国外优秀生命科学教学用书

世界优秀教材
中国版

Foundations in Microbiology

Fifth Edition

微生物学基础

第5版 / 影印版

Kathleen Park Talaro

高等教育出版社
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图字：01-2005-3093

Kathleen Park Talaro
Foundations in Microbiology, fifth edition
ISBN：0-07-295170-2

图书在版编目(CIP)数据

微生物学基础 = Foundations in Microbiology：第 5 版/(美)特拉诺(Talaro, K. P.)—影印本. —北京：高等教育出版社，2005.8
ISBN 7-04-017580-0

Ⅰ. 微… Ⅱ. 特… Ⅲ. 微生物学-高等学校-教材-英文 Ⅳ. Q93

中国版本图书馆 CIP 数据核字(2005)第 077425 号

策划编辑 王 莉 **责任编辑** 王 莉 **封面设计** 张 楠
责任设计 史新薇 **责任校对** 金 辉 **责任印制** 陈伟光

出版发行	高等教育出版社	**购书热线**	010-58581118
社 址	北京市西城区德外大街 4 号	**免费咨询**	800-810-0598
邮政编码	100011	**网 址**	http://www.hep.edu.cn
总 机	010-58581000		http://www.hep.com.cn
		网上订购	http://www.landraco.com
经 销	北京蓝色畅想图书发行有限公司		http://www.landraco.com.cn
印 刷	北京民族印刷厂		
开 本	889×1194 1/16	**版 次**	2005 年 8 月第 1 版
印 张	38.25	**印 次**	2005 年 8 月第 1 次印刷
字 数	1 100 000	**定 价**	52.00 元(含光盘)

本书如有缺页、倒页、脱页等质量问题，请到所购图书销售部门联系调换。

物料号 17580-00

《微生物学基础》中国版序言

——一本值得推荐的优秀教材

美国帕萨迪纳城市学院 Kathleen Park Talaro 教授编写的《微生物学基础》(Foundations in Microbiology, Fifth Edition) 于 2005 年由McGraw-Hill公司出版，该教材从 20 世纪 90 年代中期出版以来，每隔两年一版，已连续出版了 4 版，在欧美和亚洲等许多国家是一本很受欢迎的优秀微生物学教科书。第 5 版除保留了前 4 版中众多成功的特征和优点外，对许多章节做了重要的修改和补充，使该书更具特色，优点更加突出，主要表现在下列方面：

1. 体系新颖，注重综合性，科学性强。例如：该书将微生物的营养、生态学和生长作为一章(第 7 章)进行综合介绍，这不仅能更好地反映微生物生长与外界条件及生态环境的紧密关系及其自身的规律，也充分体现了微生物学科与其他学科的交叉性，而且还减少了篇幅，内容更加紧凑，标题新颖。该章还充分利用了插入短文对特殊状态下的微生物生长进行了生动有趣的介绍。如“极端环境中的生命”(Life in the Extremes)，“光驱动的有机合成”(Light-Driven Organic Synthesis)，“利用‘热’微生物赚钱”(Cashing in on ‘Hot’ Microbes)，“生命的协同作用：互惠共生”(Life Together: Mutualism)等。这与目前国内、外其他微生物学教材用 3 章的篇幅来分别介绍微生物的营养、生长和生态的传统编排体系相比，无疑有其独到之处。又如，将“药物、微生物和宿主——化学治疗的要素”作为第 12 章叙述，以微生物为中心，将微生物与药物以及与宿主的关系进行了精彩的描述。同时也附有几个有趣而生动的插入短文，如“从巫术到神奇药物”(From Witchcraft to Wonder Drugs)，“设计药物的现代探索”(A Modern Quest for Designer Drugs)，“药物抗性的增长”(The Rise of Drug Resistance)等，有的还附有漫画。此外，该书还将研究微生物的方法单独列为一章，体现了微生物在研究方法上不同于其他生物的独特性，并在“培养微生物的方法”这一节中综合提出了 5 个“I”：接种(Inoculation)，培育(Incubation)，分离(Isolation)，检验(Inspection)，鉴定(Identification)5 大基本技术。

2. 重点突出，取材新。该教材的内容重点是微生物学基本原理，侧重于医、药和卫生方面应用的微生物学，因此，无论是内容的取舍，插入短文，还是思考题、附录等，都充分体现了这点。

该书的取材新颖，尤其是适当地介绍了近年来微生物学领域乃至整个生命科学界所获得的重大成果，增加了不少新资料和新知识。例如，将何大一教授发明了“鸡尾酒法”治疗 AIDS 列入了微生物学中的重大事件表，这是以往的《微生物学》中没有的；将 2003 年 SARS 流行期间对旅客检测的照片作为第六章“病毒导论”的开篇图片，也别具一格，颇具新意。此外，书中还适时适量地、以不同的形式介绍了一些新的技术和进展，如：用 DNA 测序来检测免疫缺陷疾病；微生物基因组测序；用基因芯片分析基因表达；用转基因动

物生产药物；控制基因表达的小分子 RNA；微生物形成的生物膜等。甚至在介绍最基础的微生物细胞计数时，也将库尔特计数器和流式细胞仪在微生物细胞计数中的应用进行了比较详细的介绍，流式细胞仪不仅可用于精确计数，而且还可以测定细菌细胞的大小，区分死、活细胞及革兰阳性和革兰阴性细菌。

3. 形式多样，富有启发性。例如，每章之后附有 1～6 篇插入短文，全部短文可分为历史上的重要事件、医学的微型档案、微生物学聚焦、点滴故事等 4 类，并分别以黄、蓝、褐、绿色标示，所述内容生动活泼，富有启发性。每章还附有 5 个方面的问题：关键词的提要、概念性问题、多项选择题、重要思考题和网络查询题。其中，网络查询题既具有学习内容的先进性及拓展知识，又是一种培养学生独立学习和解决问题能力的好办法。例如，“微生物遗传”这一章的网络查询题中，其中一题是要求学生通过网络查询有关“内含子”的信息，并对其可能的功能至少说出 5 种目前的推测。这显然是最新的学科进展方面的内容，课本中不可能有详细描述，但学生在课堂上学到基本概念后，通过“网络查询题”的引导而拓展知识，使学生增长了独立获取知识的能力。

