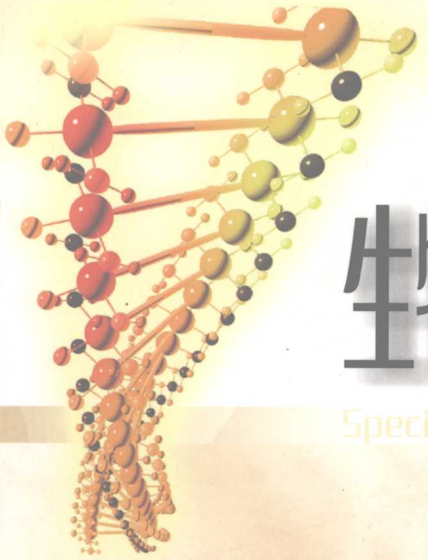
专业英语系列教材

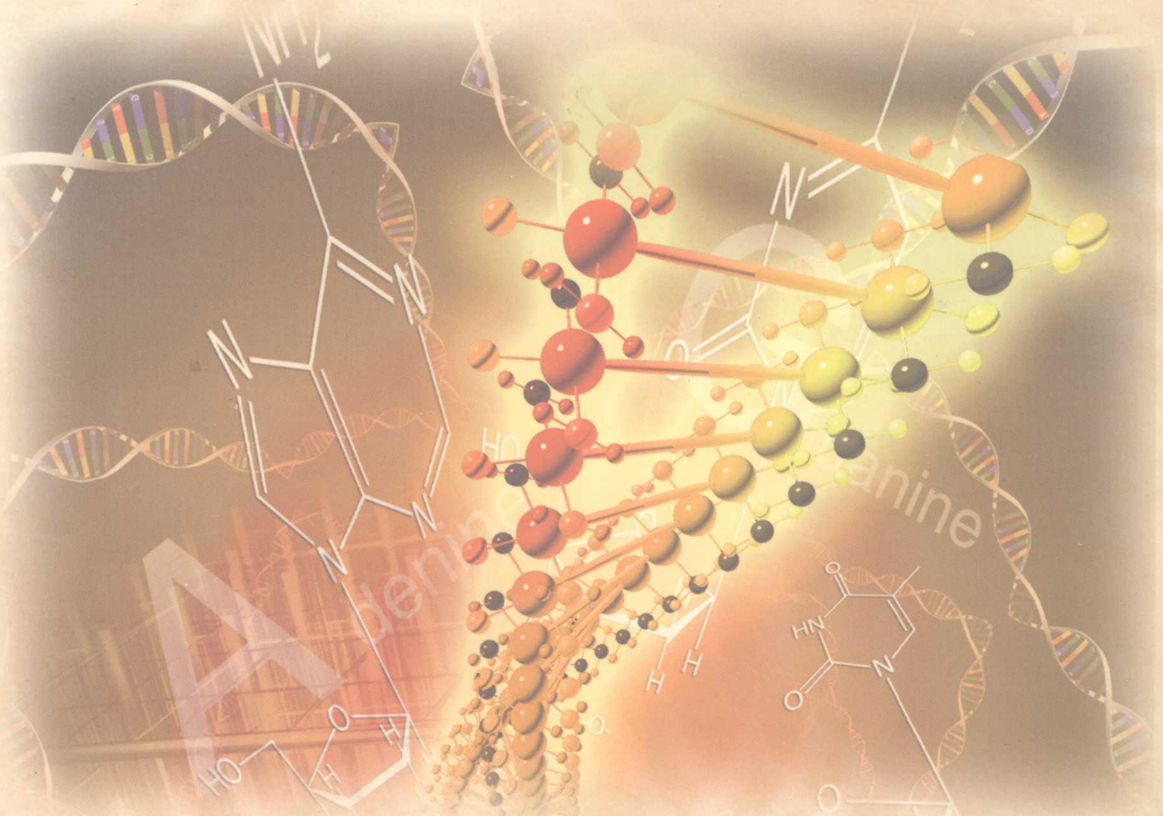


Specialistic English of Bioengineering and Biotechnology

生物工程及生物技术专业英语

Specialistic English of Bioengineering and Biotechnology

主　编　范伟平
主　审　周　华



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前　言

专业英语是大学本科学生完成了基础英语学习后的一门后续课程。该课程目的是通过这门课程的学习与训练，使学生掌握常用专业词汇和相关科技英语表达方式，提高阅读和翻译英语科技文献的能力；以英语为工具获取专业所需的信息。随着高等教育改革的深入，面对非基础课程学时的缩减，以及学生就业面拓宽的新形势的需要，编者感到有必要编写新的专业英语教材。本教材精心摘选一些近年来与生物工程相关的科技成果信息和报道以吸引学生的兴趣；专业词汇的注释突出专业英语构词法的特点，提供一些具有本专业特色的英语表达形式和科技英语常用句式以及一些常用资料，有助于学生尽快掌握翻阅专业英语书刊的基本技巧，也便于学生在毕业论文实践和日后工作中，或研究生学习期间将本教材作为一本实用的专业工具参考书使用。现将本书编写方式、内容和特点介绍如下。

一、课文内容

本教材课文内容的编排参照本科学生基础理论课程和专业课程的教学计划，由浅入深，逐步接触更多的专业知识。课文内容涉及无机化学、有机化学、分析化学、生物化学、微生物学、分子生物学和发酵工程、酶工程、生物分离工程、环境生物技术等工业生物技术。本教材力求让学生掌握更多的与生物工程相关的基本专业词汇，结合课文内容介绍科技英语常用句式、表达方式和基本文体。

二、编写结构

本教材的基本编写结构如下。

1. 课文包括正文(Text)和阅读材料(Reading Material)两个部分

Text 附有词汇注释和难句解析(Notes)，注重介绍专业词汇构词法(词根、前缀、后缀等)，配有和 Text 相关的基本练习(Exercises)。Reading Material 附有是非判断题供课后阅读训练；此外还附有相关的专业词汇和常用短语(Related Words and Expressions)，供学生扩展必要的专业词汇。

2. 专业英语阅读、翻译技巧和英文写作基础知识

本教材较系统地介绍有关翻译理论知识，重点介绍英译汉的技巧。有关英文写作常识的介绍，在课文中注重分析和拓展科技论文常用句式；课文采用了常见的多种文体，包括美国《化学文摘》(CA) 的摘要、美国专利，本领域专业核心期刊的研究论文和综述，结合课文介绍专业论文摘要和正文的结构特点及写作方法。与课文同步的 Exercises 也要求学生做这方面的训练，以逐步提高学生专业英语的阅读和写作能力。

3. 教材后面附有 Text 的译文

