21世纪农业科学专业英语

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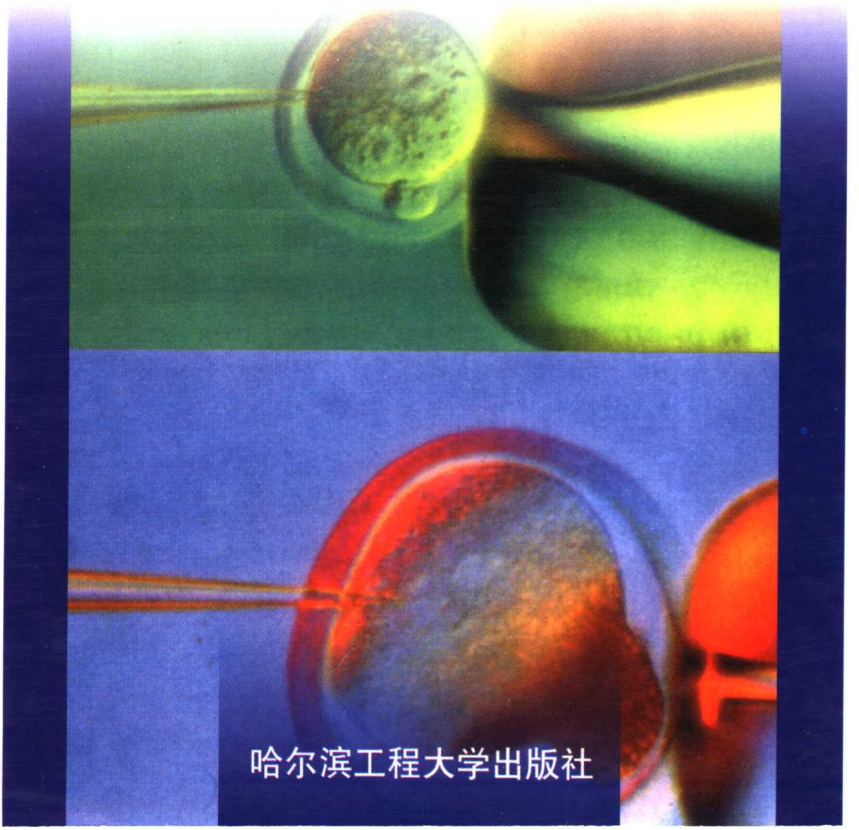
生物技术英语

English Course for Biotechnology

贾洪波 孙兴参 主编



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内 容 简 介

本书精选了有一定理论深度,并能深入浅出阐述该技术领域基础知识和科研成果的文章,有助于读者理解并增加了趣味性和可读性。

为了更好地学习科学知识和科技英语,每一单元我们精选了两篇,分为Part A和Part B两部分,每篇都作了详细的注释,Part A给出了参考译文,并附有练习和思考题。本书适合大学本科学生作为专业英语教材使用,也可作为科技人员的参考阅读使用。

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总　序

国家教育部1999年9月颁发的现行《大学英语教学大纲(修订本)》(以下简称《大纲》)规定:大学英语教学分为基础阶段(大学一、二年级)和应用提高阶段(大学三、四年级)。基础阶段的教学分为六级,或称大学英语一至六级(College English Bands 1－6,简称CEB1－6)。应用提高阶段的教学要求包括专业英语(Subject－Based English,简称SBE)和高级英语(Advanced English,简称AE)两部分。学生在完成基础阶段的学习任务即达到四级或六级后,都必须修读专业英语。已达到六级要求且学有余力的学生,除修读专业英语外,还可以选修高级英语课程。《大纲》不仅对专业英语的重要性,而且对专业英语的词汇和读、听、说、写、译的能力都做了明确说明。

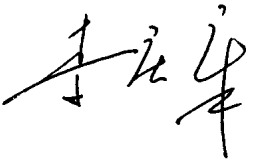
按照《大纲》要求,本套教材在选材时,既注重专业英语的文体特征,又避免使用科普文章。本书教材的75%左右为专业基础内容,25%左右为专业前沿文献,一般从专业英语期刊中选取。主要因为学生在两年基础阶段的学习后,虽然专业基础知识已经建立,但对专业前沿内容尚知之不多。选取期刊上的内容,目的在于让学生深入了解专业英语文体特征和专业文献阅读方法,用英语来学习专业知识,同时也是向双语教学的过渡。

