

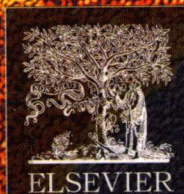
PRINCIPLES OF MOLECULAR VIROLOGY

fourth edition

(第四版)

分子病毒学原理

Alan J. Cann



英文原版名作
中文导读系列



科学出版社

www.sciencepress.com

Principles of Molecular Virology

4th Edition

分子病毒学原理 (第4版)

Alan J. Cann

University of Leicester, UK

科学出版社

北京

图字:01-2006-0534 号

This is an annotated version of
Principles of Molecular Virology, 4th edition

Alan J. Cann

Copyright © 2005 Elsevier Ltd.

ISBN 0-12-088787-8

All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the publisher

Published by arrangement with **Elsevier Pte Ltd.**

AUTHORIZED EDITION FOR SALE IN P. R. CHINA ONLY

本版本只限于在中华人民共和国境内销售

图书在版编目(CIP)数据

分子病毒学原理=Principles of Molecular Virology/(美)卡恩(Cann, A.)
编. —北京:科学出版社,2006

(Elsevier 英文原版名作中文导读系列)

ISBN 7-03-016712-0

I. 分… II. 卡… III. 分子生物学:病毒学-英文 IV. Q939.4

中国版本图书馆 CIP 数据核字(2005)第 155555 号

责任编辑:马学海 盖 宇 穆 蕊

责任印制:钱玉芬/封面设计:耕者设计工作室

科学出版社 出版

北京东黄城根北街16号

邮政编码:100717

<http://www.sciencep.com>

新蕾印刷厂 印刷

科学出版社发行 各地新华书店经销

*

2006年1月第 一 版 开本:B5(720×1000)

2006年1月第一次印刷 印张:25 1/4

印数:1—4 000 字数:466 000

定价:50.00元(含光盘)

(如有印装质量问题,我社负责调换〈环伟〉)

导读编译者

王克夷 教授

(中国科学院上海生物化学与细胞生物学研究所)

第四版序言	
第三版序言	
第二版序言	
第一版序言	
第一章 引言	1
病毒不同于活体生物	2
病毒学的历史	3
活体寄生系统	5
细胞培养方法	7
血清学/免疫学方法	9
超结构研究	12
“分子生物学”	18
进一步阅读	24
第二章 核酸	25
病毒颗粒的功能和形成	25
衣壳对称性和病毒结构	28
有壳病毒	39
复杂病毒的结构	43
蛋白质—核酸相互作用和基因组包装	49
病毒受体—识别和结合	53
病毒衣壳与寄主细胞的其他相互作用	53
总结	54
进一步阅读	54
第三章 基因组	56
病毒基因组的结构和复杂性	56
分子遗传学	59
病毒遗传学	62
病毒突变体	64

图书, 01-2006-9534号

This is an annotated version of

Principles of Molecular Biology **青 春 对 话**

Alan J. Cann

Copyright © 2005 Elsevier

ISBN 9-12-058787-8

For Joe and Jules

译者 袁京王

(南京师范大学出版社出版 外埠主发上海外文书局)

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the written permission of the publisher.

Published by arrangement with Elsevier Pte Ltd.

AUTHORIZED EDITION FOR SALE IN P. R. CHINA ONLY

本版本只限于在中华人民共和国境内销售

图书在版编目(CIP)数据

分子生物学原理 = Principles of Molecular Biology / (美) 坎农(Cann, A.) 著. —北京: 科学出版社, 2006

(21世纪英文原版名作中文导读系列)

ISBN 7-03-016712-0

I. ①分… II. ①坎… III. ①分子生物学—高等学校—教材 IV. ①Q59—4
中国版本图书馆CIP数据核字(2005)第106555号

责任编辑: 吴学海 袁京王

责任印制: 魏永芬/封面设计: 谢志庆/张立华

科学出版社出版

北京东黄城根北街16号

邮政编码100717

http://www.sciencep.com

北京中科厂印刷

科学出版社发行 各地新华书店经销

2006年1月第 一 次 开本: 88(780) × 130(60)

