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现代科技英语教程

张亚非　主编

Modern English for Science and Technology

科学出版社

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内 容 简 介

本书是根据教育部《大学英语教学大纲》对专业英语教学的要求，为具有英语四级水平的大学三至四年级学生编写的科技英语课程教材。本书内容涉及5个方面：科技史话、科苑巨匠、科海泛舟、高新技术、走向未来等，在上述课文内容基础上，每一课附有练习。

本书可作为大学三至四年级科技英语教材，亦可供科技人员和英语爱好者自学英语使用。

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学习英语的几点建议

（代序）

一、充分认识英语的重要性

随着 Internet 网的出现和全球经济一体化趋势的日益加强，世界正在逐步成为一个信息化的网络社会。在这个社会里，使用得最广泛的语言就是英语，不掌握英语，就会成为这个社会中的“文盲”和“哑巴”。作为跨世纪人才的中国大学生，一定要下决心掌握英语，以迎接时代的挑战。

二、脚踏实地，循序渐进，力求词词懂和句句懂

和学习其他知识一样，学习英语必须脚踏实地，循序渐进。

脚踏实地和循序渐进就是不图虚名，不好高骛远，以提高实际英语应用能力为唯一的学习目标。

脚踏实地和循序渐进的最基本方法是在阅读和听写中力求“词词懂和句句懂”。

“词词懂和句句懂”是英语的基本功，是各种高级英语能力的基础。

就拿快速阅读来说吧。它是逐词逐句搞懂大量文章后阅读能力的升华，绝不是边查词典边看文章的人能做到的。所以笔者建议要十分用心地学习本书的每一篇文章，要“十目一行”，逐词逐句地抠，多问几个为什么，不可一词无来历，不可一词不讲究。

听力中的“抓关键词”与“听大意”也是这样。它是逐词逐句听懂大量录音材料后听力的升华，是水平高的人才能使用的一种方法。水平低的人如果错把这种能力当方法，机械地模仿水平高的人那样去听大意，只能连蒙带猜，其结果必然是“关键词听不出、听不懂或听错了”，而“听懂的几乎都不是关键词”，抓住的大意十有八九是错的。所以笔者建议要十分用心地听本书所附的录音带，力争听懂每一个词和每一句话，绝不可囫囵吞枣。

由于急于求成思想的影响，也许有人会认为“词词懂和句句懂”的学习方法收效太慢。其实正好相反，用这种方法学习英语，不但学得扎实，而且水平提高得速度是很快的，有时快得令自己都会感到惊讶。任何一个具有正常逻辑思维能力的人，只要坚持这样做，最后必然会获得具有“一目十行”的快速阅读能力以及“抓关键词”与“听大意”的能力，令那些热衷于速成的人望尘莫及。

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三、精读一本英语书

除了学习专业英语课以外,还可根据自己的爱好选择一本英语书(专业书或小说均可),从封面的左上角开始,逐词逐句阅读,一直读到封底的右下角。碰到问题尽量自己解决,因为解决问题的过程就是复习与提高的过程。实在解决不了可请教英语老师,英语老师解决不了可发 e-mail 给作者。

在从头到尾阅读一本英语书的同时,还应该经常阅读英语专业期刊,以便及时了解现代科技发展,掌握新出现的词语。

四、注意应用英语

学习英语的目的全在于应用。一个人从中学算起到大学毕业,学了十几年英语,学了不用,实在太可惜了。

一说起用英语,往往容易与出国联系起来,似乎只有出国,英语才有用。其实这是一个很大的误解。随着对外开放的日益深入与现代传媒(尤其是 Internet 网)的快速发展,国内和国外的界限变得不太清楚了,在国内应用英语的天地也是很广阔的。

除了结合业务工作应用英语以外,还可以上 Internet 网、阅读英语报刊和收听英语广播,以做到"不出门知天下事"和"不花分文周游世界",尽情享受高科技带给我们的乐趣。

在业务工作中用英语,上 Internet 网、阅读英语报刊和收听英语广播等等都是学习英语的永久课堂,长期坚持在这个课堂里学习,定能进入"乐在英语中"和"收获英语外"境界。