专业英语与公共英语中的日常英语和文学英语并无本质区别,只是文体(genre)不同。专业英语并无独立的语言系统,虽然专业英语中有大量的专业名词和术语,但是它的基本词汇都来自公共英语。除此之外,专业英语的语法有其自身特性和语法现象,但语法结构都仍遵循公共英语的一般规则,并无自己的独立语法。由此可见,公共英语是专业英语的基础,二者相互关联而具有显著

的共通性。在编写这套教材时，我们采用专业教师和英语教师结合。专业教师负责文献取材，英语教师负责练习编排，文献翻译由专业教师和英语教师共同负责。既注重语言文字的流畅，又注重内容术语的准确。

本套教材是学生完成英语从基础学习过渡到实际应用的有效教材。通过教学，从英语文献阅读、英语资料翻译到英文摘要写作，系统科学地培养学生的英语应用能力，也为日后双语教学的逐步开展铺路搭桥。

是为之序。



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2002 年 9 月 10 日

前　言

近些年，生命科学发展迅速，尤其是生物技术的发展更是突飞猛进，出现了许多惊人的新成果。这些成果不仅引起了学术界的极大关注，而且也在很大程度上影响了人类的生活。这是一个激动人心的时代，不论是专攻生命科学的还是其它专业的学子，不论是专业研究人员，还是普通读者，都迫切希望掌握和了解这些最新成果和应用前景。由于英语是一门国际性交流语言，所以许多科技成果都要借助英语进行表述和交流。为此我们编选了这本《生物技术英语》以飨读者。

入选的文章不但突出了最新的成果和发展方向，同时也尽可能反映该技术领域的基础知识，使读者在掌握最新的科技突破的同时又巩固了基本知识。为了避免文章过于专业化，我们精选了有一定理论深度，并能深入浅出阐述该技术领域基础知识和科研成果的文章，有助于读者理解并增加了文章的趣味性和可读性。为了更好地学习科学知识和科技英语知识，每一专题文章我们选择了两篇(A，B 两篇，其中 A 篇给出了参考译文)，每篇都进行了详细的注释和说明，并附有练习和思考题。我们希望这本书能帮助广大读者更好地掌握生物技术知识，提高阅读科技英语文章的能力，拓宽知识面，加强对全球信息的了解，以适应科技时代的发展。

这本书是集体劳动的结晶，除了编委人员，还有很多人为此书的编写提供了帮助。在此特别感谢哈尔滨工程大学出版社和胡家英副院长，他(她)们为此书的出版提供了机会。东北农业大学李景鹏教授负责本书的主审工作，对他诚挚的帮助表示最深的谢意！

贾洪波

2002 年 10 月

Preface

Life science, especially biotechnology, has developed rapidly in recent years. Great achievements have been made and these achievements not only draw attention from academic circle, but also make great effect on human beings' life. This is an encouraging age. People from all walks of life are eager to know the latest outcome and the potential applications of biotechnology. In order to meet the readers' need, we edit this Scientific English on Biotechnology. This book is intended to help the readers master the knowledge of biotechnology and improve the scientific English reading ability.

The articles chosen here highlight the up-to-date research and achievements and at the same time the basic knowledge of this field is also introduced. We hope in this way, the readers can not only know the breakthrough in this field, but also strengthen their basic knowledge. To avoid being too professional, the articles selected should explain deep theories with simple words and easily – understood examples. There are fourteen units in this books and each one has two articles. The two articles are chosen on one subject for a better understanding of both biological and English knowledge. All part A articles are translated and exercises are attached to each one.

This book is a product of group work. Except the editors, I must thank several people for their help. The publishers and Associate Professor Hu Jiaying provided the initial push to get the project under way. I am indebted to Professor Li Jingpeng at North

East Agriculture University for reading the text and suggesting improvements. This book would never have been finished without their help.