4. 照片、插图、表格不仅精美，而且形象、生动，兼具很强的科学性和艺术性，真正起到了画龙点睛的作用。该教材正文共 500 多页，但微生物学的基本理论和微生物在医药、卫生方面的应用，论述充分，层次清晰，这主要是借助于大量的图解、照片、表格进行阐明，全书每一页几乎不是有图，就是有表，或是有照片，使读者能一目了然，做到了少而精，而且能给读者深刻的印象，易读、易懂、易记，增强了教材的可读性、适应性和实用性。书中的照片和图表之所以能有如此好的效果，重要原因之一是其大多数都由作者本人摄影、绘制或修改，本书的作者 Kathleen Park Talaro 教授不仅是一位有 25 年以上讲授微生物学课程经验的教育家，而且也是一位摄影家，还是一位插图画家，这非常难得，很值得我们国内的作者学习和借鉴。

本书的内容强调了微生物与人的关系，体现了以人为本的理念，这也是一大特色。虽然对微生物在其他众多领域（例如工业、农业、环境保护等方面）的描述显得有些单薄，但总的来说，该教材无论是在体系、结构布局、内容编排，还是在形式多样等方面，都是一本颇具特色的优秀教材。为了更好地优化、整合世界优秀教育资源，并通过本土化使其最大程度地发挥作用，提高我国高等教育的教学质量，高等教育出版社决定将本书列为“世界优秀教材中国版”系列教材之一，由国内一流学者根据我国高等学校的课程体系及教学要求，对本书进行了英文改编，使之更具教学适用性。

谨将此书推介给全国同行和学子。

沈 萍 陈向东
武汉大学生命科学学院
2005 年 6 月 5 日

前言

2001 年 9 月 11 日的一则标题新闻摘录

“FBI 和美国邮政部正悬赏 250 万美元以获取有助于解决‘美洲炭疽病’的信息。调查人员已经查询了 5000 多人，用于科学实验的资金已超过 1300 万美元。”

“六月，FBI 抽干并搜查了马里兰州弗雷德里克的一个池塘，但一无所获。弗雷德里克是国家炭疽病研究中心之一的军队传染病医学研究所所在地。”

“2001 年 10 月 5 日到 11 月 21 日有 5 人死于吸入性炭疽。另有 17 人因吸入或皮肤接触炭疽而生病，其中至少有 3 人是邮局的工作人员，其身体正在恢复中，还没有回去上班。”

“医学委员会说：‘一次成功的生物攻击的后果可能远远超过一次化学攻击，甚至是核攻击，特别是这种易于传播的传染病。’在当今旅行频繁和全球化进程加快的情况下，世界上任何地方的疾病爆发都会威胁到所有的国家。”

“天花、炭疽病和黑死病——恐怖分子可能利用任意一种致死疾病对成千上万的美国人搞报复破坏。然而，没有足够的抗生素和疫苗储备，公共卫生设备无法应付这样的‘洪流’，而且大多数法律强制机构也对如何处理这样的危机束手无策。”“毫无疑问，恐怖分子和恐怖团伙会用传染性疾病因子伤害无辜的市民，问题是在什么时候和什么地方。”

新时代的微生物学

2001 年的秋天，这本书的上个版本准备印刷之际，令人震惊的事件发生了，微生物学因此而受到了广泛的关注。用微生物作为武器的可能性不再仅仅是一种猜测。这些相关事件的一个作用就是使微生物较之以前备受关注，尤其是在我班上的学生中。许多情况下，我的同事和我不得不用大量的课堂时间去讨论这一主题，从虚构中剥离真相，阐述新闻报道中最新的潜在“威胁”。很多时候都用来回答这样的问题：“什么是炭疽病，如何治疗？这么多年过去了，天花如何会再复原？预防传染的疫苗安全吗？什么情况下会感染 SARS？西尼罗河热是如何传到北美的？”论述这些关注是一个苦乐掺半的教育经历。当然，很高兴看到大家对这门学科高涨的兴趣，并能利用现实生活中的例子来教授基本概念——例如，如何消毒邮件以破坏炭疽菌孢子，对生物的有效治疗方法，或考察“一周的病原体”的流行病学方法。令我矛盾的是，这些反应也折射出这些突发事件给许多人灌输了对微生物的不适当的、有些夸张的恐惧。较之过去，这些微小的、无处不在的、多数有益的生物更多地成为了误解和焦虑的主题。

在这样一个非常时期，迫切需要关于微生物及其活动的正确的有用信息，以便公众能在认知的基础上行动并理解，而不是害怕或传谣。这一教育必须有助于保持一种平衡的观点，即微生物具有感染特性的同时，在地球运转中有着不可否认的重要性。这是过去 4 个版本的首要目标，我们在第 5 版的修订中仍然持有相同的观点。我们再一次希望所有的学生脱离开为任何个人的或专业的挑战而准备的课程学习，而是从未知到已知展开思索，在经受考验时发出理性的声音。

正如你们将要看到的，微生物学是一门复杂的、跨学科的科学，涵盖了从细胞及其功能的基础生物学到微生物在地球生态系统、工业生产乃至疾病中的角色的广泛领域的信息。无论你的目的是为卫生职业做准备，还是为技术工作获得技能，或是了解日常生活中的实际应用，增加你对生物世界中这些最小的居住者的认识，你都能从中有所收获。

