大学专业英语系列教材

理工专业英语教程

A COURSE IN SCIENCE-BASED ENGLISH

主编　张敬源　彭漪

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中国人民大学出版社

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第三册

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前　言

《大学专业英语系列教材》是根据教育部最新颁布的《大学英语教学大纲》的基本要求，为大学英语学习四年不断线而编写的一套教材。该套教材的编写得到了教育部高等教育司的大力支持。

本套教材分法学专业英语、经济学专业英语、管理学专业英语、人文科学专业英语和理工专业英语，每一系列包括三个分册，每一分册供一个学期使用。全套教材由复旦大学、中国人民大学、南京大学、北京科技大学联合编写，南京大学杨治中教授担任总主编。法学专业英语教程由赵建、夏国佐教授主编；管理学专业英语教程由邱东林、华宏鸣教授主编；经济学专业英语教程由翟象俊教授主编，参加编写的有张勇先教授等；人文科学专业英语教程由谌馨荪教授主编，参加编写的有郭庆民、张卫平和章安祺教授；理工专业英语教程由彭漪、张敬源教授主编。全套教材由专业英语教师和公共英语教师共同编写。

本系列教材具有如下特点：

一、考虑到我国大学生学完两年英语后的实际水平，课文的选材、注解和练习以《大学英语教学大纲》所要求的四级为基础。

二、教材在内容和语言上贯彻循序渐进的原则。在内容上，第一册主要涉及本专业的原理和基础知识，第二册、第三册主要涉及本专业的历史及专家论点；其要旨在于帮助学生完成从基础英语到专业英语的过渡。在语言上，选材从难度、可读性等方面出发，贯穿了由浅入深的原则。

三、考虑到《大学英语教学大纲》对专业英语学时和阅读量的要求，我们主要采用了主、副课文（阅读文章）制，对主课文从注解和练习两方面进行了重点处理，写作教师课内重点讲解的内容，副课文（阅读文章）主要供学生课后自学，以便对主课文从语言和知识两方面起到巩固作用。

四、本教材强调理解的准确性和学生的应用能力，因此，练习针对这两方面进行了重点编写，配有理解、语言应用（包括词汇应用、语句应用）等练习，理解题强调准确理解、思考、分析、评价、讨论，每课练习中所采用的例句从知识和语言上均与主课文或已学过的课文有关。

五、为方便自学，书后提供了主课文的参考译文和练习答案。

六、全套五种教材在遵循总的编写原则的同时，又根据各自课程的知识特点自成体系。

由于本书编写仓促，不足之处在所难免，敬请读者指正是幸。

编　者

2001 年 6 月

编写与使用说明

大学英语教学大纲规定：大学英语教学的目的是培养学生具有较强的阅读能力和一定的听说读写能力，使他们能用英语交流信息。大学英语教学分为基础阶段（一至二年级）和应用提高阶段（三至四年级）。其中，在应用提高阶段对专业英语阅读能力的要求如下：能顺利阅读有关专业的原版教科书、参考书及其他参考资料，能掌握其中心大意，抓住主要事实和有关细节，对其中重要的论著和文献等材料能正确理解、抓住要点，并对其内容进行分析、推理、判断和综合概括，阅读速度达到每分钟70词。

本套教材就是为了培养学生阅读英语科技类文献资料和提高专业英语阅读能力而编写的，目的在于帮助理工科学生在顺利完成大学英语基础阶段学习后，能够将所学英语知识用于专业英语文献的阅读，熟练地以英语为工具，获取专业学习所需要的信息。

