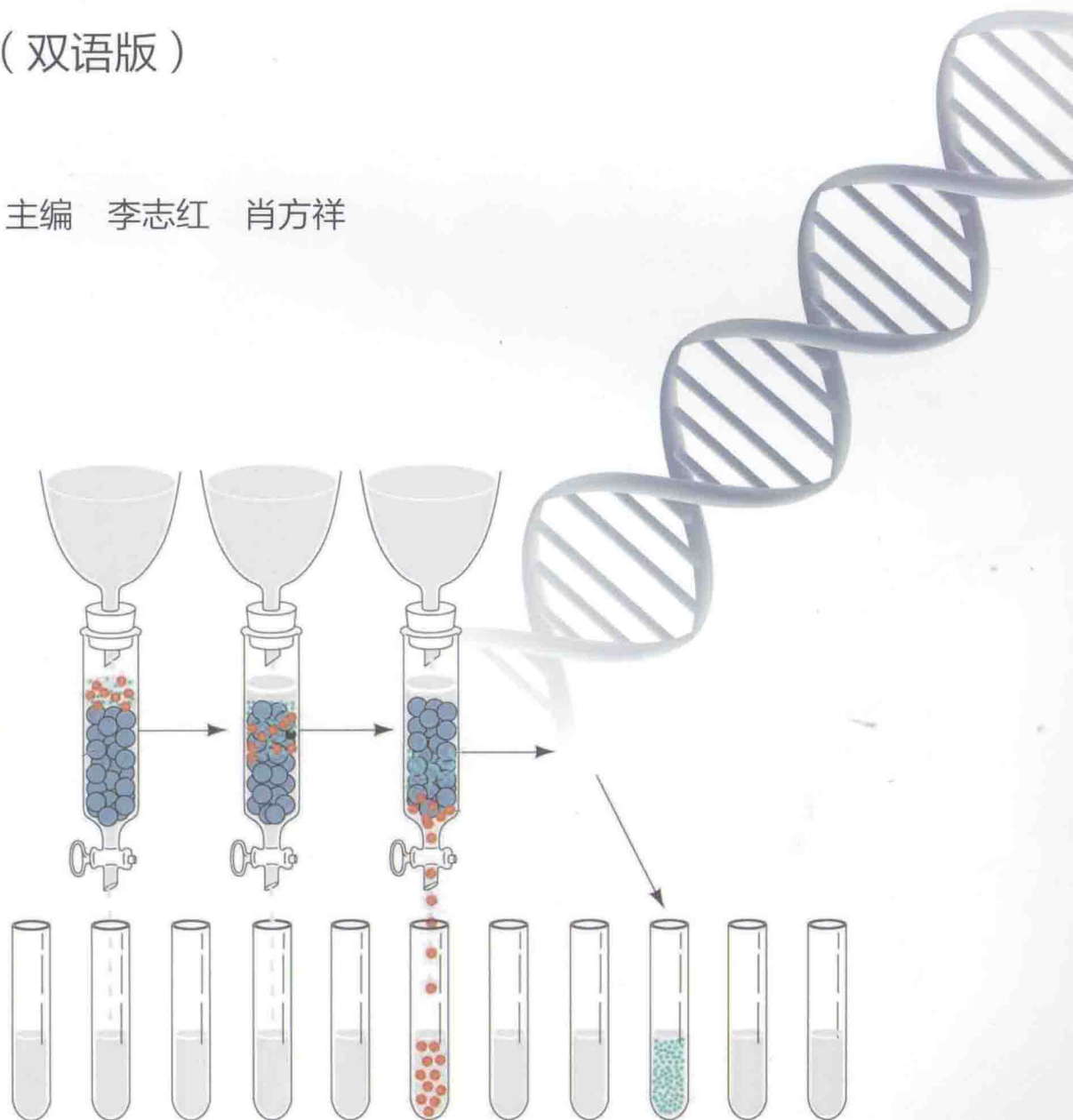


医学生物化学与 分子生物学实验教程

Practical Textbook of Medical
Biochemistry and Molecular Biology

(双语版)