钟道隆

1999 年 2 月 1 日

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前　言

在大学英语四、六级教学取得了可喜的进展之后，如何搞好大学英语的后继课程这一问题，正受到全国越来越多的高等院校的关注。

国家教育部颁布的《大学英语教学大纲》(文理科本科用，以下简称《大纲》)对大学英语的后继课程——专业英语提出了明确的要求。《大纲》将专业英语规定为继大学英语四级之后的一门正式课程。大学英语四、六级阶段的教学主要侧重于传授语言基础知识与技能，而能否使学生的语言知识转化成较强的专业应用能力，则在很大程度上取决于英语后继课程的教学是否成功。因此，搞好专业英语教学，提高学生的英语应用能力，已成为各高等院校共同面对的一项重要课题。为此，我们特编写了《现代科技英语教程》，旨在提供一种通用性强，便于各类专业使用的教材，以利更好地开展专业英语这门课程的教学。

本书的编写指导思想是，在《大纲》对专业英语教学所提出的要求的指导下，围绕近、当代世界科技领域重要历史、人物、事件、成就、知识等题材来设计和编写教材内容。其使用对象为大学本科理工科专业具备大学英语四级水平的学生，或具有相应水平的英语学习者。

本书的选材以科普文章为主，富有科技英语语言特色，含有较丰富的通用与专业科技英语词汇和科技英语语法结构。其语言难度略高于大学英语四级精读教材。其内容覆盖了常用基础类科学知识，并紧扣当前科学与高新技术成果，展现未来科技发展趋势，同时还注意兼顾理、工、农、医、军事等各学科的通用性。此外，编者除确保本书具有较强的知识性之外，还力求使其兼有一定的趣味性。本书的内容可概括为如下五个方面：

1. 科技史话(Historical Developments)：内容为近、当代世界科技史上有影响的主要事件和成果等。
2. 科苑巨匠(Giants of Science and Technology)：介绍了近、当代几位世界著名科学家、发明家和科技产业精英的成长史，他们的主要科学活动、理论与成就，以及对科技发展的影响等。
3. 科海泛舟(Across the Science World)：收集了一些较常用的基础科学知识和通用性强，应用面宽的各类学科专业科普知识、理论及技术题材。如电信、计算机、航空航天、军事科学等。
4. 高新技术(High and New Technology)：主要为当代具有代表性的高新科技知识，如通信技术、信息技术、生物技术、材料科学、认知科学等。
5. 走向未来(Onward to the Future)：内容为对21世纪科学技术发展所做的预测、展望和推断。

本书还为每一课编写了配套练习。在编写时，我们尽可能地使其形式新颖、实用，有

利于听、说、读、写、译等技能的训练与培养，从而最终达到提高专业英语应用能力的目的。

本书编写分工如下：李建军（第1、2课），冯大威（第3、4课），鲍德旺（第5、6、10课），步阳辉（第7、8课），王正文（第9、11、12课），张定觉（第13、14、15课），吴苓（第16、17、20课），张亚非（第18、19课）。全书由张亚非、王正文统校。

鉴于编者的水平与经验有限，本书难免存在着不足之处，敬请广大读者批评指正。

编　者

1998年12月

使 用 说 明

本教材根据其内容可分为五个部分，共20课。每篇课文的长度为1500 - 2000词。每课课文加上注释和练习，其总长度为4000词左右。对本教材的使用，特提如下建议：

1. 建议每课用5 - 6学时，学完全书约需100 - 120学时。《大学英语教学大纲》(文理科本科用)为专业英语课程规定的教学时数为80 - 100学时，在此课时数之内完成本书的教学，恐有一定的难度。可根据本校的实际情况，在每部分中选教二至三课。
2. 课文中的生词有两种类型，一类为通用词，即大学英语1 - 4级词表中未列出的词汇；另一类词为科技专业词汇，是大学英语1 - 4级未列出的，或未注明科技专业词意的词汇和术语。生词均用黑体字标出，以使其更加直观，方便学生记忆。
3. 课文前均加了用斜体字写成的"引子"，目的是提高学生的阅读兴趣，让其带着问题去阅读。
4. 本书的练习包括词汇(Building Up Your Word Power)、课文理解(How Much Do You Understand)、听力理解(Watch and Listen)、翻译(Getting It Across To The Other Language)和写作(Writing)五个部分。其中听力理解部分配有录音磁带，建议备齐磁带，以达到训练目的。对于这些练习，教师可以酌情选用。
5. 书后附有总词汇表，以供学生查找和记忆。
6. 本书配有与其配套使用的CAI多媒体教学光盘。该光盘含有配合课文讲解的丰富的动态画面，可以提供互动式教学环境，并且还配有练习与自测，以方便教学时进行成绩统计与能力评估。此外，光盘还含练习参考答案、课文参考译文和课文录音等辅助性内容，以满足使用该教材从事教学工作的教师的专用需求。该光盘既可用于课堂教学，也可供学习者自学使用。