一、教学对象

本教材是理工类专业科技英语教学用书，适用对象为已经顺利完成基础阶段英语学习的理工类专业大学生。具有一定英语基础，对科技英语感兴趣的其他读者也可阅读。

二、编写原则

本教材的编写力求体现两个原则：一、循序渐进性。本书的编写既注重与大学英语基础阶段的衔接，便于学生在大学英语基础阶段学习的基础上顺利过渡到专业英语的学习，同时在选材的长度、难度以及课后练习的编写上都体现了由易到难、由浅到深、循序渐进的原则。二、注重培养学生实际应用英语的能力。本书的编写不以通过任何英语水平考试为目的，重在培养学生运用所学英语知识进行具有一定难度的口语及书面语交际的能力，在使用英语的过程中发现语言基础知识的不足，并有目的、有针对性地弥补语言基础知识方面的欠缺，真正做到学有所用、以用促学、边用边学。

三、课文选材

本教材的选材着力新颖、规范。我们注意到国内图书市场已经有一些专业英语阅读类读物如计算机英语、冶金英语、机械工程英语等。本套教材的着眼点不在于像上述教材那样用英文介绍各专业的基础知识，因为通过专业基础课和专业课的学习学生对这些基础知识已经耳熟能详。理工类专业错综庞杂，而学生普遍欠缺的是如何完成由基础英语的学习向专业英语学习的顺利过渡，在阅读专业文献时做到应用自如。为此，本教材在选材内容上不局限于某一特定专业，但所有选材均反映了科技文献语言正式规范、句式严谨复杂、各类从句重复出现等特点，突出了科学与社会这一主题。我们力图使学生

通过学习语言表达的内容进一步巩固对语言知识的掌握。

四、教材内容结构

本教材由正文和附录两部分组成。正文包括 10 个单元，各单元含有正课文一篇、补充读物一篇，每个单元的正课文和补充读物围绕同一主题展开。这样编写的目的是便于学习者能就同一话题了解更多的信息，从而达到阅读时积极思维、批判性地阅读的目的。正课文后的阅读理解旨在检查学生对课文内容的理解情况；词汇练习旨在培养学生熟练运用已知词汇，借助必要的构词法知识，扩大词汇量；完形填空部分是对文章内容的高度浓缩与概括，不但有助于加深学生对所学课文的理解，同时还能帮助学生把握所读科技文献的主要信息，为口头或书面交流文献内容打下基础；口语练习部分旨在培养学生就某一科技话题连续完整地表达自己思想的能力。大学英语学习的最终目的是培养学生实际应用英语的能力。为此，本册教程翻译部分练习在第一、第二册单句翻译的基础上改为段落翻译，旨在培养学生准确理解并熟练翻译英汉科技文献段落的能力。本册教程作文部分练习重点在于培养学生在限定时间内迅速把握科技文献的整体结构与主要内容，并以此为基础，对文献内容进行简要总结的能力。

本教材的附录部分包括“练习参考答案”、“课文译文”以及“词汇总表”三部分内容。

五、教学方法与教学安排

本教材的教学活动应力求体现“以学生为中心”的教学思想，在课堂教学中建议教师要发挥“导”而不是“教”的作用，最大限度地让学生通过阅读，找出并把握所读科技文献的中心内容，尤其应注意培养学生用英语宣讲文献内容、表达自己观点的能力。

本教材的教学安排为 20 教学周，每周两学时，每两周完成一个单元，课内教学活动时间和学生自主学习时间可由教师自行安排。

限于编者水平，错讹之处在所难免，敬请读者批评指正。

目　录

Unit One

Text:

The Seven Pillars of Life

Daniel E. Koshland Jr.

What is the definition of life? "The ability to reproduce — that is the essential characteristic of life," said one statesman of science. Although everyone knows what life is, there is no simple definition of it.

If I were forced to rush in where angels fear to tread, I would offer "a living organism is an organized unit, which can carry out metabolic reactions, defend itself against injury, respond to stimuli, and has the capacity to be at least a partner in reproduction." But I'm not happy with such a brief definition. When allowed more extensive reflection, however, I think the fundamental pillars on which life is based can be defined. By "pillars" I mean the essential principles by which a living system operates. Current interest in discovering life in other galaxies and in recreating life in artificial systems indicates that it would be desirable to elucidate those pillars, their operation, and why they are essential to life. In this essay, I will refer to the particular mechanisms by which those principles are implemented in life on Earth, while reserving the right to suggest that there may be other mechanisms to implement the principles.