主编 李志红 肖方祥



高等教育出版社

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(双语版)

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《生物化学》第2版

赵宝麟 (大连医科大学)

本数字课程是《医学生物化学与分子生物学实验教程》(双语版)一书的配套资源。是利用数字化技术整合优质教学资源的出版形式,可扩展纸质教材的内容,为读者提供教学PPT中文、教学PPT英文和图片等,供读者完善学习内容。

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内容简介

本书以英/中双语的形式较全面、系统地介绍了生物化学与分子生物学常用的实验理论与技术,主要包括:量器的使用、校正与实验数据的处理,分光光度技术,层析技术,电泳技术,酶活力测定与酶法分析,临床常用生物化学检测方法等。在每种实验技术理论介绍之后都附有与之对应的基本技能实验。在基本技能实验的基础上,本书还编写了血清白蛋白的纯化与鉴定、重组DNA的构建及其在大肠埃希菌中的诱导表达等综合性实验,并介绍了一些常用生物化学仪器的使用方法。

本书特点:①英/中双语;②以“问题”为中心,书中的实验技术理论都以问题的方式展开,引导学生带着问题学习,通过探寻解决问题的方法,加深学生对相关实验理论和技术的认识。

本书可作为医学院校各专业本科生、留学生和硕士研究生的实验指导教材,也可供有关教师和科研技术人员参考使用。

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Practical Textbook of Medical Biochemistry and Molecular Biology

医学生物化学与分子生物学实验教程 (双语版)

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PREFACE

Experiment is the foundation of all research. It plays an irreplaceable role in cultivating students' observation power, scientific thinking and practical ability and improving their overall quality. Experimental techniques of Biochemistry and Molecular Biology have been developed rapidly in recent years, therefore, understanding and mastering their essential theories and methods is much needed for scientific research and teaching in the field of life sciences.

The experiment teaching reform of "questions-centered" has been carried out since 2005 and gains widespread popularity. Based on the *Practical Manual on Medical Biochemistry & Molecular Biology* (Chinese version) and *Biochemistry Practical Manual* (English version), we edit this bilingual English / Chinese textbook, where our experience from practical teaching and scientific research for overseas students and postgraduates also shed light on. It can be used as a practical guidance to biochemistry and molecular biology experiments for medical students of different levels from undergraduates, overseas students to postgraduates.

This textbook is designed to focus on the questions, combining technical theory with experimental methods, basic technical skills experiments with comprehensive ones. Every chapter presents technical theory in the form of questions, the solutions to which need students' exploration in the learning process so that they will learn with the questions on the one hand and deepen the understanding of the experimental theory and technology on the other.

This textbook contains four parts. (I) Essential principles and skills, including chapters of introduction, operation and calibration of volumetric equipment, spectrophotometry, chromatography, electrophoresis, determination of enzymatic activity and enzymatic analysis. The corresponding experiments on basic technical skills are attached to the end of the theory. (II) Clinical biochemistry tests, including the determination of proteins in serum, blood glucose and blood lipids, liver function tests and renal function tests. (III) Comprehensive experiments, including purification & identification of serum albumin, construction and expression of recombinant DNA in *E. coli*. (IV) Appendix, including the operation of common biochemical devices.

We wish to warmly and gratefully acknowledge the assistance of Ling Huang, Zhifang Li, Min Zhang, Ram Babu Sah and Umakanta Bhattarai who helped revise this book and the efficient work of Higher Education Press that made the successful publication of this book

possible. In addition, we have referred to many published books related to biochemistry and molecular biology experiments. So we would like to express our sincere thanks to the authors of these books.

Any comments and suggestions from the readers are welcomed to help us make improvements in the next edition.