第 5 版的侧重点和变化

过去的版本仅有 1 位作者，而这一版本我们有幸得到了 4 位颇具才华的专家的帮助。他们是 3 位

微生物学家和1位医生：

帕萨迪纳城市学院的巴里·切斯(Barry Chess)

巴尔的摩郡社区学院的查尔斯·莱特(Charles Wright)

俄亥俄州迈阿密大学的马乔里·凯利·寇文(Marjorie Kelly Cowan)

大峡谷州立大学的史蒂夫·赫克(Steve Hecht)

修订工作要求检查大量的微小细节，是他们分担了这一令人畏缩的任务。感谢他们在我写新的章节和特辑专栏，绘制新插图和改进插图，编辑和更新正文，更改各章概述、摘要和思考题时给予的建议和帮助。虽然编写这本教科书一直是我心甘情愿做的工作，我还是发现合作大有好处，它使我从注视于每一个单词的疲劳中解放出来，能够专心于内容和插图。

与过去的修订一样，我们尽量保留了作为微生物学基础的基本内容，同时适当引入了该学科许多领域的新发展。我们的目的是：

- 保持该书的可读性和准确性，满足各种层次和能力的学生的需要。
- 按逻辑顺序编排标题，使前面的概念和术语为随后的部分奠定基础。
- 利用图解、示意图、流程图、模式图和表格，便于不同学习风格的学生更好地吸收所学到的知识。
- 使难懂的概念易于理解和接受。
- 为实际应用提供背景知识。
- 鼓励对该学科的终身学习。
- 激发对这门科学的兴趣和崇敬之情。

增强艺术性

直观素材的编排是任何自然科学教科书的一个重点。我们再一次把目光放在了对图片和照片的外观和可读性的精细调整上。

- 检查书中的每个图形，其中至少60%被修改过或重新制作。
- 强调各个章节表述的一致性。
- 只要可行，我们就把图例说明放到图形中，置于它所描述的步骤旁边。
- 我们还简化了一些复杂的图解，提高了另一些图解的精确性和流畅性。
- 特别关注图片和照片中标示的数量和准确性。
- 耗费大量时间用于搜寻高质量的照片，其中不少来自作者本人。
- 许多读者表示很欣赏图例图表和流程图，因此，我们在新版增加了一些新图。

简化并改善表述

要涵盖这样一门广博的学科是件伤脑筋的事。首先，需要充分包括微生物学中各种各样的主题。其次，伴随图例说明还需要含有足够的背景描述。另一方面，我们必须意识到这本书通常用于一个学期的课程，学生阅读它的时间是有限的。值得关注的是：

- 我们通过编辑、改写、简化和删除不必要的细节来压缩内容，但保留了重要的概念。
- 在不缩减重要概念的前提下，删除或重新安排一些特辑专栏。
- 所有图形、图表和特辑专栏在文中第一次出现时均以黑体字显示，其他重要的观点或概念在文中用数字编号或用黑体显示。
- 我们认识到生物恐怖的严重性，新增了涉及这个主题及涌现的疾病的特辑单元和章节。

其他简化办法还包括压缩各章的概述和缩写摘要。由于大量的复习题受到了读者的欢迎，与过去的版本一样，我们保留了3种类型的思考题。大多数的章节有附加题，包括一些分析图形的题。与过去相同，大量的注意力放到了词汇和发音上，在术语汇编中增加了一些新的术语。

学生适用

加深理解的学习技巧

这类技术课程提出的挑战是："什么是最佳的学习方式，既能在课程中获得成功，将来也不会忘记学到的知识?"

首先，最重要的因素可能取决于你的学校和教师是如何组织这门课程的。相对于一般的课程它所覆盖的信息量更大，你的教师会根据授课和讨论的时间选择他(她)想强调的部分，布置阅读任务和习题作业。许多教师有一个详细的教学提纲或学习指导，引导学生学习特定的内容和词汇。其他教师可

能会用他们自己的网站去布置作业，甚至有考试样题。这些材料将是你预备学习的主要指导。

其次需要考虑的就是什么样的学习方式最适合你。要想获得成功，你必须牢记基本的概念和术语。埃德加·戴尔(Edgar Dale)有一个如何保持记忆的速成列表，他按优先次序排成如下的学习金字塔：

我们所读到的10%
我们所听到的20%
我们所看到的30%
我们所看到和听到的50%
我们和其他人讨论过的70%
我们亲身经历过的80%
我们教授给别人的95%

从这个列表可以明显看出有许多吸收信息的办法，主要是你需要用你所有的感官去读、去写，画图表，做实验，进行测验，及和他人一起学习。这就意味着你不仅需要花时间阅读这本书，你还需要边读边做笔记。你需要去上讲授和讨论课，听你的教师或助教解释这些东西。课间记下的笔记要重新整理或概括以组织出要点。这样就开始了沉淀记忆的过程。你应该和其他人——辅导教师或学习小组——进行讨论，甚至时不时地充当一下讲授者。这些互作活动使你不是死记硬背，而是理解所学的知识，并能在将来应用它们。

进行自我测验是亲自感受所学知识的一个有效办法。你可以使用书中的试题、学习指导，或者自己进行组织。自我测验的一个策略就是根据笔记制作一系列的抽认卡片，而这本身就是一个很好的学习训练。然后你能时不时地利用卡片评估你掌握概念的情况。这一方法还有一个好处，就是你对参加考试心中有数，能估计自己的成绩。

学习中的另一要点就是你学习的频率。两周中坚持每天学习1个小时左右远比在周末填鸭式地学上14个小时有效。大脑不可能不停顿地记住大量信息，它需要消除疲劳。如果你一步一步地学习该学科中相关的词汇和主题，时间长了你就会发现它们融合在一起了。那么考试之前，你需要做的就是复习了。