本教材课文摘选自各种与生物工程相关的书刊文献，每篇文章末尾均注有原文的出处和作者姓名。在此谨向被摘用的文章作者和出版社表示衷心的感谢和敬意。本教材还摘用了许赣荣编写的《发酵生物技术专业英语》和邬行彦、储炬等编写的《生物工程、生物技术专

业英语》的附表部分内容，特在此表示衷心的感谢和敬意。

本教材由南京工业大学制药与生命科学学院范伟平教授编写，由周华副教授邀请徐虹教授、何冰芳教授、严明副教授和姚忠副教授对教材内容共同进行了审核。在本教材撰写过程中，多名教师热情提供了资料和帮助，在此，编者向关心本书编写的同事们表示诚挚的谢意，也向积极支持本教材编写的华中科技大学出版社的有关编辑表示由衷的感谢。

另外，要说明的是，对于化学单位、符号等一般尊重原文，按原文标识。

由于编者的业务和英语水平有限，也因时间紧促，在本教材的注释和译文中，难免会有错误之处，欢迎专家和广大读者批评指正，帮助编者进一步完善专业英语教材。

编　者

2007年10月于南京工业大学

CONTENTS

Unit 1

Text

Chemical and Biological Engineering

Biological engineering and bioengineering are no longer new topics for chemical engineering. However, while these terms have become quite common in the *lexicon* of the *discipline*, the concepts associated with them are still rather ill defined and often confusing. As there is no longer doubt about the growing importance of biology as enabling science of industries critical for chemical engineering, it is becoming imperative that a discussion be initiated to eventually lead to a consensus about the meaning of biological engineering and its relevance to the profession of chemical engineering. ①This consensus could then guide present activities in *curriculum* reform, department name changes, *reorientation* of student and *faculty* interests and similar efforts by our professional organization. The purpose of this perspective is to offer some thoughts that might be helpful to this end.