The first pillar of life is a *Program*. By program I mean an organized plan that describes both the ingredients themselves and the kinetics of the interactions among ingredients as the living system persists through time. For the living systems we observe on Earth, this program is implemented by the DNA that encodes the genes of Earth's organisms and that is replicated from generation to

generation, with small changes but always with the overall plan intact. The genes in turn encode for chemicals — the proteins, nucleic acids, etc. — that carry out the reactions in living systems. It is in the DNA that the program is summarized and maintained for life on Earth.

The second pillar of life is *Improvisation*. Because a living system will inevitably be a small fraction of the larger universe in which it lives, it will not be able to control all the changes and vicissitudes of its environment, so it must have some way to change its program. If a warm period changes to an ice age so that the program is less effective, the system will need to change its program to survive. In our current living systems, such changes can be achieved by a process of mutation plus selection that allows programs to be optimized for new environmental challenges that are to be faced.

The third pillar of life is *Compartmentalization*. All the organisms that we consider living are confined to a limited volume, surrounded by a surface that we call a membrane or skin that keeps the ingredients in a defined volume and keeps deleterious chemicals — toxic or diluting — on the outside. Moreover, as organisms become large, they are divided into smaller compartments, which we call cells, in order to centralize and specialize certain functions within the larger organism. The reason for compartmentalization is that life depends on the reaction kinetics of its ingredients, the substrates and catalysts of the living system. Those kinetics depend on the concentrations of the ingredients. Simple dilution of the contents of a cell kills it because of the decrease in concentration of the contents, even though all the chemicals remain as active as before dilution. So a container is essential to maintain the concentrations and arrangement of the interior of the living organism and to provide protection from the outside.

The fourth pillar of life is *Energy*. Life involves movement — of chemicals, of the body, of components of the body — and a system with net movement cannot be in equilibrium. It must be an open and, in this case, metabolizing system. Many chemical reactions are going on inside the cell, and molecules are coming in from the outer environment — O_2, CO_2, metals, etc. The organism's system is parsimonious; many of the chemicals are recycled multiple times in an organism's lifetime, but originally they enter the living system from the outside, so thermodynamicists call this an open system. Because of the many reactions and the fact that there is some gain of entropy, there must

be a compensation to keep the system going and that compensation requires a continuous source of energy. The major source of energy in Earth's biosphere is the Sun — although life on Earth gets a little energy from other sources such as the internal heat of the Earth — so the system can continue indefinitely by cleverly recycling chemicals as long as it has the added energy of the Sun to compensate for its entropy changes.

The fifth pillar is *Regeneration*. Because a metabolizing system composed of catalysts and chemicals in a container is constantly reacting, it will inevitably be associated with some thermodynamic losses. Because those losses will eventually change the kinetics of the program adversely, there must be a plan to compensate for those losses, that is, a regeneration system. One such regeneration system is the diffusion or active transport of chemicals into the living organism. Another system for regeneration is the constant resynthesis of the constituents of the living system that are subject to wear and tear. For example, the heart muscle of a normal human beats 60 times a minute — 3 600 times an hour, 31 104 000 times a year, 2 177 280 000 times a lifetime. No man-made material has been found that would not fatigue and collapse under such use, which is why artificial hearts have such a short utilization span. The living system, however, continually resynthesizes and replaces its heart muscle proteins as they suffer degradation; the body does the same for other constituents — its lung sacs, kidney proteins, brain synapses, etc.

This is not the only way the living system regenerates. The constant resynthesis of its proteins and body constituents is not quite perfect, so the small loss for each regeneration in the short run becomes a larger loss overall for all the processes in the long run, adding up to what we call aging. So living systems, at least the ones we know, use a clever trick to perfect the regeneration process — that is, they start over. Starting over can be a cell dividing, in the case of Escherichia coli, or the birth of an infant for Homo sapiens. By beginning a new generation, the infant starts from scratch, and all the chemical ingredients, programs, and other constituents go back to the beginning to correct the inevitable decline of a continuously functioning metabolizing system.