目　录

Lesson 1

Text
Evolution of Science

[*Science is a term used in its broadest meaning to denote systematized knowledge in any field, but applied usually to the organization of objectively verifiable sense experience. Its evolution has experienced a long history . . .*]

Origins of Science

1. Efforts to systematize knowledge can be traced to **prehistoric** times, through the designs that **Paleolithic** people painted on the walls of caves, through numerical records that were carved in bone or stone, and through artifacts surviving from **Neolithic** civilizations. The oldest written records of **protoscientific** investigations come from Mesopotamian[1] cultures; lists of astronomical observations, chemical substances, and disease **symptoms**, as well as a variety of mathematical tables, were **inscribed** in **cuneiform** characters on **clay** tablets. Other tablets dating from about 2000 BC show that the Babylonians[2] had knowledge of the Pythagorean theorem, solved **quadratic equations**, and developed a **sexagesimal** system of measurement (based on the number 60) from which modern time and angle units stem.

2. From almost the same period, **papyri** documents have been discovered in the Nile Valley, containing information on the treatment of wounds and diseases, on the distribution of bread and beer, and on finding the volume of a portion of a pyramid.

Rise of Scientific Theory

3. Scientific knowledge in Egypt and Mesopotamia was chiefly of a practical nature, with little rational organization. Among the first Greek scholars to seek the fundamental causes of natural phenomena was the philosopher Thales[3], in the 6th century BC, who introduced the concept that the earth was a flat disk floating on the universal

prehistoric /prihiz'tɔrik/ *adj*. 史前期的
Paleolithic/ˌpæliəu' liθik/ *adj*. 旧石器时代的
Neolithic/niəu'liθik/ *adj*. 新石器时代的
protoscientific/ˌprəutəsaintifik/ *adj*. 原始科学的
symptom /'simptəm/ *n*. 表征，征兆
inscribe /'inskraib/ *v*. 题写，铭刻
cuneiform /'kju: nii' fɔ: m/ *n*. 楔形的
clay /klei/ *n*. 粘土，陶土
quadratic /kwə'drætik/ *adj*. 二次(方程)的
equation /i' kweiʃən/ *n*. 方程式，等式
sexagesimal/ˌseksə'dʒesiməl/ *adj*. 六十进制的
papyri /pə'paiərai/ *n*. (papyrus/pə'paiərəs/的复数) 草纸

[1] Mesopotamian 美索不达米亚； [2] Babylonian 巴比伦尼亚； [3] Thales 台利斯(460-546BC)

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element, water. The mathematician and philosopher Pythagoras[4], who followed him, established a movement in which mathematics became a discipline fundamental to all scientific investigation. The Pythagorean scholars **postulated** a spherical earth moving in a circular orbit about a central fire. At Athens[5], in the 4th century BC, Ionian[6] natural philosophy and Pythagorean mathematical science combined to produce the **syntheses** of the philosophies of Plato[7] and Aristotle[8]. At the Academy of Plato, **deductive** reasoning and mathematical representation were emphasized; at the **Lyceum** of Aristotle, **inductive** reasoning and **qualitative** description were stressed. The **interplay** between these two approaches to science has led to most subsequent advances.

4. During the so-called Hellenistic[9] Age following the death of Alexander the Great[10], the mathematician, astronomer, and geographer Eratosthenes[11] made a remarkably accurate measurement of the earth. Also, the astronomer Aristarchus of Sámos[12] **espoused** a **heliocentric** (sun-centered) planetary system, although this concept did not gain acceptance in ancient times. The mathematician and inventor Archimedes[13] laid the foundations of[14] mechanics and **hydrostatics**; the philosopher and scientist Theophrastus[15] became the founder of botany; the astronomer Hipparchus[16] developed **trigonometry**; and the **anatomists** and physicians Herophilus[17] and Erasistratus[18] based **anatomy** and physiology on **dissection**.