lexicon	词典，手册
discipline	学科
curriculum, curricula (pl.)	课程
reorientation	再定位，再定方向
faculty	系，（大学）教员

Let me begin by noting that the most precious asset of a profession is its intellectual core. In an era of rapid evolution of industry and curricula, it is imperative that a discipline defines its own core and strengthens it through scholarly activity and diverse applications. During the past 15 years, we have witnessed an increasing attraction of students and faculty to biological applications of chemical engineering. This trend is paralleled by an *on-going transformation* of the chemical processing industry to a life sciences based one. In response to these developments, we have expanded our base to include biology, along with chemistry and physics, as fundamental science of chemical engineering. However, it is important to note that, amidst such drastic industrial and educational changes, our own chemical engineering core remains virtually unchanged regardless of the domain of its application.

on-going	正进行的
transformation	转化

. . .

It is important to note that the vision of chemical and biological engineering does not imply a radical departure from the present but an evolution into a very promising future. It does not change the core; on the contrary, it strengthens it with examples from a most exciting science. ② It does not suggest that areas where chemical engineers have contributed in the past and presently lead be abandoned. On the contrary, it enriches the *portfolio* of chemical engineering education and research, thus creating unparalleled opportunities at the interfaces between biology and the more traditional chemical engineering areas, such as, *polymers* (biomaterials), reaction engineering (*metabolic* engineering), computers and systems (systems biology), *thermodynamics* (thermo of large molecules), separations (of peptide fragments for *proteomic* applications), control (of metabolic pathways), (bio) catalysis, *fluid mechanics* (*microfluidics* for analytical applications), and many more.

What is the best way to develop biological engineering?

The present national scene suggests that two models may be followed. In the first, chemical and biological engineering, and bioengineering (as defined earlier) are pursued in a parallel and mutually beneficial manner. The latter is centered around medical devices, *imaging*, biomechanics and *biophysics*, *prostheses* and *radiology*. The former *encompasses* medical and industrial applications of biological systems where chemical reactions are a fundamental determinant. It comprises multi-scale biological systems and applications ranging from the molecular to the cellular and equipment levels, such as, *biotechnology*, *bioprocessing*, metabolic engineering and *cellular-molecular biomedical* applications defined by equilibrium or rate (reaction and/or transport) processes. True to our attention to integration and quantification, I would also include that aspect of *bioinformatics* that deals with data *integration* aiming at elucidation of cellular function and physiology.

The second model consists of planting seeds from different curricula (including chemical engineering) into new organizational units to encourage the evolution of new versions of biological engineering free from the *shackles* of history. This approach is in direct opposition to all lessons learned from history about evolution of engineering disciplines in concert with industries. Nevertheless, it has a certain appeal with administrations eager to consolidate fragmented bioengineering efforts into a single department without regard to the need for an intellectual core shared by all faculty or an industry to absorb its graduates.

Until recently, chemical engineering departments were rather slow in embracing and moving forward with biological engineering. With few

portfolio	卷宗，文件内容
polymer	聚合物
metabolic	新陈代谢的
thermodynamics	热力学
proteomic	蛋白质组学的
fluid	流体
mechanics	力学，机械学
microfluidics	微流学
imaging	成像
biophysics	生物物理学
prostheses	修补术，假体
radiology	放射学，放射医学
encompass	包括
biotechnology	生物技术，生物工艺学
bioprocessing	生物过程
cellular-molecular	细胞的-分子水平的
biomedical	生物医学的
bioinformatics	生物信息学
integration	集成，整合
shackles	桎梏，枷锁

exceptions, they were content with a model of just a few bio-faculty within a steady-state, process-oriented, *petro-centric* paradigm. As it has been amply *articulated* before, this model is no longer satisfactory. In light of its *ever-increasing* importance, biological engineering cannot be viewed as another one of the manyfields of chemical engineering. Biology should be included as a foundational science of our discipline, along with physics and chemistry. Curriculum reform is needed to reflect this fundamental change primarily in a contextual sense aiming at introducing chemical engineers to basic concepts of genetics, biochemistry and molecular cell biology. Such a curriculum reform would enrich chemical engineering as an engineering discipline and profession and will serve well the needs of the new chemical, biotechnology and pharmaceutical industries. We must work hard to infuse these concepts in our education and research and leave no doubt that the chemical engineering *paradigm* is the best vehicle for teaching and studying biological systems at the cellular and molecular levels.