2006年1月第一次印刷 印张: 25 1/4

字数: 1-4 000 印数: 405 000

定价: 50.00元(含光盘)

如有印装质量问题, 我社负责调换(环伟)

PREFACE TO THE FOURTH EDITION

In addition to complete updating, this edition of *Principles of Molecular Virology* contains a number of additions to the text and illustrations; for example, new information on topics such as SARS and bioterrorism. However, most changes have been made to the enclosed CD. In addition to complete reformatting, the content has been completely revised and we have been able to include for the first time a series of animations covering important topics such as capsid symmetry, virus replication and immune recognition and killing of virus-infected cells. There is also a new interactive self-assessment quiz for each chapter so you can judge for yourself your knowledge of virology.

I would like to extend my thanks to the staff of Elsevier for their assistance during the preparation of the book. I am confident that readers will find this edition as useful as the previous ones.

Alan J. Cann
University of Leicester, UK
alan.cann@leicester.ac.uk
April 2005

PREFACE TO THE THIRD EDITION

This edition of *Principles of Molecular Virology* seeks to build on the success of the first and second editions. In addition to complete updating, numerous additions (and hopefully, enhancements) have been made to the text. These include new sections on 'Viruses and Apoptosis' (Chapter 6) and 'Bacteriophages and Human Disease' (Chapter 7), the addition of learning objectives for each chapter and a new appendix describing key events in the history of virology (Appendix 3). However, probably the first change most readers will notice is a new format with the addition of colour illustrations to enhance understanding of key points.

An exciting new development has been the inclusion of an electronic companion to the book in the form of the enclosed CD. In addition to interactive learning resources on the CD which complement each chapter, the 'Virology Online' section has been written to encourage readers with access to the internet to go beyond reading the text of the book to find more information online.

I would like to extend my thanks to all of my academic colleagues who have helped with the preparation of this edition, but in particular I value the contribution of the many people who have contacted me with suggestions and comments regarding the previous editions. I hope that readers of this edition will continue to do so. I would also like to thank the editorial staff of Academic Press for their support and assistance during the preparation of the book. Finally, I would like to thank my family for respecting the sign which has spent many hours on the door of my study, 'I am working. Please don't come in'. It's OK now kids, I've taken the sign down.

Alan J. Cann
Department of Microbiology & Immunology
University of Leicester
June 2000

PREFACE TO THE SECOND EDITION

Much has changed since the first edition of *Principles of Molecular Virology* was published in 1993, but the need for this book is now stronger than ever. This edition is completely revised and updated and contains many new figures and tables. As a result, it is somewhat longer, but not, I hope, so long that it loses sight of the original objective—to present the concerns of contemporary virology to students in a concise and digestible manner.

Many people should be thanked for helping inspire this edition, but I will single out a few for particular mention. I am very grateful to all those who provided feedback on the first edition and I have tried to include as many of their comments/requests as possible; in particular, coverage of the rapidly developing area of plant virology has been greatly expanded. I am also grateful to my teaching colleagues in Leicester and elsewhere for their suggestions. Finally, the person who should perhaps receive most thanks is my long-suffering editor at Academic Press, Tessa Picknett.

Alan J. Cann

Department of Microbiology & Immunology

University of Leicester

July 1996

PREFACE TO THE FIRST EDITION

This book came about through my own need for a text to augment my undergraduate lectures on virology. Not that there is a particular shortage of books on virology, but even during my own relatively short career, the subject has expanded so rapidly that most professionals feel pressurized by the the task of keeping up with current trends, let alone the responsibility of initiating a new generation in such a rapidly changing discipline. Many excellent and recent texts exist that deal with the subject in a detailed and somewhat traditional manner; the second edition of *Fields' Virology* (Raven Press, 1990), the third edition of Matthews' *Plant Virology* (Academic Press, 1991) and, in a more general sense, the second edition of *Molecular Biology of the Cell* (Garland Press, 1989) immediately spring to mind. Unfortunately, these books have two major disadvantages for their use in teaching. First, the volume of material they contain is overwhelming for a student discovering the subject for the first time and who may be unable to sort out the information they require from the mountain of detail they encounter. Second, in these times, few students can afford to purchase one of these tomes. Even persuading university libraries, whose budgets are under constant pressure, to purchase more than one or two copies is difficult and an inadequate solution in a time of expanding student numbers. Better then to reserve these texts for the reference purpose for which they are best suited and to introduce students to the subject in a gentler way.

