双语版

MIANYIXUE GAILUN

ESSENTIAL IMMUNOLOGY

免疫学概论

宋新强 刘金锋 祁红兵 Jack W. Lapan [加拿大] 编著

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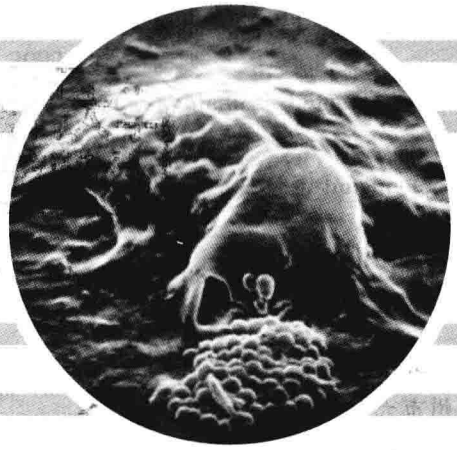

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Abstract

内容提要

The book is composed of 15 chapters, which covers the main contents of immunology. The contents conclude immune organs, tissues, cells, antigen, antibody, complement system, major histocompatible complex, cytokines, cytokine receptors, immune response, immunoregulation, immune Tolerance, clinical immunology and immunological techniques. We used succinct language and detailed illustrations purposefully to intensify bilingual education. The text book can provide readers with modern and practical learning styles by the training of important immunological contents and special english in the associated fields.

The book is compiled for immunology bilingual education and it fits for the senior undergraduates and postgraduates majoring in medical and science biology in the comprehensive university, normal school, medical college and agriculture and forestry schools, and it also be suitable for the students who choose it as selective course majoring in non-biology and for the staffs associated with life sciences.

本书由15章组成，内容涵盖免疫学的中心问题，即免疫器官、组织和细胞、抗原、抗体、补体系统、主要组织相容性复合体、细胞因子和细胞因子受体、免疫应答、免疫调节、免疫耐受、临床免疫、免疫技术等。我们有目的地使用简洁的语言和详尽的插图来强化双语教学。通过提供有关免疫学重要内容和相关领域专业英语方面的训练，本教材能真正为读者提供一种现代的、切合实际的学习方式。

本书是为免疫学双语教学而编写，适用于综合大学、师范院校、医学院校、农林院校内医学或者生物学专业的高年级本科生和研究生，也可作为非生物专业的选修课教材使用，或者供从事生命科学研究的相关人员参考阅读。

Preface

前言

The language of immunology is now english. The vast majority of published research is in english, as are most international conferences. Important questions can only be answered through the collaboration of researchers from all over the world, who each contribute their piece of the puzzle and build on each other's work. But this lively interaction also poses challenges, particularly the problem of language. The language has become so central because a large number of scientists and research centers that have made important contributions to immunology were, and still are, based in England and the United States. The predominance of one language is not necessarily fair, but it is a reality that most professionals working in the field must face.

现在免疫学所用的语言是英语。绝大多数研究结果都用英语发表，大多数国际会议也用英语发言。重大问题只能通过全世界研究人员的合作才能找到答案，每个研究小组为解答难题贡献出他们的研究成果，并在他人研究成果的基础上开展更深入的研究。但是要开展这种密切合作也面临着许多挑战，特别是语言问题。由于对免疫学做出过重大贡献的许多科学家和研究中心都在英国和美国，现在也仍然是这些国家在发挥着主导作用，因此英语已经成为首要的语言。一种语言起主导作用不一定是公平的，但这是大多数在这一领域工作的专业人员必须面对的现实。

For chinese students, learning immunology in english can be very exciting, but also quite challenging. chinese and english are very different languages, with completely different phonetics and writing systems. On top of this, immunology textbooks and articles in english are especially difficult to understand, even for native english speakers. There are a lot of unique vocabularies, and there may be sentence structures particular to scientific writing.

对中国学生来说，用英语学习免疫学会是很令人兴奋的，但也会是颇具挑战性的。汉语和英语是很不一样的语言，具有完全不同的语音和语法体系。此外，免疫学的英语教材和文章特别难以理解，即使对母语为英语的读者来说也是如此。书中有许多特殊的词汇，还会有一些特殊的科技写作方面的惯用句子结构。

In many cases, chinese students are presented with a giant textbook only in english and instructors hope for the best. Our experience as teachers of immunology in China is that this approach is unrealistic. Most students in China at this time, especially those

许多时候，中国学生拿到手的是一本厚厚的英文教材，教师希望学生从中获得最大的收益。我们在中国讲授免疫学的体会是：这样的做法是不切合实际的。这一阶段的大多数中国学生，特别是那些还

who are on a course of scientific study, do not have enough training in english to understand textbooks written for native english speakers. Struggling with the language often comes at the expense of actually learning the concepts and principles of immunology.