petro-centric	以石油为核心的
articulate	铰接，接合，清晰表述
ever-increasing	空前增长的
paradigm	范例，模式

Let there be no doubt that, should chemical engineering fail to respond to this challenge, there will be no lack of suitors to fill in the void. There is hardly any time left either. Although newly formed bioengineering departments are presently focusing on the more classical side of this field, it will not be too long before they take an interest in the cellular and molecular applications of biology and biotechnology. This trend will be implemented most likely by chemical engineers, who will not be developing a new version of bioengineering but will be simply *transplanting* the highly successful chemical engineering paradigm to bioengineering. I would suggest that such a development would be equivalent to robbing chemical engineering of its most precious resource, its intellectual core, with devastating consequences for the profession.

transplant	移植

There has been talk already of possible fragmentation of chemical engineering.③ A possible outcome of fragmentation may indeed be the demise of chemical engineering as we know it.④ A fragmented chemical engineering is not a legacy that will make us proud. We need to initiate without delay a serious curriculum development process to truly fuse biological content with the chemical engineering core and evolve our discipline into Chemical and Biological Engineering.

摘自 Gregory Stephanopoulos. Invited comment: Chemical and Biological Engineering[J]. Chemical Engineering Science, 2003, 58: 4931-4933.

Notes

①As there is no longer doubt about the growing importance of biology as enabling science of industries critical for chemical engineering, it is becoming imperative that a discussion be initiated to eventually lead to a consensus about the meaning of biological engineering and its relevance to the profession of chemical engineering. 毫无疑问的是，对于化学工程的重要产业来说，生物学作为支撑学科的关键作用在日益增长，目前的当务之急是发起一场讨论，从讨论中对生物工程的含义及其与化学工程这一专业的关系上逐渐达成共识。

这是一句典型的科技英语中的长句。两个并列分句中，前一句是倒装句，后一句以形式主语“it”带着一个主语从句的复合句。一般主语从句较长，为避免句子头重脚轻，以这种形式将主语从句置于句末。这种句式在科技英语中常见。翻译时常根据汉语习惯将两个并列分句译成独立的无主句，原英文中主语从句转译为宾语从句。

②It does not change the core; on the contrary, it strengthens it with examples from a most exciting science.

本文多处出现 It 形式主语，引导主语从句或不定式主语的句式。“It + 系动词 + 形容词 + that...”或“It + 动词 + that...”或“It + 动词 + to 动词不定式...”形式出现的真正主语从句，在科技文章中普遍存在，表示客观阐述科学研究事实。翻译成汉语时主句常为无主句。如：

It is well known that... 众所周知……
It is imperative that... 至关重要的是……
It is addressed that/It is state that... 阐述为……
It was reported that... 据报道……
It is certain that... 肯定是……
It is important to note that... 有必要指出……

③There has been talk already of possible fragmentation of chemical engineering. 人们已经在谈论化学工程的分裂。

这句可以增字翻译，以符合汉语的表达习惯。

④A possible outcome of fragmentation may indeed be the demise of chemical engineering as we know it. 一种可能的结果是化学工程的衰亡，就像我们知道的。

这是顺译句。因为句中有“may indeed be...” 转义翻译更能强化表达作者的本意：一个衰亡的化学工程难道真是我们想要的历史遗产？

Reading Material

Historical Outline of Bio-based Products

The use of renewable resources as raw materials for technical applications is certainly not new. Humanity already used natural materials from the first civilizations onward to meet their basic needs. The first industrial activity was also largely based on the use of renewable and this continued until the industrial revolution.

This means that until 1850, all organic consumer products and industrial raw materials were plant-based. Within the relatively short period of 150 years society changed from a mainly plant-based economy to an economy based on fossil fuels (coal until the end of the 19th century, until 1950 mineral oil, and now, increasingly, natural gas). Wood supplied 70% of the fuel demand in 1870, in 1920 70% came from coal, in 1970 70% from mineral oil.