In discussion with many of my colleagues at this and other universities, it was clear that most felt there was a place for a text which would cover the current emphasis and concerns of virology. In these conversations, there was no doubt as to what was required. My contemporaries have no difficulty with the label 'molecular virology,' but most when pressed would have difficulty in expressing a comprehensive definition. Perhaps the best way to describe how I have approached the subject here is consider it as 'virology at a molecular level' or even better, 'molecules and viruses.' Having already damned the 2000-page reference source as unsuit-

able for my purpose and yet such an all-embracing definition of 'molecular virology,' the problem was therefore how to resolve these two apparently conflicting issues. My chosen solution is to outline the *principles* of the subject with reference to specific *examples* chosen to illustrate the matter under discussion. The onus is therefore firmly on the reader to pursue particular matters on which he or she requires more information in more detailed 'reference texts' or in the immense volume of research publications appearing annually.

I would like to have spent much more time discussing the history of virology in Chapter 1, a subject I find to be a fascinating as well as a valuable insight as to how we got to where we are today. In the event, it was only possible to provide a brief overview and to refer the reader to one of the many other texts which have been published on this subject—perhaps the one area of virology where an author's work does not become outdated in a short period. It is only my intention to arm readers with the framework that makes it possible for them to achieve this task successfully. Anyone who complains that this book does not spend sufficient time dealing with (or even mention) their pet area of interest has therefore missed the point.

To disarm the jargon (which I have avoided wherever possible) and unavoidable technical terms, I have included a glossary as an appendix to the book. Terms shown in the text in **bold** print are defined in this glossary.

Cliché it may be, but there are genuinely too many people to acknowledge for the creation of this book to make it possible to do this individually. It will have to suffice for me to thank all my colleagues in Leicester and elsewhere for helpful discussions; all the people who have helped and influenced my career over the years, and the undergraduates on whom I have field-tested the material, and for whom this book is intended.

Alan J. Cann

Microbiology Department

University of Leicester

October 1992

第四版序言

除了完成更新外，这一版的《分子病毒学原理》，在正文和图表加入了许多内容，例如有关 SARS 和生物恐怖主义论题的新信息。然而，对附带的 CD 作了最大的变动。除了完成重新编排外，目录已经完全改写，以至于第一次可以包含了一系列涵盖重要论题的卡通，诸如衣壳的对称性、病毒复制、疫苗识别、病毒感染细胞的杀灭。每一章还有一种新的互动的自我评估性测验，这样，读者可以由你自己判断你的病毒学知识。

我想对 Elsevier 的工作人员在制作本书中给予的帮助表示感谢。我深信读者将发现，这一版和以往版本同样是有用的。

Alan J. Cann

英国莱切斯特大学

alan.cann@leicester.ac.uk

2005 年 4 月

第三版序言

这一版《分子病毒学原理》是试图建筑在第一版和第二版成功的基础上的。除了完成更新外，在课文中加入了许多内容，以期有所提高。这些包括：在第六章中的“病毒和凋亡”和第七章中的“噬菌体和人类疾病”新的小节；在每一章前加了学习目的；新的附录 3，叙述病毒学历史中的关键事件。然而，也许大多数读者将注意到，居于首位的改变是采用了一种新的格式，加入了彩色的说明，以便对关键之处更好地理解。

一个令人振奋的新发展是，本版带有一个 CD 形式的电子手册。在 CD 中，除了有对每一章作为补充的互动式的学习资源，还写了“在线病毒学”一节，鼓励读者通过互联网，在阅读本书的课文外，发现更多的信息。