Zhihong Li, Fangxiang Xiao

May, 2014

前 言

实验是一切研究的基础。实验对培养学生敏锐的观察能力、科学的思维习惯、良好的动手能力，全面提升学生的素质起着不可替代的作用。近年来，生物化学与分子生物学实验技术得到突飞猛进的发展，了解和掌握生物化学与分子生物学实验技术核心理论与方法，是生命科学领域教学与科研的共同需求。

2005年以来，我们开展了“以问题为中心”的生物化学与分子生物学实验教学改革，受到学生的普遍欢迎。本书是在《医学生物化学与分子生物学实验》（中文版）与《Biochemistry Practical Manual》（英文版）的基础上，结合近年来指导留学生和硕士研究生的实验教学与科研经验，采用英/中双语编写而成。本书可作为高等医学院校各专业本科生、留学生和医学硕士研究生的生物化学与分子生物学实验指导用书。

本书的编写思想是：以问题为中心，将实验技术理论与实验方法相结合，基本技能训练实验与综合实验相结合，每章的技术理论都以问题的方式展开，引导学生带着问题学习，通过探寻解决问题的方法，加深读者对相关实验理论和技术的认识。

本实验教程共包括四个部分。第一部分为生物化学实验的基本理论与基本技能，包括绪论、量器的使用与校正、分光光度技术、层析技术、电泳技术、酶活力测定与酶法分析等，每章后面都附有与之对应的相关基本技能训练实验。第二部分为临床常用生物化学检验，包括血清蛋白质、葡萄糖、脂类物质含量的测定，肝功能与肾功能的相关检测等。第三部分为综合实验，包括血清白蛋白的纯化与鉴定、重组DNA的构建及其在大肠埃希菌中的诱导表达等。第四部分为附录，介绍了常用生物化学仪器的使用方法。

感谢黄玲、李志芳、张敏、Ram Babu Sah和Umakanta Bhattarai协助完成本书的校对工作，高等教育出版社的高效工作使本书得以顺利出版，在此表示衷心的感谢。另外，本书在编写过程中参考了已经出版的国内外生物化学与分子生物学实验技术方面的书籍，谨向这些编写者致以诚挚的谢意。

由于编者水平有限，敬请读者在使用过程中提出宝贵的意见与建议，以利于再版时进一步改进与修正。

李志红 肖方祥

2014年5月

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Introduction

Welcome to biochemical laboratory to learn the experimental rationales and technology of biochemistry and molecular biology!

We believe that, it is not the first time for you to perform chemical experiments, and you will find that the experiment course of biochemistry and molecular biology is one of the most interesting, exciting and beneficial courses. However, it will also demand much of your endeavor and commitment! The theoretical knowledge, experimental technology and operation skills you have learnt in such subjects as physics, chemistry and biology will be widely applied in these experiments. Meanwhile, you will learn more experimental techniques which are essential to the research of biochemistry and molecular biology. These techniques arise from the rapid progress of the major life sciences theories and are important approaches to further research on the molecular mechanism of disease. We hope the study on the technology will give you more than novelty and lead you into the world of life sciences research. You will learn how to study biological phenomena with the techniques and scientific thinking, and eventually raise your innovation awareness, creativity and critical thinking.

During the biochemical experiments, you may compare them with previous experiments. Firstly, you will find the cylinder and dropper has been replaced with the adjustable micropipette, test tube and flask with small centrifugal tube, even the metric unit has become μL , μg and ng rather than mL and gram. You will do research at μL and μg level, even molecular level. It is very typical of biochemistry and molecular biology experiments, which are of microanalysis and even trace analysis, at ng or pg level more often than not. Secondly, in order to minimize the damage to the structure and function of the sample, the operating condition of biochemical experiment is always mild, usually in buffer solution at room temperature. Thirdly, the method applied has high resolution which can distinguish clearly the materials of very similar structures and properties. Furthermore, in most cases, the biological molecules dissolve in the solution where the sample and its changes cannot be detected. In this condition, various methods applied in the biochemical experiments work as "eyes" observing and monitoring the sample and its biochemical process.

1. Learning Objectives

At the end of the experiment course of biochemistry and molecular biology, you should

be able to:

(1) Familiarize yourself with the basic ideas of the experimental design and the principles, how to meticulously organize the experiment and reasonably arrange the operating process and time.