We have put together this book with the hope of creating a more realistic, more sympathetic, and more specialized approach to learn immunology in english. Advanced students can learn by reading the english portion of the book, and refer to the chinese translation to check their understanding, or for reference on individual words. Beginners in english can learn from the chinese portion, and refer to the english for an introduction to vocabularies. With both languages present, students and instructors have more options for how to learn.

An added feature of this book is that all the english texts and vocabularies have been accompanied by audio files. They are especially helpful for those who intend to improve their listening comprehension of academic english. Meanwhile, the elaborately designed figures will enable readers to understand concepts and principles in molecular terms much more easily.

It is with great excitement that we invite you to learn immunology with us in english. This is an important age for China and the rest of the world! As China becomes every day more prosperous, its research centers and companies are improving and have much to offer scientific communities around the world. In immunology, you will give your efforts if you can share and communicate with others.

Song Xinqiang Xinyang Teacher's College

October 2012

处于科学研究课程学习阶段的学生，并不具备足够的英语能力去理解为母语是英语的读者编写的教材。在语言上的些许进步实际上是以牺牲理解免疫学概念与原理为代价的。

我们编写此书的目的是想为用英语学习免疫学提供一种更实际、更让人喜欢和更专业的方法。程度好的学生可以阅读本书的英文部分，并参考中文译文以检查他们的理解情况，或参考个别单词的中文含义。英语程度差一点的学生可以从本书的中文部分学习，并参考英文而开始掌握专业词汇。使用这样的英汉对照教材，在如何学习上学生和教师都可以有更多的选择。

本书的另一个特点是：所有的英语课文和词汇都有配套的音频文件。它们对那些希望提高自身专业英语听力水平的人很有帮助。同时，精心设计的插图能使读者更容易地从分子水平上理解相关的概念与原理。

能邀请你与我们一道用英语来学习免疫学让我们觉得很兴奋。中国和世界的其他国家正处于一个重要的时代！随着中国的日益进步与繁荣，中国的研究中心和公司正在取得更大的进展，它们正在为世界科学共同体提供更多的研究成果。在免疫学领域，如果你能够共享知识与技能并相互交流，科技进步也有你的一份贡献。

宋新强　信阳师范学院

2012 年 10 月

Contents

目录

1.1 Immune Organs and Tissues

The bone marrow and thymus are the primary lymphoid organs in mammals. T and B cells with diverse antigen receptors are produced in these organs. Following selection processes, they migrate to the secondary lymphoid tissues-spleen, the lymph nodes, and the mucosa—associated lymphoid tissues (MALT) (Fig. 1-1).

1.1 免疫器官和组织

骨髓和胸腺是哺乳动物的初级淋巴器官。具有多样抗原受体的T细胞和B细胞在这些器官中产生。在经历选择过程后，它们迁移到次级淋巴组织——淋巴结、脾和与黏膜相关淋巴样组织(MALT)。

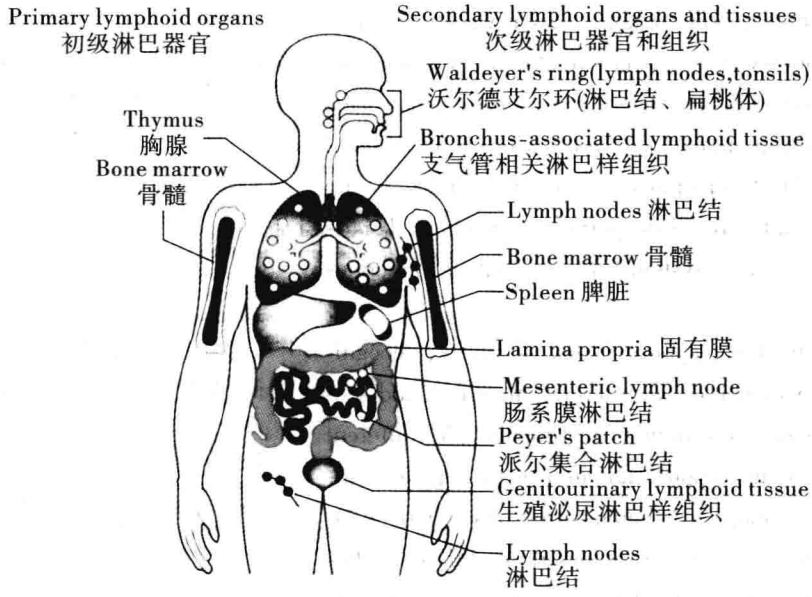

Fig. 1-1 Lymphoid Organs and Tissues. (淋巴器官和组织)

Lymphocytes produced in the primary lymphoid organs (thymus and bone marrow) migrate to the secondary organs and tissues where they respond to microbial infections. The mucosa-associated lymphoid tissue (MALT) together with other lymphoid cells in sub-epithelial sites (lamina propria) of the respiratory, gastrointestinal and genitourinary tracts comprise the majority of lymphoid tissue in the body.