我愿意表达对于帮助准备这一版的所有学术界同事的谢意，但是我特别珍视与我有过接触，并对前两版提出建议和意见的许多人所作出的贡献。我希望这一版的读者继续如此。对在准备这一版期间学术出版社编辑人员的支持和帮助表示感谢。最后，我应感谢我的家人，是他们遵守了经常贴在我书房门上的告示：“我正在工作，请不要进来”。现在好了，孩子们，我已经取下这一告示。

Alan J. Cann

莱切斯特大学

微生物学和免疫学系

2000 年 6 月

第二版序言

自从第一版《分子病毒学原理》在 1993 年出版以来，已经发生了很多改变，但是，读者对这本书的需求比以前更强烈。这一版经过完全改写，是最新的，包含了许多新的图和表。因此，这一版的篇幅更长了一些，但是，这不是我所希望的，太长就达不到原先的目的——以简明和可读的方式给予学生一本现代的病毒学。

帮助促成这一版的许多人是值得感谢的，但是，在这里想特别提到其中的某些人。我非常感激所有提供反馈意见的第一版的读者，而且我也试图尽可能地在这一版中写入他们的意见和要求；特别是在植物病毒学中，发展之迅速致使该领域的涵盖面已经得到了极大的拓展。对在莱切斯特和其他地方的教育界同人的建议，我也表示感谢。最后，最应该感谢的人是学术出版社（Academic Press）中长期为我作出努力的编辑 Tessa Picknett。

Alan J. Cann

莱切斯特大学

微生物学和免疫学系

1996 年 7 月

第一版序言

这本书的产生全是源于我个人的需要，即为我的本科生病毒学课程增添一本教科书。病毒学的书籍并不特别短缺，但是在我自己较短的教育生涯中，该课程拓展得如此地快，以至于大多数专业人士会感到一种压力，以赶上流行趋势为己任，更不必说我凭着责任感在这一个快速改变的学科中引领新一代。许多优秀的和新的教科书已经有了，写得很详尽，而且多数是传统的模样。马上就能想到的就有：第二版的“*Fields Virology*” (Raven Press, 1990)，Matthews 写的“*Plant Virology*” 第三版，范围更大些的有“*Molecular Biology of Cell*” (Garland Press, 1989)。遗憾的是，将它们用作教科书有两个缺点。第一，对于刚涉足这一领域的学生，它们所包含的内容太多，他们不能从浩瀚的资料中分拣到所需要的信息。其次，目前几乎没有一个学生能购买这些巨著中的任何一本，甚至劝说大学图书馆购买多几本拷贝也是有困难的，因为他们的预算也是紧张的，而且在当今学生人数正在增长的情况下，这不是一个合适的解决办法。更好的办法是，储备一些可作为学生参考用的教科书，同时又能以更轻松的方式引领学生进入这一领域。

在与许多校内外的同行讨论时，最大的同感是应该有一本能涵盖病毒学最新要点和主要方面的教科书。在交谈中，对需要写些什么也已明确无疑。以“分子病毒学”定名，对我这一代人是没有困难的，但是，当出版时，表达一个全面的定名可能有些难度。也许最好的方法是，记述我是如何进入这一学科的，而且将其考虑为“在分子水平的病毒学”，或者更好考虑为“分子与病毒”。已有的非常庞大的 2000 页参考资料并不适合我的目的，但是，又要定名为无所不包的“分子病毒学”，面临着如何解决这两个显然矛盾的问题。我选择的办法是，通过说明讨论材料所选用的特定例子，概要地写出学科的原理。任务也就牢牢地落在读者身上，以这些材料为基础，再由更详尽的参考书和每年发表的大量研究刊物中获取更多的信息。

我愿意在第一章中花更多的时间讨论病毒学的历史，我发现这是一个诱人的议题，由此还能得到有价值的见解，比如我们是如何才到达今天这种境地的。终究，本书只能提供一些简单的梗概，有时候给读者的是许多其他教科书中的某一本作参考，这些书是以一个主题出版的，也许这主题是病毒学中一个领域，而作者的工作在短期内还没有过时。我的愿望是用一种框架武装读者，使他们有可能成功地完成这一任务。任何一个抱怨本书没有提供足够的篇幅涉及（甚至提及）他们感兴趣的领域的读者都是不得要领的。