本书便于学习的特色

这本教科书有一些方便学习的特色之处。

章节概述(Chapter Overview) 简略阐述了各章的内容，指出主要的概念。

含有关键术语的章节小结(Chapter Capsule with Key Terms) 将关键的词汇和概念以提纲的方式总结在一起。它们也是复习功课时的有用指导。

章节检查点(Chapter Checkpoints) 用于快速复习各部分的要点。

章后问题(End of Chapter Questions) 形式多样，让你练习回答不同类型的考题。在第一章的后面有一段关于怎样回答这些思考题的叙述。多项选择题可对你所知道的东西进行快速自查(答案在书后)。它们随机选自正文中的信息，如果你选对了，很可能你已做了充分的准备。匹配题也是同样的道理。

概念题(Concept Questions) 要求你对所学的知识有更深的理解，需要你写几句甚至几段论述，看你是否掌握了所列的概念。

思考题(Critical-Thinking Questions) 比较难，在你掌握了特定概念的基本要素之后，给予你解决问题的训练。许多题涉及个案研究、模型、图表分析、比较和实验练习。它们给你的真实生活提供应用微生物学的经验。

总之，学习的过程要归结到自我激励。为了能混过考试不得不记住某些东西与真正想知道并理解所学的东西有着天壤之别。我们深刻感受到了微生物学的内在价值和迷人魅力。你需要满怀激情地投入进去，被探索这个新世界的奇妙感觉所吸引。无论你的最终目的是什么，这都是获得成功和取得成就的关键。尽管掌握书中的论题确实是具有挑战性的，但任何抱着“我能做到”的态度的学生都能达到目的，成千上万已获得成功的学生就是证据。

新版说明

图片的改进

- 修订了 60% 的图片
- 增强了图形表达的一致性
- 把图例置于图形中
- 提高准确性

第 4 版

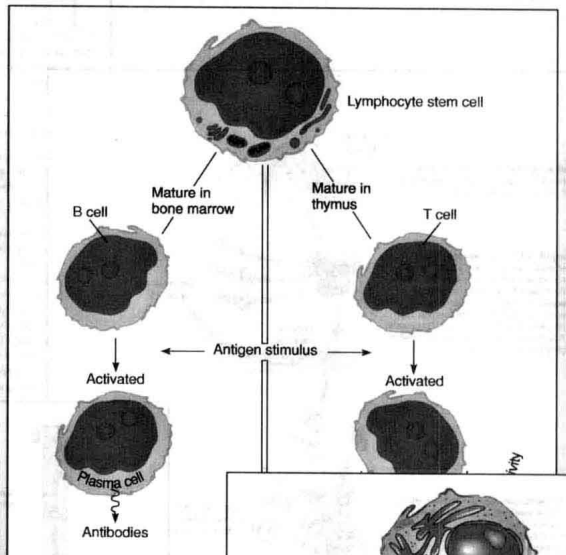


FIGURE 14.11

Summary of the general … lymphocytes, which are t… reactions. B cells and T… diverge into two cell lines. … cannot differentiate them o… large nucleus—cytoplasm …

第 5 版

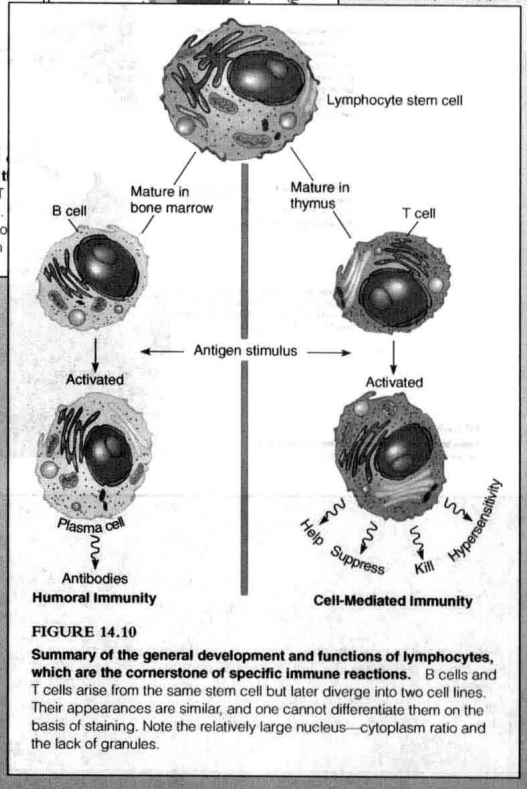


FIGURE 14.10

Summary of the general development and functions of lymphocytes, which are the cornerstone of specific immune reactions. B cells and T cells arise from the same stem cell but later diverge into two cell lines. Their appearances are similar, and one cannot differentiate them on the basis of staining. Note the relatively large nucleus—cytoplasm ratio and the lack of granules.