Jia Hongbo

2002.10

Contents

Unit 1

Part A

A Basic Primer on Biotechnology

Michael D. Peel and David F. Betsch

1 Biotechnology Defined

Biotechnology can be broadly defined as "using living organisms or their products for commercial purposes." As such, biotechnology has been practiced by human society since the beginning of recorded history in such activities as baking bread、brewing alcoholic beverages or breeding food crops or domestic animals. A narrower and more specific definition of biotechnology is "the commercial application of living organisms or their products, which involves the deliberate manipulation of their DNA molecules". This definition implies a set of laboratory techniques developed within the last 20 years that have been responsible for the tremendous scientific and commercial interest in biotechnology, the founding of many new companies, and the redirection of research efforts and financial resources among established companies and universities. These laboratory techniques provide scientists with a spectacular vision of the design and function of living organisms, and provide technologists in many fields with the tools to implement exciting commercial applications.

2 Principles of Biology

Biotechnology and its use to modify the genetic makeup of living organisms has become a topic of heated discussion in recent years. Confusion is plentiful on the topic of biotechnology and genetically modified organisms (GMOs). The purpose of this section is to discuss genetic/biochemical processes at a basic level.

2.1 Genome

The complete set of genetic instructions for a living organism is contained in its genetic code, referred to as its genome. The genome for each organism differs by the number and size of chromosomes and the number of genes each contains. Each chromosome is composed of a single strand of deoxyribonucleic acid (DNA) and specialized protein molecules. (Figure 1a and Figure 1b). Coding regions called genes are along the DNA strand of each chromosome. Only specific regions of each chromosome code for genes. Alternate forms of genes in each organism account for the differences between individuals. Each DNA strand is composed of similar repeating units called nucleotides (Figure 1c). Four different nucleotide bases are present in DNA. They are adenine (A), thymine (T), cytosine (C), and guanine (G). The specific order of these bases in a gene coding region on the DNA strand specify exact genetic instructions.

Two DNA strands are held together by bonds between the bases; these constitute base pairs. Often the size of a genome is referred to by its number of base pairs. Each time a cell divides, the full genome is replicated and each daughter cell receives an exact copy of the genetic code(Figure 1d). Each strand of DNA directs the synthesis of a complementary strand with free nucleotides matching up with their new complementary bases on each of the strands. Strict base pairing is adhered to; A will only pair with T, and C will only pair with G. Each daughter cell receives one old and one new DNA strand(Figure 1e)..

2.2 Genes

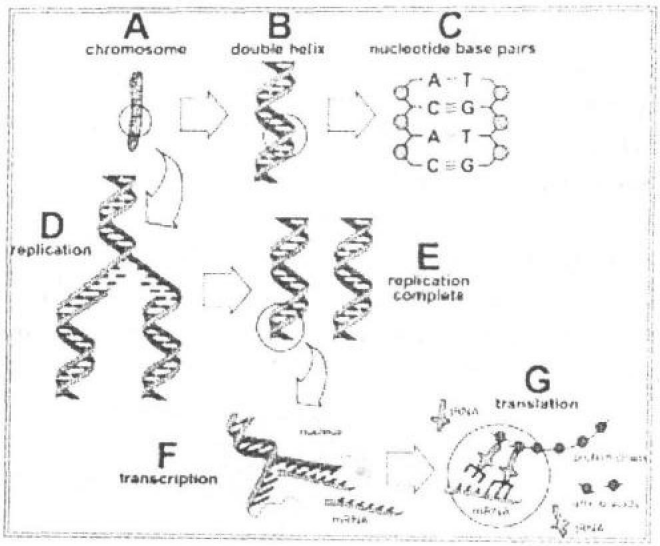

Figure 1. The basic structure and function of chromosomes and genes

The genes on each DNA strand contain the basic physical and functional units of heredity. A gene is a specific sequence of nucleotide bases, whose sequences carry the information required for constructing proteins. In turn, proteins regulate the expression of the genes and provide structural components and enzymes for biochemical reactions necessary for all living organisms. The protein-coding instructions from genes are transmitted indirectly through messenger ribonucleic acid (mRNA), a transient intermediary molecule similar to a single strand of DNA. For the information within a gene to be expressed, a complementary RNA strand is produced (by a process called transcription) from the DNA template in the nucleus(Figure 1f). This mRNA is moved from the nucleus to the cellular cytoplasm, where it serves as the template for protein synthesis. The cell's protein-synthesizing machinery then translates

the genetic code, or codons, into a string of amino acids that will constitute the protein molecule (by a process called translation) encoded by the gene (Figure 1g). Following modification, the resulting protein can begin its function either as an enzyme, structural or regulatory protein.