The sixth pillar is *Adaptability*. Improvisation is a form of adaptability, but is too slow for many of the environmental hazards that a living organism must face. For example, a human that puts a hand into a fire has a painful experi-

ence that might be selected against in evolution — but the individual needs to withdraw his hand from the fire immediately to live appropriately thereafter. That behavioral response to pain is essential to survival and is a fundamental response of living systems that we call feedback. Our bodies respond to depletion of nutrients with hunger, which causes us to seek new food, and our feedback then prevents our eating to an excess of nutrients by losing appetite and eating less. Walking long distances on bare feet leads to calluses on one's feet or the acquisition of shoes to protect them. These behavioral manifestations of adaptability are a development of feedback and feedforward responses at the molecular level and are responses of living systems that allow survival in quickly changing environments. Adaptability could arguably include improvisation, but improvisation is a mechanism to change the fundamental program, whereas adaptability is a behavioral response that is part of the program. Just as these two necessities are handled by different mechanisms in our Earth-bound system, I believe they will be different concepts handled by different mechanisms in any newly devised or newly discovered system.

Finally, and far from the least, is the seventh pillar, *Seclusion*. By seclusion, I mean something rather like privacy in the social world of our universe. It is essential for a metabolizing system with many reactions going on at the same time, to prevent the chemicals in pathway 1 (A→B→C→D) from being metabolized by the catalysts of pathway 2 (R→S→T→U). Our living system does this by a crucial property of life — the specificity of enzymes that work only on the molecules for which they were designed and are not confused by collisions with miscellaneous molecules from other pathways. In a sense this property is like insulating an electrically conducting wire so it isn't short-circuited by contact with another wire. The seclusion of the biological system is not absolute. It can be interrupted by feedback and feedforward messages, but only messages that have specifically arranged conduits can be received. There is also specificity in DNA and RNA interactions. It is this seclusion of pathways that allows thousands of reactions to occur with high efficiency in the tiny volumes of a living cell, while simultaneously receiving selective signals that ensure an appropriate response to environmental changes.

These seven pillars of life are the fundamental principles on which a living system is based. Mechanisms to achieve such a system can be varied as long

as they satisfy the thermodynamic and kinetic requirements. We have one example, life on Earth, showing how it can be done. It will be interesting to see whether a different, self-consistent set of mechanisms could yield a model with life as an outcome.

Notes

1. Daniel E. Koshland Jr.: the author of this essay who works in the Department of Molecular and Cell Biology, University of California, Berkeley, and a former Editor-in-Chief of Science magazine.
2. Escherichia coli /ˌeʃə'rikiə'kəli/ [微] 埃希氏大肠(杆)菌
3. Homo sapiens /'həuməu'sæpiənz/ *n*. used to refer to human beings, considered as a type of animal, in contrast to other species of ape or animal, or earlier evolutionary forms of humans. 智人（现代人的学名），人类，人
4. DNA abbr. deoxyribonucleic acid (the basic constituent of the gene) 脱氧核糖核酸（基因的基本成分）
5. RNA abbr. ribonucleic acid 核糖核酸

New Words and Expressions

1. kinetic /ki'netik/ *adj*. concerned with movement or produced by movement 动力（学）的；（运）动的
2. elucidate /i'lu:sideit/ *v*. to make sth. clear; explain 使(某事物)更清楚；解释，阐明
3. encode /in'kəud/ *v*. to put a message or some information into a code or express it in a different form or system of language 将信息等译成代码；编码
4. intact /in'tækt/ *adj*. undamaged; complete 无损伤的；完整的
5. nucleic acid /nju:'kli:ik'æsid/ *n*. either of two acids (DNA and RNA) occurring in all living cells 核酸
6. improvisation /ˌimprəvai'zeiʃn/ *n*. making sth. without preparation 临时凑成；临时凑成的事物
7. vicissitude /vi'sisitju:d/ *n*. (usu. pl.) change in one's circumstances, esp. for the worse 个人情况的改变，（尤指）变坏
8. mutation /mju'teiʃən/ *n*. change; alteration 变化，转变；突变，变异