在初级淋巴器官(胸腺和骨髓)中产生的淋巴细胞迁移到它们应答微生物感染的次级器官和组织。黏膜相关淋巴样组织(MALT)与呼吸、胃肠和泌尿生殖道的亚上皮部位(固有膜)中的其他淋巴细胞一起，构成机体大部分淋巴组织。

1.1.1 Bone Marrow

During early fetal development blood cells are produced in the mesenchyme of the yolk sac. As the development of the fetus progresses the liver and spleen take over this role. It is only in the last months of fetal development that the bone marrow becomes the dominant site of hemopoiesis (blood cell formation). Bone marrow is composed of hemopoietic cells of various lineages and maturity, packed between fat cells, thin bands of bony tissue (trabeculae), collagen fibers, fibroblasts and dendritic cells. All of the hemopoietic cells are derived from multipotential stem cells which give rise not only to all of the lymphoid cells found in the lymphoid tissue, but also to all of the cells found in the blood.

Ultrastructural studies show hemopoietic cells cluster around the vascular sinuses where they mature, before they eventually are discharged into the blood. Lymphocytes are found surrounding the small radial arteries, whereas most immature myeloid precursors are found deep in the parenchyma. The bone marrow gives rise to all of the lymphoid cells that migrate to the thymus and mature into T cells, as well as to the major population of conventional B cells. B cells mature in the bone marrow and undergo selection for non-self before making their way to the peripheral lymphoid tissues: there they form primary and secondary follicles and may undergo further selection in germinal centers.

1.1.2 Thymus

The thymus is a lymphocyte-rich, bilobed, encapsulated organ located behind the sternum, above and in front of the heart. It is essential for the maturation of T cells and the development of cell-mediated immunity. In fact, the term "T cell" means thymus-derived cell and is used to describe mature T cells. The

1.1.1 骨髓

在胎儿发育早期,在卵黄囊的间充质中产生血细胞。当胎儿生长发育时,肝和脾接替这一任务。仅在胎儿发育的最后几个月,骨髓成为血细胞生成(血细胞形成)的主要部位。骨髓由填充在脂肪细胞之间的各种谱系和成熟度的造血细胞、薄的骨组织带(骨小梁)、胶原纤维、成纤维细胞和树突细胞组成。所有的造血细胞都起源于多能干细胞,多能干细胞不仅产生淋巴组织中见到的所有淋巴细胞,而且也产生血液中见到的所有淋巴细胞。

超微结构的研究显示,造血细胞在它们最后释放到血液中之前,聚在它们得以成熟的血管窦周围。在小的桡动脉周围可见到淋巴细胞,而在实质深处发现大多数未成熟的骨髓前体。骨髓产生迁移到胸腺并且成熟为T细胞的所有淋巴细胞,也产生主要的常规B细胞群。B细胞在骨髓中成熟,并在使它们通向外周淋巴组织之前,经历非自身选择,它们在外周淋巴组织中形成初级和次级滤泡,并可能在生发中心经受进一步选择。

1.1.2 胸腺

胸腺是有丰富的淋巴细胞、有两叶被囊的、位于胸骨后心脏上前方的器官。它对于T细胞的成熟和发展细胞介导的免疫是必不可少的。事实上,术语"T细胞"意味着胸腺起源的细胞,并用来描述成熟的T细胞。胸腺的活性在胎儿期和儿童

activity of the thymus is maximal in the fetus and in early childhood and then under-goes atrophy at puberty although never totally disappearing. It is composed of cortical and medullary epithelial cells, stromal cells, interdigitating cells and macrophages. These "accessory" cells are important in the differentiation of the immigrating T cell precursors and their "education" (positive and negative selection) prior to their migration into the secondary lymphoid tissues.

The thymus has an interactive role with the endocrine system as thymectomy leads to a reduction in pituitary hormone levels as well as atrophy of the gonads. Conversely, neonatal hypophysectomy (removal of the pituitary gland) results in thymic atrophy. Thymic epithelial cells produce the hormones (thymosin and thymopoietin) and in concert with cytokines (such as IL-7) are probably important for the development and maturation of thymocytes into mature T cells (Fig. 1-2).