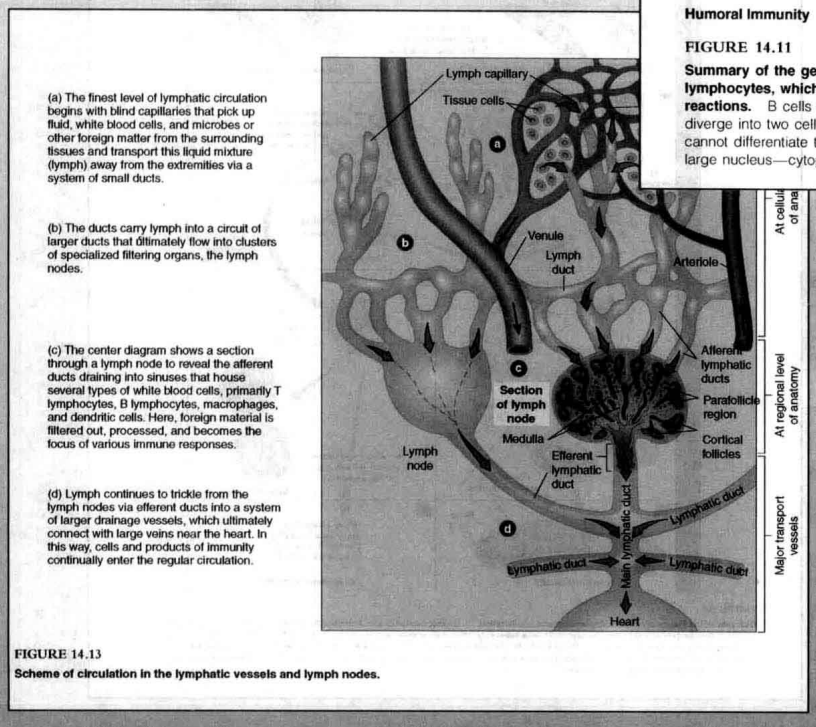
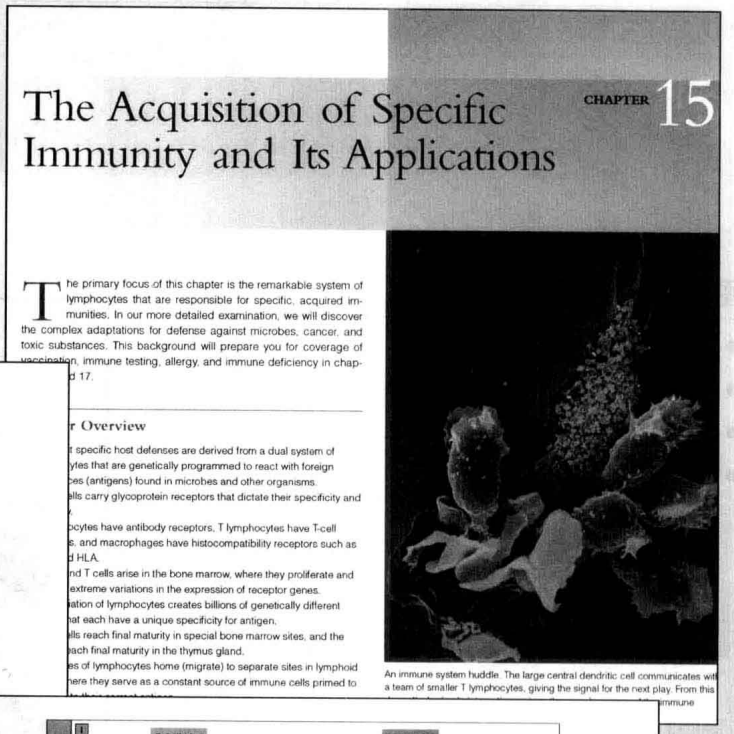


FIGURE 14.13

Scheme of circulation in the lymphatic vessels and lymph nodes.

图 片

- 整合了高质量的照片
- 贯穿全书增加一些新的图解表格和流程图



CHAPTER 15

The Acquisition of Specific Immunity and Its Applications

An immune system huddle. The large central dendritic cell communicates wit a team of smaller T lymphocytes, giving the signal for the next play. From this immune

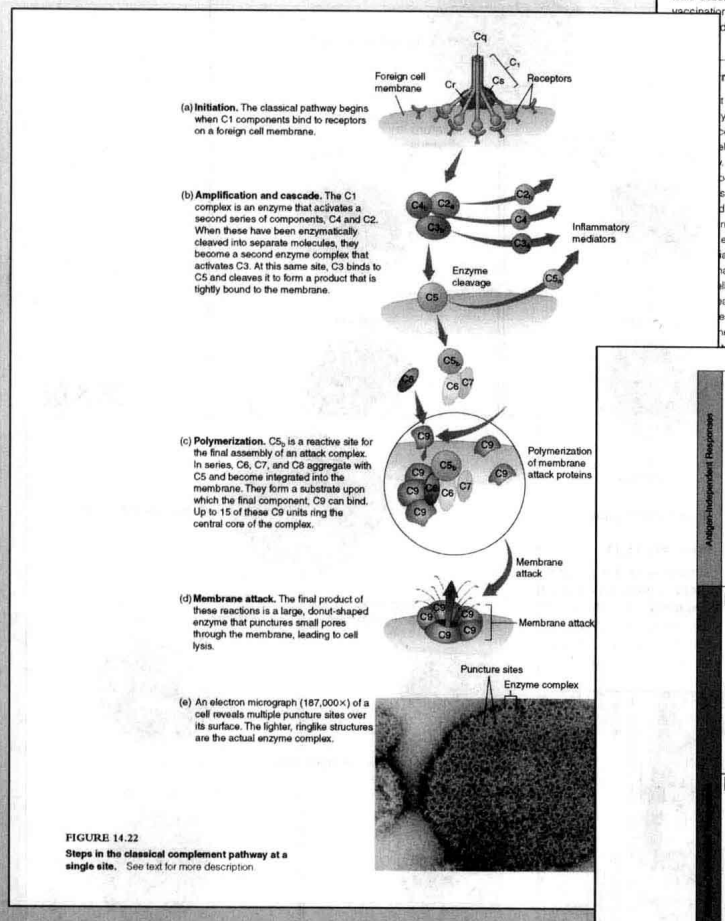


FIGURE 14.22
Steps in the classical complement pathway at a single site. See text for more description.