9. optimize /'ɔptimaiz/ *v*.
(a formal use) 1. to arrange or design sth. so that it operates as smoothly and efficiently as possible 优化，使尽可能有效地进行 2. to get as much advantage or benefit from a situation or opportunity as you can 充分利用

10. compartmentalize /ˌkəmpɑːt'mentəlaiz/ *v*.
to divide sth. into separate sections 将某事物分成隔间或部分
compartmentalization *n*. 分隔

11. membrane /'membrein/ *n*.
piece of thin pliable skin-like tissue connecting, covering or lining parts of an animal or a vegetable body 膜；薄膜

12. deleterious /ˌdeli'tiəriəs/ *adj*.
harmful 有害的

13. dilute /dai'ljuːt/ *v*.
1. make (a liquid or color) thinner or weaker (by adding water or another liquid) 使变稀；变淡 2. make sth. weaker in force, effect, etc. 削弱（某事物）的力量、效果等；使减色；降低
dilution *n*. diluting or being diluted 稀释，冲淡

14. substrate /'sʌbstreit/ *n*.
(= substratum) sth. that exists under the surface of sth. else, or is less obvious than sth. else [生] 培养基；基质；酶作用物

15. catalyst /'kætəlist/ *n*.
1. substance that speeds up a chemical reaction without itself changing 催化剂 2. person or thing that causes a change 促使变化的人或事物

16. adversely /'ædvəːsli/ *adv*.
unfavorably 不利地

17. parsimonious /ˌpɑːsi'məuniəs/ *adj*.
very careful in spending money or using resources 吝啬的，小气的；节俭的

18. thermodynamicist /ˌθəməudai'næmisist/ *n*.
热力学家

19. biosphere /'baiəsfiə/ *n*.
生物圈（指地球上生物可以生存的区域，包括陆地、水界和大气层）

20. entropy /'entrəpi/ *n*.
宇宙中能量与物质（降至惰性均匀的极限状态）的退降

21. diffusion /di'fjuːʒn/ *n*.
spreading all around; sending out in all directions 散布；传播；弥漫；扩散

22. resynthesis/ri'sinθisis/ *n*.
再合成

23. constituent /kən'stitjuənt/ *adj*. & *n*. forming or helping to make a whole; component parts 组成的，构成的；成分

24. degrade /di'greid/ *v*. (chemistry or biology) cause sth. to become less complex in structure （使某物）降解，分解，退化

25. sac /sæk/ *n*. bag-like part of an animal or plant （动物或植物组织中的）囊，液囊

26. synapse /'sainæps/ *n*. [解] 突触（指一个神经元的轴突接触并影响另一神经元的树突或胞体的部位）

27. nutrient /'nju:triənt/ *n*. energy supplies 能量的供给

28. callus /'kæləs/ *n*. area of thick hardened skin 茧子（皮肤硬化增厚的部分）

29. miscellaneous /ˌmisə'leiniəs/ *adj*. of various kinds; of mixed composition or character 各式各样的；不同成分的；性质混杂的

30. seclusion /si'klu:ʒn/ *n*. being secluded; secluded place; privacy 隔离；私人的范围

31. specificity /ˌspesi'fisəti/ *n*. [生] 特异性；特征，特性

32. enzyme /'enzaim/ *n*. organic chemical substance that is formed in living cells and assists chemical changes (e.g. in digestion) without being changed itself 酶

33. conduit /'kɔndit/ *n*. tube enclosing insulated electric wires 导线管

Exercises

Ⅰ. COMPREHENSION OF THE TEXT

DIRECTIONS: Answer the following questions according to the text.