5. Following the destruction of Carthage[19] and Corinth[20] by the Romans in 146 BC, scientific inquiry lost its impetus[21] until a brief **revival** took place in the 2nd century AD under the Roman emperor and philosopher Marcus Aurelius[22]. At this time the **geocentric** (earth-centered) Ptolemaic system, advanced by the astronomer Ptolemy[23], and the medical works of the physician and philosopher Galen[24] became standard scientific treatises for the **ensuing** age. A century later the new experimental science of **alchemy** arose, springing from[25] the practice of **metallurgy**. By 300, however, alchemy had acquired an **overlay** of secrecy and **symbolism** that **vitiated** the

postulate /ˈpɔstjuleit/ *v*. 假设，假定
synthesis /ˈsinθisis/ *n*. (*pl*. syntheses) 综合，合成
deductive /diˈdʌktiv/ *adj*. 推论的，演绎的
lyceum /laiˈsiːəm/ *n*. 演讲厅
inductive /inˈdʌktiv/ *adj*. 归纳法的
qualitative /ˈkwɔlitətiv/ *adj* 与性质有关的，定性的
interplay /ˈintəplei/ *n*. 相互作用
espouse /isˈpauz/ *v*. 拥护（主义，学说）
heliocentric /hiːliəuˈsentrik/ *adj*. 日心学说的
hydrostatics /haidrəuˈstætiks/ *n*. 流体静力学
trigonometry /ˌtrigəˈnɔmitri/ *n*. 三角学
anatomist /əˈnætəmist/ *n*. 解剖学家
anatomy /əˈnætəmi/ *n*. 解剖学
dissection /diˈsekʃən/ *n*. 解剖
revival /riˈvaivəl/ *n*. 复活，复苏
geocentric /dʒiəuˈsentrik/ *adj*. 地心学说的
ensue /inˈsjuː/ *v*. 随着发生，因而发生
alchemy /ˈælkəmi/ *n*. 炼金术
metallurgy /meˈtælədʒi/ *n*. 冶金术
overlay /ˈəuvəlei/ *n*. 覆盖，镀
symbolism /ˈsimbəlizəm/ *n*. 用符号代表概念，象征主义
vitiate /ˈviʃieit/ *v*. 降低……的品质，削弱……的力量

[4] Pythagoras 毕达哥拉斯(? -497BC); [5] Athens 雅典; [6] Ionian 爱奥尼亚; [7] Plato 柏拉图(427-347BC)
[8] Aristotle 亚里士多德(384-322BC); [9] Hellenistic 希腊的; [10] Alexander the Great 亚力山大大帝(356-323BC)
[11] Eratosthenes 厄拉多塞 (约 276-194 BC); [12] Aristarchus of Sámos 阿里斯塔克斯(约 3 世纪 BC)
[13] Archimedes 阿基米德(287-212BC); [14] lay the foundation of 奠基; [15] Theophrastus 狄奥弗拉斯塔(371-287BC)
[16] Hipparchus 希巴克斯(约 2 世纪 BC); [17] Herophilus 希罗菲芦斯(约 335-280BC)
[18] Erasistratus 埃拉西斯特拉图斯(活动期约 250BC); [19] Carthage 迦太基 (非洲北部)
[20] Corinth 科林斯(希腊南部); [21] lose one's impetus 失去原动力; [22] Marcus Aurelius 马卡斯奥里留斯(*121-180*)
[23] Ptolemy 托勒密; [24] Galen 伽林(130-200); [25] spring from 起源于

advantages experimentation might have brought to science.

Medieval and Renaissance Science

6. During the Middle Ages, six leading culture groups were in existence: the Latin West, the Greek East, the Chinese, the East Indian, the Arabic, and the Mayan[26]. The Latin group contributed little to science before the 13th century, the Greek never rose above paraphrases of ancient learning, and the Mayan had no influence on the growth of science. In China, science enjoyed periods of progress, but no sustained drive existed. Chinese mathematics reached its **zenith**[27] in the 13th century with the development of ways of solving **algebraic** equations by means of **matrices**, and with the use of the arithmetic triangle. More important, however, was the impact on Europe of several practical Chinese innovations. These include the processes for manufacturing paper and gunpowder, and the use of printing and the **mariner**'s compass. In India, the chief contributions to science were the formulation of the so-called Hindu-Arabic numerals[28], which are in use today, and in the **conversion** of trigonometry to a **quasi-modern** form. These advances were transmitted first to the Arabs, who combined the best elements from Babylonian, Greek, Chinese, and Hindu sources. By the 9th century Baghdad[29], on the Tigris River[30], had become a center for the translation of scientific works, and in the 12th century this learning was transmitted to Europe through Spain, Sicily[31], and Byzantium[32].