The use of renewable materials declined substantially with time, mainly as a consequence of the extremely low prices of petrochemical resources. Currently, approximately 96% of all organic chemical substances are based on fossil resources. Nevertheless, several important industries are still based on renewable raw materials. Half of the fiber used in the textile industry is natural material (cotton, wool, flax), the oleo-chemical industry supplies society's daily hygienic needs for soaps and detergents that are based on vegetable oils. The building industry continues to use natural fiber for thermal insulation purposes. Petro-chemistry does not always offer a realistic alternative to the use of renewable materials. Classic examples are, for example, in the production of antibiotics and of drugs where fermentation processes play an important role. Moreover, industrial biotechnology frequently has further significant performance benefits compared with conventional chemical technology, for example higher reaction rates, increased conversion efficiency, improved product purity, reduced energy consumption, and significantly reduced chemical waste generation. This branch of biotechnology has recently been named "White Biotechnology".

The penetration of bio-based product today is estimated at 5% with growth potential up to 10% ~20% by the year 2010. The Vision for Bioenergy and Biobased Products in the United States and the related Roadmap have established far reaching goals for increasing the role of bio-based energy and products in this country.

The oil crisis of the 1970s gave renewed impetus to the use of renewable resources. The worlds increasing dependence on fossil resources, and the finite availability of these, created serious concern. The concern was, however, largely channeled in the direction of energy security. Renewable materials were less of a concern and all attention disappeared when the oil price dropped. With increasing awareness and concern in the 1990s about industrial and consumer waste, and its effect on the environment, the need arose for better biodegradable intermediates and final end products. Those products can naturally degrade into components that are absorbed back into the natural cycle. Biodegradability was the new key property of many new products and they were often based on renewable resources, in view of their intrinsic biodegradability. With regard to fossil reserves, the world is now faced with the dilemma that while crude oil is being consumed faster than ever, "proven oil reserves" have remained mostly unchanged. The cost of exploration and exploitation of crude oil increases, which is reflected in increasing oil prices. In contrast with this, agricultural raw materials such as wheat, corn, sugar, and oil crops are becoming cheaper as a fundamental consequence of increasing agricultural efficiency and yield.

This trend will most probably continue for some time to come. This long-term trend may be perturbed by the transitory effects of market imbalances and politics but for a growing number of applications the economic balance is tipping toward the use of renewable resources; this is also true of bulk chemicals.

Process and catalysis technology revolutionized the chemical industry in the 20th century. Now the same thing is happening for the production of industrial chemicals from biomass. A wave of project initiatives is under way globally, the objective of these is to convert renewable resources into industrial chemicals. Industrial biotechnology uses biological systems in conjunction with existing and new thermochemistry, for production of useful chemical entities. Biotechnology is mainly based on biocatalysis and bioprocessing (the use of enzymes and cells to catalyze chemical reactions) and fermentation technology (directed use of microorganisms), in combination with recent breakthrough in the forefront of molecular genetics and metabolic engineering.

摘自 Birgit Kamm, Patrick R. Gruber, Michael Kamm. Biorefineries—Industrial Processes and Products[M]. WILEY-VCH Verlay GmbH & KgaA, Weinheim,2006.

Comprehension

True or false.

1. Humanity already used natural materials before initiation of civilizations to meet their basic needs. ( )
2. About 70% of the energy demand was met by mineral oil in 1970. ( )
3. The oleo-chemical industry supplies soaps and detergents needed to keep society's daily hygiene that is contaminated by vegetable oils. ( )
4. The ratio of bio-based product occupies about 5% in all chemical products today with growth potential up to 10% ~20% by the year 2010. ( )
5. This long-term trend may be toward the extensive use of renewable resources; this is also true of bulk chemicals. ( )