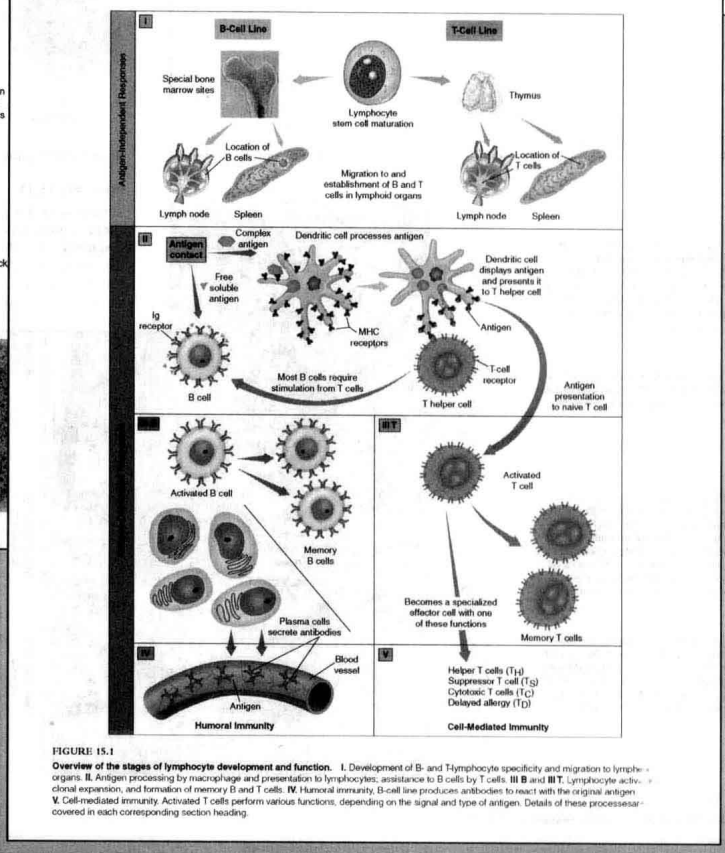


FIGURE 15.1
Overview of the stages of lymphocyte development and function. I. Development of B- and T-lymphocyte specificity and migration to lymphoid organs. II. Antigen processing by macrophage and presentation to lymphocytes; assistance to B cells by T cells. III B and III T. Lymphocyte activation, clonal expansion, and formation of memory B and T cells. IV. Humoral immunity. B-cell line produces antibodies to react with the original antigen. V. Cell-mediated immunity. Activated T cells perform various functions, depending on the signal and type of antigen. Details of these processes are covered in each corresponding section heading.

便于学习的特色

章节概述：每章都以一段适当表述本章中心的短文开头，以提纲列表的方式用粗圆点引出各章主题。

章节检查点：用以快速复习每章各主要部分的主题。

章节小结：以提纲的形式列出关键的单词和概念。小结可帮助学生复习每章的重要信息。

Physical and Chemical Control of Microbes

CHAPTER 11

The natural condition of humanity is to share surroundings with a large, diverse population of microorganisms. The complete exclusion of microbes from the environment is not only impossible but of questionable value. In many instances, however, our health and comfort can depend on the ability to destroy, inhibit, and remove microbes in the habitats we share. These techniques, also known as antimicrobial control, are very broad in scope. They include routine activities such as cleaning, refrigeration, and cooking. They are also of central importance in the medical, dental, and commercial settings to prevent infection and spoilage, and to ensure the safety of food, water, and other products. Both this chapter and chapter 12 will survey important aspects of microbial control.

A look down the cleaning products aisle of most any store will confirm our preoccupation (some would say obsession) with microbial control.

Chapter Overview

- The control of microbes in the environment is a constant concern of health care and industry since microbes are the cause of infection and food spoilage, among other undesirable events.
- Antimicrobial control is accomplished using both physical techniques and chemical agents to destroy, remove, or reduce microbes in a given area.
- Many factors must be contemplated when choosing an antimicrobial technique, including the material being treated, the type of microbes involved, the microbial load, and the time available for treatment.
- Antimicrobial agents damage microbes by disrupting the structure of the cell wall or cell membrane, preventing synthesis of nucleic acids (DNA and RNA), or altering the function of cellular proteins.
- Microbicidal agents kill microbes by inflicting nonreversible damage to the cell. Microbistatic agents temporarily inhibit the reproduction of microbes but do not inflict irreversible damage. Mechanical antimicrobial agents physically remove microbes from materials but do not necessarily kill or inhibit them.
- Heat is the most important physical agent in microbial control and can be delivered in both moist (steam sterilization, pasteurization) and dry (incinerators, Bunsen burners) forms.
- Radiation exposes materials to high energy waves that can enter and

Controlling Microorganisms

Much of the time in our daily existence, we take for granted tap water that is drinkable, food that is not spoiled, shelves full of products to eradicate "germs," and drugs to treat infections. Controlling our degree of exposure to potentially harmful microbes is a monumen-

CHAPTER CHECKPOINTS

Chemical agents of microbial control are classified by their physical state and chemical nature.

Chemical agents can be either microbicidal or microbistatic. They are also classified as high-, medium-, or low-level germicides.

Factors that determine the effectiveness of a chemical agent include the type and numbers of microbes involved, the material involved, the strength of the agent, and the exposure time.

Halogens are effective chemical agents at both microbicidal and microbistatic levels. Chlorine compounds disinfect water, food, and industrial equipment. Iodine is used as either free iodine or iodophor to disinfect water and equipment. Iodophors are also used as antiseptic agents.

Phenols are strongly microbicidal agents used in general disinfection. Milder phenol compounds, the bisphenols, are also used as antiseptics.

Alcohols dissolve membrane lipids and destroy cell proteins. Their action depends upon their concentration, but they are generally only microbistatic.

Hydrogen peroxide is a versatile microbicide that can be used as an antiseptic for wounds and a disinfectant for utensils. A high concentration is an effective sporicide.

Surfactants are of two types: detergents and soaps. They reduce cell membrane surface tension, causing membrane rupture. Cationic detergents, or quats, are low-level germicides limited by the amount of organic matter present and the microbial load.

Aldehydes are potent sterilizing agents and high-level disinfectants that irreversibly disrupt microbial enzymes.

Ethylene oxide and chlorine dioxide are gaseous sterilants that work by alkylating protein and DNA.