为了裁去行话（我已经尽可能地避免）和不可避免的技术术语，我在书中包含了词汇作为附录。在课文中以黑体印刷的术语均在词汇中有定义。

也许这是老一套，然而为了这本书能出版，确实有太多人是需要感谢的。我必须感谢：莱切斯特和其他所有给予有益讨论的同事；所有在过去几年中对我事业给予帮助和影响的人；所有使用过这一教材和需要这本书的大学生。


Alan J. Cann

莱切斯特大学

微生物学系

1992年10月

THE PRINCIPLES OF MOLECULAR VIROLOGY CD

Wherever the  icon appears in the text, an accompanying learning resource can be found on the compact disk (CD) included with this book. Before starting, ensure that you have Macromedia FLASH Player installed on your machine. FLASH plays small, fast multimedia buttons, as well as interactive animations, flying logos, and graphics. This player is very small, takes only a short time to download, and is a great starting point for experiencing multimedia on the Web. To download the player for free, go to: <http://www.macromedia.com/downloads/> and select 'Macromedia Flash Player'.

To use the CD on a PC, put the disk into the CD-ROM drive, double-click on the My Computer icon, double-click on the CD-ROM icon and double-click on the Start.htm file. To use the CD on a Macintosh, put the disk into the CD-ROM drive, double-click on the CD-ROM icon on the desktop and double-click on the Start.htm file. If you need further help, click on the file 'README.txt'.

The CD contains interactive learning resources which complement each chapter of the book. However, to gain the maximum benefit from the disk, you will need internet access. The resources in the 'Virology Online' section have been selected to encourage you to move beyond the text of the book and find information about any topic you may wish to investigate. Not sure what any word or name in the text means? Type it into the search forms listed in 'Virology Online' and you will be surprised how much information is available.

However, readers should be aware that the quality and accuracy of information they may find on the internet varies greatly. All of the resources suggested on the CD are of the highest quality, although neither the author nor Academic Press can guarantee that they will remain freely available indefinitely. Information accessed through search engines is another matter—it is up to users to judge the quality of resources found in this way:

- Who wrote the information? A knowledgeable academic in a respected university or a teenager in their bedroom?
- When did they write it? This year or six years ago—is there even a date on the page?
- What is their motivation for making the information available? Commercial or non-commercial?

By considering these quality issues, readers can expand the capacity of this book indefinitely.

本书配套 CD

在课文中所有出现光盘标志的地方，都可以在本书附有的 CD 中找到相关的学习资料。在启动前，需确认在你的机器上安装了 Macromedia FLASH Player。FLASH 可操演小的快速按钮，以及互动的动画制作，游动的标识和图像。此播放器非常小，不花很多时间就能下载，它也是享受 Web 多媒体的必备工具。为了免费下载播放器，可以上 <http://www.macromedia.com/download/>，选择“Macromedia FLASH Player”。

使用 CD 时，将其放入计算机中，使用你喜欢的浏览器打开文件“START.htm”。假如你需要进一步帮助，点击文件“README.txt”。

CD 含有互动的学习资源，对本书的每一章加以补充。然而，欲从盘片中得益最大，你将需要与互联网连接。在“在线病毒学”一节中的资源是经过选择的，鼓励你超越本书的课文，发现任何你想调研命题的信息。对本书中任何一个词和名词有疑问吗？键入“在线病毒学”列出的搜索方式中，你将感到吃惊，如此多的信息是现成的。

然而，也应该提醒读者，在互联网上发现的信息的质量和精确性差别很大。本书 CD 中提示的所有资源是最高质量的，尽管作者和出版社都不能保证这些资源将无限期地免费提供。通过搜索引擎得到的信息则是另一回事，用户应判断资源的质量，依据有以下几点：

■谁提供的信息？一位在有名望大学中知识渊博的学者，还是一个躺在床上十几岁的孩童？

■他们什么时候写的？今年还是 6 年前，在页码上是否有日期？

■写此信息的动机是什么？商业性的还是非商业性的？

通过考虑这些涉及信息质量问题，读者能够无限地扩展本书的容量。