(2) Train the practical ability, use various devices for biochemical experiments proficiently, including the balance, spectrophotometer, centrifuge, automatic fraction collector, nucleic acid and protein detector, electrophoresis apparatus and shaker; complete all the experiments skillfully, cultivate rigorous and meticulous scientific attitude.

(3) Record the phenomenon and data accurately and carefully and improve the writing skills on the experimental report.

(4) Master various basic experimental methods and techniques of biochemistry, especially electrophoresis and chromatography technologies, understand the principles and the significance of clinical detection and draw inferences.

(5) Cooperate closely with your teammates if required by the experiments and assume your responsibility.

Through the training of the experimental skills of biochemistry and molecular biology, we hope you will learn the basic methods of scientific research, deepen the understanding of the basic knowledge and lay solid foundation for further study.

2. Laboratory Regulations

(1) Please preview the experiment, understand the purposes and requirements, grasp the principles, finish the preview reports and put on the work clothes before entering the lab.

(2) Please comply with the practical regulations. No absenteeism, late arrival or early leave is allowed. Keep quiet and no loud talking or laughing. Using experimental instruments or animal for play is strictly prohibited.

(3) Carefully follow the operating procedures while operating the instruments. No use of the instruments before understanding their operations. Inform the teacher once any failure, damage or loss of the device occurred. Responsibility will be investigated if device damage is due to the violation of the operating procedures.

(4) It is necessary to operate the experiment boldly and cautiously. Observe the experimental phenomena carefully and record the original data. Save reagents, power and water.

(5) For the experimental samples, especially those stored in the refrigerator, it is necessary to label them and indicate the details, including their names, concentrations, operator's name and date. The volatile solution and acidic solution stored in the refrigerator should be sealed tightly.

(6) Please clean the materials used after the experiments, throw solid wastes (such

as the used filter paper and gel strip for electrophoresis) into the provided waste containers rather than the sink to avoid the blocking. Recycle timely the expensive Sephadex gel and DEAE-Cellulose. Leave the lab with the permission of the instructor.

(7) Every student should know the positions of the electric switches in the laboratory and comply with the regulation on Safety Utilization of Electric Power and other regulations.

(8) The student on duty should carefully clean the lab after the experiment. The last one who leaves the lab should check and switch off the power, turn off the tap, close the doors and windows, and then leaves the lab after the permission of the instructor.

3. Experimental Report

The experimental report is a summary and report on the experiment. It can help you to deepen the understanding of relevant principles and experimental technology of biochemistry and molecular biology, lead you to learn data processing methods, analyze and summarize the experience and problems from the experiment. Furthermore, it is not only a process of learning how to write scientific paper, but also an important aspect of assessing your experimental performance.

The experimental report includes the preview report, recording and summary report.

3.1 Preview Report

It is vital to preview the experiment and write the preview report, from which you will know the experimental purposes and requirements, comprehend the principles, dos and don'ts, understand the rationales and operations of the devices, know the components and functions of reagents, and arrange the detailed procedures (represented with the flow chart) and the data sheets.

3.2 Recording

Recording the experiments carefully, accurately and faithfully is the essential principle of the experimental science research and important method to cultivate your rigorous scientific attitude and basic experiment skills. You should record the observation and measured data timely, accurately, fairly and objectively. Even if there is a great deviation between the measured data and expectations, they should also be truthfully recorded without arbitrary changes. No tearing or alteration is allowed but you can rule out and rewrite the wrong content. You should pay attention to the significant figures during the recording.

3.3 Summary Report

The summary report includes the purpose, principle, equipment and reagent, procedure, data processing and result, problem and discussion and clinical significance, of which the last three parts are relatively more important. In general, the experimental discussion should be sufficient. You should consult the relevant literature and textbooks, apply thoroughly the previous knowledge and biochemical rationales and explore deeply

to put forward your original analysis and opinions. Any suggestion about experiment is welcome! The experimental report must be finished independently and plagiarism is absolutely forbidden.

Wish you complete success in the experiment of biochemistry and molecular biology!

(Fangxiang Xiao, Zhihong Li, Fan Peng)