CHAPTER CAPSULE WITH KEY TERMS

I. **Physical methods for controlling microorganisms**
   A. Moist heat denatures proteins and DNA while destroying membranes.
      1. **Sterilization: Autoclaves** utilize steam under pressure to sterilize heat resistant materials while intermittent sterilization can be used to sterilize more delicate items.
      2. **Disinfection:** Pasteurization subjects liquids to temperatures below 100°C and is used to lower the microbial load in liquids. Boiling water can be used to destroy vegetative pathogens in the home.
   B. Dry heat, using higher temperatures than moist heat, can also be used to sterilize.
      1. **Incineration** can be carried out using a Bunsen burner or incinerator. Temperatures range between 600°C and 1800°C.
      2. **Dry ovens** coagulate proteins at temperatures of 15° to 180°C.
   C. Cold temperatures are microbistatic, with refrigeration (0° to 15°C) and freezing (below 0°C) commonly used to preserve food, media and cultures.
   D. Drying and desiccation lead to (often temporary) metabolic inhibition by reducing water in the cell.
   E. Radiation: Energy in the form of radiation is a method of **cold sterilization,** which works by introducing mutations into the DNA of target cells.
      1. **Ionizing radiation,** such as Gamma rays and X-rays, has deep penetrating power and works by causing breaks in the DNA of target organisms.
      2. **Nonionizing radiation** uses **ultraviolet waves** with very little penetrating power and works by creating dimers between adjacent pyrimidines, which interferes with replication.
   F. Filtration involves the physical removal of microbes by passing a gas or liquid though a fine filter and can be used to sterilize air as well as heat sensitive liquids.

II. **Chemical Control of Microorganisms**
   A. Chemicals are divided into **disinfectants, antiseptics, sterilants, sanitizers** and **degermers** based on their level of effectiveness and the surfaces to which they are applied.
   B. Antimicrobic chemicals are found as solids, gases and liquids. Liquids can be either aqueous (water based) or tinctures (alcohol based).
   C. Halogens are chemicals based on elements from group VII of the periodic table.
      1. **Chlorine** is used as chlorine gas, hypochlorites and chloramines. All work by disrupting disulfide bonds and, given adequate time, are sporicidal.
      2. **Iodine** is found both as free iodine (I_2) and iodophors (iodine bound to organic polymers such as soaps). Iodine has a mode of action similar to chlorine and is also sporicidal given enough time.
   D. Phenolics are chemicals based on phenol that work by disrupting cell membranes and precipitating proteins. They are bactericidal, fungicidal and virucidal, but not sporicidal.
      1. Although phenol is now considered too toxic to be used in most circumstances, phenolic compounds (Lysol, Triclosan) are commonly used as, or added to, home and hospital disinfectants.
   E. Chlorhexidine (Hibiclens, Hibitane) is a surfactant and protein denaturant with broad microbicidal properties, although it is not sporicidal. Solutions of chlorhexidine are used as skin degerming agents for preoperative scrubs, skin cleaning and burns.
   F. Ethyl and isopropyl alcohol, in concentrations of 50% to 90%, are useful for microbial control. Alcohols act as **surfactants,** dissolving membrane lipids and coagulating proteins of vegetative bacterial cells and fungi. They are not sporicidal.
   G. Hydrogen peroxide produces highly reactive hydroxyl-free radicals that damage protein and DNA while also decomposing to O_2 gas, which is toxic to anaerobes. Strong solutions of H_2O_2 are sporicidal.
   H. Detergents and soaps
      1. Cationic detergents known as **quaternary ammonium compounds** (quats) act as surfactants that alter the membrane permeability of some bacteria and fungi. They are not sporicidal.
      2. Soaps have little microbicidal activity but rather function by removing grease and soil that contain microbes.

章后问题：形式多样，训练学生回答不同类型的问题，包括多项选择题、概念题和思考题。

MULTIPLE-CHOICE QUESTIONS

1. A microbicidal agent has what effect?
   a. sterilizes c. is toxic to human cells
   b. inhibits microorganisms d. destroys microorganisms
2. Microbial control methods that kill ____ are able to sterilize.
   a. viruses c. endospores
   b. the tubercle bacillus d. cysts
3. Any process that destroys the non-spore-forming contaminants on inanimate objects is
   a. antisepsis c. sterilization
   b. disinfection d. degermation
4. Sanitization is a process by which
   a. the microbial load on objects is reduced
   b. objects are made sterile with chemicals
   c. utensils are scrubbed
   d. skin is debrided
5. An example of an agent that lowers the surface tension of cells is
   a. phenol c. alcohol
   b. chlorine d. formalin
6. High temperatures ____ and low temperatures ____.
   a. sterilize, disinfect
   b. kill cells, inhibit cell growth
   c. denature proteins, burst cells
   d. speed up metabolism, slow down metabolism
7. The temperature-pressure combination for an autoclave is
   a. 100°C and 4 psi c. 131°C and 9 psi
   b. 121°C and 15 psi d. 115°C and 3 psi
8. Microbe(s) that is/are the target(s) of pasteurization include:
   a. *Clostridium botulinum* c. *Salmonella* species
   b. *Mycobacterium* species d. both b and c
9. Ionizing radiation removes ____ from atoms.
   a. protons c. electrons
   b. waves d. ions
10. The primary mode of action of nonionizing radiation is to
    a. produce superoxide ions c. denature proteins
    b. make pyrimidine dimers d. break disulfide bonds
11. The most versatile method of sterilizing heat-sensitive liquids is
    a. UV radiation c. beta propiolactone
    b. exposure to ozone d. filtration
12. ____ is the iodine antiseptic of choice for wound treatment.
    a. Eight percent tincture c. Iodophor
    b. Five percent aqueous d. Potassium iodide solution
13. A chemical with sporicidal properties is
    a. phenol
    b. alcohol
    c. quaternary ammonium compound
    d. glutaraldehyde
14. Silver nitrate is used
    a. in antisepsis of burns c. to treat genital gonorrhea
    b. as a mouthwash d. to disinfect water
15. Detergents are
    a. high-level germicides
    b. low-level germicides
    c. excellent antiseptics
    d. used in disinfecting surgical instruments
16. Which of the following is an approved sterilant?
    a. chlorhexidine c. ethylene oxide
    b. betadyne d. ethyl alcohol