1. How does a statesman of science define life?
2. How does the author understand the definition of life?
3. What does the article focus on?
4. Why does the author describe the "pillars" as fundamental?
5. What does the author mean by "program"? Why is it so important?
6. What is the key point of the second pillar?
7. What is the function of the third pillar according to the author?
8. How do you understand that life is energy?
9. What is the exact meaning of the word "entropy" in this context?

10. What caused those thermodynamic losses?
11. What can be done to compensate for those losses?
12. What is the advantage of the fifth pillar?
13. Can you explain the feedback and feedforward mentioned by the author?
14. Is the seclusion of the biological system absolute? Why not?
15. Do you think these seven pillars are perfect? Why or why not?

Ⅱ. VOCABULARY

Section A

DIRECTIONS: Complete the following sentences with the words or phrases given below. Change the form where necessary. Note there are more words than necessary.

respond to	carry out	refer to	in turn
as long as	depend on	start off	add up to
divide into	subject to	confine to	rush in

1. It is now known that the terrible disease such as AIDS — not _____ any one group in society.
2. In those days, Ted and I took it _____ to go into the hospital and sit with Emma.
3. Many people wonder why the international community cannot _____ the current economic crisis in a unified way.
4. She _____ as an assistant of her husband after graduation and later became an engineer.
5. The structure of all parts of the department was continually _____ reappraisal.
6. Their proposals put forward at the yesterday's meeting did not _____ any real compensation for the losses.
7. After World War Ⅱ, Germany _____ two separate countries for more than four decades.
8. It is hoped that the kidnappers will not _____ their threat to kill the hostages.
9. Pollution of the sea has killed thousands of the fish which many fishermen _____ for their livelihoods.
10. The interior minister said that he would still support them _____ they didn't break the rules.

Section B

DIRECTIONS: Complete the following sentences with the appropriate forms of the words given in brackets.

1. The concept is of an _____ (interact) museum where by pressing buttons, children can get the exhibits to work.

2. Many of the so-called _____ (generate) diseases, for which there are as yet no effective therapies, could then be alleviated or healed.
3. As a pianist, she was noted for the _____ (improvise) which she would insert into middle of classical pieces.
4. Many _____ (gene) engineered species have already been produced, so the danger of such mixing is high.
5. A study is under way to determine the exact _____ (concentrate) of lead in the local water supply.
6. Scientists have already successfully planted _____ (correct) genes in laboratory animals and in laboratory samples of human tissues.
7. We need to sunbathe on a _____ (seclusion) beach that was completely cut off when the tide came in.
8. His life was carefully __ ____ (compartment) with his work in one city and his social life in another.
9. Human eyes are very _____ (adapt) optical sensors, able to respond to a wide range of light levels.
10. Although this "live fast, die young" hypothesis seems true in a very general way — short-lived shrews have higher _____ (metabolize) than long-lived elephants — it breaks down when examined more closely.

Ⅲ. CLOZE

DIRECTIONS: Fill in each of the following blanks either with a word concerning the subject matter or with a word necessary to complete the sentence structure. Try to use the words in the text.

When asked about the definition of life, we all became convinced that the ability to reproduce is the essential characteristic of life. (1) _____ I am not happy with such a brief answer. When allowed more extensive reflection, however, I think the fundamental pillars on (2) _____ life is based can be defined. By "pillars" I mean the essential principles by which a living system operates.

The first pillar of life is a program which is implemented by the DNA that (3) _____ the genes of Earth's organisms and that is replicated (4) _____ generation to generation. It is (5) _____ the DNA that the program is summarized and maintained for life on Earth. The second pillar is improvisation (6) _____ function allows programs to be optimized for new environmental challenges that (7) _____ to be faced. The third pillar is like a container (8) _____ to maintain the concentrations and arrangement of the interior of the living organism and to provide (9) _____ from the outside. The fourth pillar is energy that is required to be a compensation (10) _____ a continuous source to keep the liv-