Related Expressions

1. Words and phrase

renewable resources	可再生资源	crisis	危机
raw material	原料	impetus	动力,推动
consumer	消费者	channel	引导,开辟
civilization	文明	awareness	知道,了解
plant-based	基于植物	environment	环境
fossil fuel	化石燃料	intermediate	中间体(物)
mineral oil	石油	degrade	降解

natural gas	天然气	component	组分,成分
petrochemical	石油化工的	biodegradability	生物可降解性
textile industry	纺织工业	intrinsic	固有的,内在的
fiber	纤维	dilemma	进退两难,窘境
cotton	棉花	proven oil reserves	探明的原油储备
wool	羊毛	exploration	勘探
flax	亚麻	exploitation	开采,利用
oleo-chemical industry	油脂化学工业	agricultural	农业的,农产的
hygienic	卫生的	wheat	小麦
detergent	清洁剂	corn	玉米
vegetable oil	植物油	sugar	糖
thermal insulation	隔热	oil crops	油料作物
petro-chemistry	石油化学	yield	单产,产率,产量
antibiotics	抗生素	perturb	扰动,紊乱
drug	药品	transitory	短暂
fermentation	发酵	imbalance	不平衡
performance	性能	tipping toward	向……倾斜
conventional	传统的	bulk chemicals	大宗化学品
conversion	转化	initiative	创始的,开创的
efficiency	效率	globally	全球地
purity	纯度	thermochemistry	热化学
generation	产生	biocatalysis	生物催化
penetration	渗透	enzyme	酶
bio-based	生物基的,基于生物的	catalyze	催化
potential	潜力,潜能	microorganism	微生物
vision	景象,远景	breakthrough	突破
roadmap	行车图,阶段计划	genetics	遗传学

2. Common inorganic acids, base, salts and solvents in the laboratory

H_2SO_4	sulfuric acid	SO_2	sulfur dioxide
HCl	hydrogen chloride	KCl	potassium chloride
HNO_3	nitric acid	$NaHCO_3$	sodium bicarbonate
HNO_2	nitrous acid	$MgSO_4$	magnesium sulfate
H_3PO_4	phosphoric acid	H_2O_2	hydrogen peroxide
KOH	potassium hydroxide	$KMnO_4$	potassium permanganate
$NaOH$	sodium hydroxide	$CHCl_3$	chloroform
Na_2S	sodium sulfide	$C_2H_4Cl_2$	ethylene chloride
CaO	calcium oxide	CH_3OH	methanol
$Ca(OH)_2$	calcium hydroxide	C_2H_5OH	ethanol

$Ca(NO_3)_2$	calcium nitrate	CH_3COCH_3	acetone
NH_4OH	cmmonium hydroxide	石油醚	petrol ether
NH_3	ammonia	$FeSO_4 \cdot 7H_2O$	ferrous sulfate heptahydrate

专业英语阅读基本知识（Ⅰ）

专业词汇构词法

随着化学、生物化学和生物技术的快速发展，新的物质和事物名称的不断涌现，科技英语词汇相应激增。新词汇的组词法有多种，其中应用最广泛的是派生法，即在词根（radical）上添加前缀（prefix）或后缀（suffix），构成一个新词。构词法常用于化学、生物化学中大量涌现的新物质命名中。

1. 与生物相关的前缀 bio-

bioassay	生物分析	biomass	生物量
biocatalysis	生物催化	biomembrane	生物膜
biocatalyst	生物催化剂	biopolymer	生物高聚物
biochemistry	生物化学	bioprocessing	生物过程

2. 与油相关的词汇添加的前缀 ole(o)-

oleic acid	油酸	oleophobic	疏油的
olein	油酸甘油酯	oleophyllic	亲油的
oleocinase	中乳氧化酶	oleoyl	油酰基

3. 与主要组分个数相关的前缀

mono-, monoglyceride	单，甘油单酸酯	penta, pentanone	五，戊酮
di-, dipeptide	二，二肽	hex-, hexitol	六，己糖醇
bi-, bicarbonate	二重，重碳酸盐	hept-/ hepta-, heptane	七，庚烷
tri-, triester	三，三酯	octa-, octanol	八，辛醇
ter-, ternary complex	三重，三元复合物	nona-, nonanol	九，壬醇
tetra-, tetrahydrofuran	四，四氢呋喃		

4. 与酶相关的词汇添加后缀-ase

amylase	淀粉酶	lipase	脂肪酶
isomerase	异构酶	glucanase	葡聚糖酶
lactase	乳糖酶	cellulase	纤维素酶

5. 与糖相关的词汇添加后缀-ose

glucose	葡萄糖	maltose	麦芽糖
fructose	果糖	ribose	核糖
lactose	乳糖	cellulose	纤维素

6. 与学科相关的词汇添加后缀-logy

biology	生物学	physiology	生理学