CONCEPT QUESTIONS

1. Compare sterilization with disinfection and sanitization. Describe the relationship of the concepts of sepsis, asepsis, and antisepsis.
   t of a tuberculocide.
   e effect of a pseudomonicide?
   static agent do?
   w the type of microorganisms present will
   ctiveness of exposure to antimicrobial agents.
   numbers of contaminants can influence the
   control them.
   microbial death?
   lation of microbes not die instantaneously when
   imicrobial agent?
   ial processes inhibited in the presence of
   natter?
6. Describe four modes of action of antimicrobial agents, and give a specific example of how each works.
7. a. Summarize the nature, mode of action, and effectiveness of moist and dry heat.
   b. Compare the effects of moist and dry heat on vegetative cells and spores.
   c. Explain the concepts of TDT and TDP, using examples. What are the minimum TDTs for vegetative cells and endospores?
8. How can the temperature of steam be raised above 100°C? Explain the relationship involved.
9. a. What do you see as a basic flaw in tyndallization?
   b. In boiling water devices?
   c. In incineration?
   d. In ultrasonic devices?

10. a. What are several microbial targets of pasteurization?
    b. What are the primary purposes of pasteurization?
    c. What is ultrapasteurization?
11. Explain why desiccation and cold are not reliable methods of disinfection.
12. a. What are some advantages of ionizing radiation as a method of control?
    b. Some disadvantages?
13. a. What is the precise mode of action of ultraviolet radiation?
    b. What are some disadvantages to its use?
14. What are the superior characteristics of iodophors over free iodine solutions?
15. a. What does it mean to lower the surface tension?
    b. What cell parts will be most affected by surface active agents?
16. a. Name one chemical for which the general rule that a higher concentration is more effective is *not* true.
    b. What is a sterilant?
    c. Name the principal sporicidal chemical agents.
17. Why is hydrogen peroxide solution so effective against anaerobes?
18. Give the uses and disadvantages of the heavy metal chemical agents, glutaraldehyde, and the sterilizing gases.
19. What does it mean to say that a chemical has an oligodynamic action?
20. a. Define cold sterilization.
    b. Name three totally different methods that qualify for this definition.

CRITICAL-THINKING QUESTIONS

1. What is wrong with this statement: "Prior to vaccination, the patient's skin was sterilized with alcohol." What would be the more correct wording?
2. For each item on the following list, give a reasonable method of sterilization. You cannot use the same method more than three times; the method must sterilize, not just disinfect; and the method must not destroy the item or render it useless unless there is no other choice. After considering a workable method, think of a method that would not work. Note: Where an object containing something is given, you must sterilize everything (for example, both the jar and the Vaseline in it). Some examples of methods are autoclave, ethylene oxide gas, dry oven, and ionizing radiation.

room air	carcasses of cows with "mad cow" disease
blood in a syringe	inside of a refrigerator
serum	wine
a pot of soil	a jar of Vaseline
plastic Petri plates	fruit in plastic bags
heat-sensitive drugs	talcum powder
cloth dressings	milk
leather shoes from a thrift shop	orchid seeds
a cheese sandwich	metal instruments
human hair (for wigs)	mail contaminated with anthrax spores
a flask of nutrient agar	
an entire room (walls, floor, etc.)	
rubber gloves	
disposable syringes	

3. a. Graph the data on tables 11.3 and 11.4, plotting the time on the Y axis and the temperature on the X axis for three different organisms.
   b. Using pasteurization techniques as a model, compare the TDTs and explain the relationships between temperature and length of exposure.
   c. Is there any difference between the graph for a sporeformer and the graph for a non-sporeformer? Explain.
4. Can you think of situations in which the same microbe would be considered a serious contaminant in one case and completely harmless in another?
5. A supermarket/drugstore assignment: With a partner, look at the labels of 25 different products used to control microbes, and make a list of their active ingredients, their suggested uses, and information on toxicity and precautions.
6. Devise an experiment that will differentiate between bacteriocidal and bacteriostatic effects.
7. There is quite a bit of concern that chlorine used as a water purification chemical presents serious dangers. What alternative methods covered by this chapter could be used to purify water supplies and yet keep them safe from contamination?
8. The shelf-life and keeping qualities of fruit and other perishable foods are greatly enhanced through irradiation, saving industry and consumers billions of dollars. How would you personally feel about eating a piece of irradiated fruit? How about spices that had been sterilized with ETO?
9. The microbial levels in saliva are astronomical (<10^6 cells per ml, on average). What effect do you think a mouthwash can have against this high number? Comment on the claims made for such products.
10. Can you think of some innovations the health care community can use to deal with medical waste and its disposal that prevent infection but are ecologically sound?

INTERNET SEARCH TOPICS

1. Look for information on the Internet concerning triclosan-resistant bacteria. Based on what you find, do you think the widespread use of this antimicrobial is a good idea? Why or why not?
2. Find websites that discuss problems with sterilizing reusable medical instruments such as endoscopes and the types of diseases that can be transmitted with them.
3. Handwashing is one of our main protections to ensure good health and hygiene. Visit the student Online Learning Center at www.mhhe.com/talaro5. Go to chapter 11, Internet Search Topics, and log on to the available websites to research information, statistics, and other aspects of handwashing.

网络搜索论题：提供学生调查当前微生物学话题的额外资源。URL 地址列于在线学习中心 www.mhhe.com/talaro5 的各个章节中。

简明目录

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