Proteins are large, complex molecules made up of long chains of amino acid subunits. There are 20 different amino acids. Within a gene, each specific sequence of three DNA bases (codons) directs the cell's protein-synthesizing machinery to add a specific amino acid. For example, the base sequence ATG codes for the amino acid methionine (any biochemistry text will have a complete list of amino acids and their corresponding codons). The genetic code is thus a series of codons that specify which amino acids are required to make the specific protein a gene codes for. The genetic code is the same for all living organisms.

Not all genes are expressed in all tissues. For example, the tassel and developing ears on a corn plant (Zea mays) produce pollen and embryos that will develop into seed. The differences between these two plant parts are ultimately controlled by gene expression. The differential expression of genes is controlled by its promoter. The expression of a few genes in plants are controlled by environmental factors such as sunlight, temperature, and day length. These three factors are important in triggering flowering in many plant species.

3 Using of biotechnology:

Biotechnology includes a vast array of tools used in research and modification of biological systems. These include: genetic mapping, the process of identifying the location of a gene on a chromosome and elucidating the gene sequence; molecular based disease diagnosis, identifying specific alleles (alternate forms of a gene) of a gene which cause genetic diseases; gene therapy, replacing an absent or defective gene with a working one enabling normal body function;

forensic science, solving crimes and identifying human remains not previously possible; and genetic transformation, movement of a gene or group of genes from one organism to another. This process is also called genetic engineering.

3.1 Genetic Transformation (genetic engineering.)

Genetic transformation is the area of biotechnology that has created the greatest amount of stir and which will be the focus from this point on. Organisms with genetic material from another organism are often referred to as genetically modified organisms or GMOs. Since all crop and domesticated animal species have been genetically modified since the dawn of time, technically they are also GMOs. When referring to organisms with a gene from another species, transgenic is a more accurate description.

Many of the processes of biotechnology have been used for many years. Insulin from pigs and cows was historically used to treat diabetes and was beneficial to a many. However, there was not a consistent supply and some individuals developed adverse reactions to this type of insulin because their bodies recognized it as foreign and mounted an immune response. Human insulin produced through cloning and inserting human genes in bacteria resulted in insulin that did not cause an immune response. This was the first pharmaceutical produced through biotechnology and it has insured a consistent reliable source of human insulin.

Before a gene is transferred to another organism it must be identified, isolated and cloned. In the laboratory, the mRNA molecule from a gene being expressed can be isolated and used as a template to synthesize a complementary DNA (cDNA) strand. This isolated cDNA strand can then be cloned (duplicated) for transformation into another species. The cDNA strand can be used to locate the corresponding gene on a chromosome, or map it.

Transformation is typically accomplished by using either Agrobacterium tumefaciens or particle acceleration and the gene gun

(Figure 2). Agrobacterium tumefaciens is a bacteria that occurs in nature. It contains a small circular piece of DNA called a Ti plasmid (Ti for tumor inducing). When this bacterium infects certain woody plant species, the Ti plasmid enters cells of the host plant. Certain regions of the Ti plasmid insert themselves into the host cell's genome. This insertion occurs in a region of the DNA strand with a specific sequence. The host cell then expresses the gene from the bacteria, which induces massive cell growth and the resultant plant tumor the bacteria is named for (Figure 3). Biotechnology utilizes this natural transformation process by removing the bacterial genes from the region transferred to the host genome and substituting genes of interest (Figure 2a). Agrobacterium use for transformation is limited because it will only infect certain dicotyledonous species.

The other transformation process involves coating gold particles with genes of interest. The gold particles are shot into single cells of the plant of interest with the gene gun. This is commonly referred to as particle acceleration. In a process not fully understood, the transgene(s) are incorporated into a DNA strand of the host genome (Figure 2b). This process is inefficient but does not have the host species limitation of Agrobacterium.

Both processes require the use of plant tissue culture. Individual cells of the plant to be transformed are cultured. These are then subjected to the transformation process. Non-transformed cells must be eliminated. This is done with selectable marker genes. In the case of the Roundup Ready gene, Roundup (glyphosate) is used directly as the selectable marker, since Roundup will kill non-transformed cells. When another trait of interest is being transformed in the crop, a selectable marker like antibiotic or herbicide resistance is used. The cells in culture are treated with the herbicide or an antibiotic. Only those cells that were transformed with the two genes will survive. Whole plants are then regenerated from the single cells that survive.