早期最大,在青春期萎缩,但是永远不会完全消失。它是皮质和髓质上皮细胞、基质细胞、交错突细胞和巨噬细胞组成。这些"佐细胞"在T细胞迁到次级淋巴组织之前,在迁移的T细胞前体分化及其"训育"(阳性和阴性选择)是很重要的。

胸腺与内分泌系统可相互作用,如胸腺切除术导致激素水平降低和性腺萎缩。相反,新生儿的垂体摘除术(去除脑下垂体)也可引起胸腺萎缩。胸腺上皮细胞产生激素(胸腺素和胸腺生成素),并与细胞因子(如IL7)合作,可能对胸腺细胞发育和成熟为成熟的T细胞是重要的。

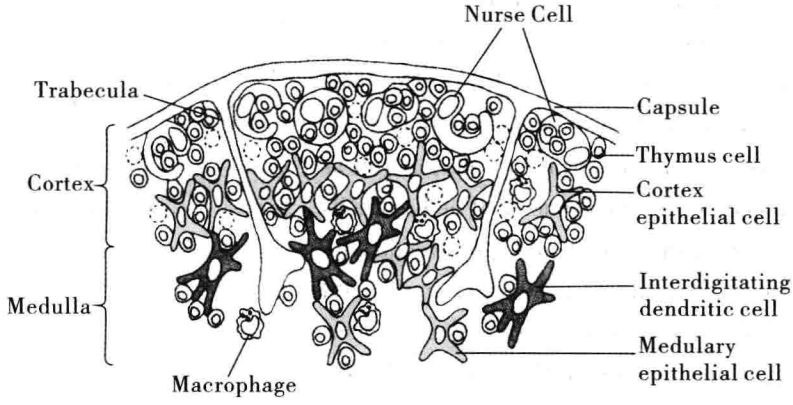

Fig. 1-2 Thymic Structure(**胸腺结构**)

trabecula 小梁;cortex 皮质;medulla 髓质;nurse cell 哺育细胞;capsule 被膜;thymus cell 胸腺细胞;cortex epithelial cell 皮质上皮细胞;interdigitating dendritic cell 指突状树突细胞;medullary epithelial cell 髓质上皮细胞;macrophage 巨噬细胞

1.1.3 Spleen

The spleen is a large, encapsulated, bean-shaped organ with a spongy interior (splenic pulp) that is situated on the left side of the body below the diaphragm. The large splenic artery pervades the spleen and branches of this artery are surrounded by highly organized lymphoid tissue (white pulp). The white pulp forms "islands" within a meshwork of reticular fibers containing red blood cells, macrophages and plasma cells (red pulp). Closely associated with the central arteriole is the "periarteriolar lymphatic sheath", an area containing mainly T cells and interdigitating cells (IDC). Primary lymphoid follicles, composed mainly of follicular dendritic cells (FDC) and B cells, are contained within the sheath. During an immune response these follicles develop germinal centers (i. e. become secondary follicles). The periarteriolar lymphoid sheath is separated from the "red pulp" by a marginal zone containing macrophages and B cells. The central arterioles in the periarteriolar sheath subdivide like the branches of a tree. The space between the branches is filled with "red pulp", and vascular channels called splenic sinuses. The spleen is a major component of the mononuclear phagocyte system, containing large numbers of phagocytes. Unlike lymph nodes, it does not contain either afferent or efferent lymphatics.

The main immunological function of the spleen is to filter the blood by trapping blood-borne microbes and producing an immune response to them. It also removes damaged red blood cells and immune complexes. Those individuals who have had their spleens removed (splenectomized) have a greater susceptibility to infection with encapsulated bacteria, and are at increased risk of severe malarial infections, which indicates its major importance in immunity. In addition, the spleen acts as a reservoir of erythrocytes

1.1.3 脾脏

脾脏是一个大的、有被囊的、有海绵质内部(脾髓)的豆形器官,位于隔膜下,身体左侧。大的脾动脉遍布脾脏,这些动脉的分支被高度组织的淋巴组织(白髓)所包围。白髓在含有红细胞、巨噬细胞和浆细胞(红髓)的网状纤维的网眼内形成"岛"。与中央小动脉有密切联系的是"小动脉周围淋巴鞘",是个主要含有T细胞和交错突细胞的区域。鞘内含有主要由滤泡树突细胞和B细胞构成的初级淋巴滤泡。在免疫应答期间,这些滤泡发展成生发中心(即变成次级滤泡)。含有巨噬细胞和B细胞的边缘区将小动脉周围淋巴鞘与"红髓"分隔开。在小动脉周围淋巴鞘中的中央小动脉像树的枝条一样再分。枝条间的空间全部被红髓,以及称之为脾窦的血管占据。脾脏是含有大量吞噬细胞的单核吞噬细胞系统的主要组成部分。与淋巴结不同,它既不含输入淋巴管也不含输出淋巴管。

脾脏的主要免疫学功能是通过截留血源性微生物,并与之产生免疫应答来过滤血液。它也去除损伤的红细胞和免疫复合体。那些去除脾(脾切除)的个体对有荚膜细菌的感染有更大的易感性,并处于增加严重疟疾感染的危险中,这表明脾脏在免疫中有较大的重要性。此外,脾脏还起红细胞储蓄器的作用。