medieval /ˌmediˈiːvəl/ *adj*. 中世纪的
renaissance /rəˈheisəns/ *n*. 文艺复兴
zenith /ˈzeniθ/ *n*. 最高点
algebraic /ˌælʤəˈbreiik/ *adj*. 代数的
matrix /ˈmætriks/ *n*. (*pl*. matrices)矩阵
mariner /ˈmærinə/ *n*. 水手
conversion /kənˈvəːʃən/ *n*. 转变
quasi-modern /ˈkwɔːziˈmɔdən/ *adj*. 近乎现代的

7. Recovery of ancient scientific works at European universities led, in the 13th century, to **controversy** on scientific methods. The so-called realists espoused the Platonic approach, whereas the **nominalists** preferred the views of Aristotle. At the universities of Oxford and Paris, such discussions led to advances in optics and **kinematics** that paved the way for[33] Galileo[34] and the German astronomer Johannes Kepler[35].

controversy /ˈkɔntrəvəːsi/ *n*. 争论,争议
nominalist /ˈnɔminəlist/ *n*. 名义主义者,唯名论者
kinematics /ˌkainiˈmætiks/ *n*. 动力学

8. The Black Death and the Hundred Years' War disrupted scientific progress for more than a century, but by the 16th century a revival was well under way. In 1543 the Polish astronomer Nicolaus Copernicus[36] published *De Revolutionibus Orbium Coelestium* (On the Revolutions of the Heavenly Bodies), which revolutionized astronomy.

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[26] Mayan 玛雅; [27] reach one's zenith 达到巅峰; [28] Hindu-Arabic numerals 印度-阿拉伯数字
[29] Baghdad 巴格达; [30] Tigris River 底格里斯河; [31] Sicily 西西里岛; [32] Byzantium 拜占庭
[33] pave the way for 为……做准备; [34] Galileo 伽利略(1564-1642);
[35] Johnnes Kepler 开普勒(1571-1630); [36] Nicolaus Copernicus 哥白尼(1473-1543);

Also published in 1543, *De Corpis Humani Fabrica* (On the Structure of the Human Body) by the Belgian anatomist Andreas Vesalius[37] corrected and modernized the anatomical teachings of Galen and led to the discovery of the circulation of the blood. Two years later the *Ars Magna* (Great Art) of the Italian mathematician, physician, and astrologer Gerolamo Cardano[38] initiated the modern period in algebra with the solution of cubic and **quartic** equations.

quartic /ˈkwɔːtik /n. 四次方的

Modern Science

9. Essentially modern scientific methods and results appeared in the 17th century because of Galileo's successful combination of the functions of scholar and **artisan**. To the ancient methods of induction and deduction, Galileo added systematic **verification** through planned experiments, using newly discovered scientific instruments such as the telescope, the microscope, and the thermometer. Later in the century, experimentation was widened through the use of the **barometer** by the Italian mathematician and physicist Evangelista Torricelli[39]; the **pendulum** clock by the Dutch mathematician, physicist, and astronomer Christiaan Huygens[40]; and the **exhaust pump** by the English physicist and chemist Robert Boyle[41], and the German physicist Otto von Guericke[42].

artisan /ˌɑːˈtizæn /n. 工匠

verification /ˌverifiˈkeiʃən /n. 验证,证实

barometer /bəˈrɔmitə /n. 气压计

pendulum /ˈpendjuləm /n. 钟摆

exhaust pump /igˈzɔːst pʌmp /n. 排气筒,排气泵

10. The culmination of these efforts was the universal law of gravitation, published in 1687 by the English mathematician and physicist Isaac Newton[43] in *Philosophiae Naturalis Principia Mathematica*. At the same time, the invention of the **calculus** by Newton and the German philosopher and mathematician Gottfried Wilhelm Leibniz[44] laid the foundation of today's sophisticated level of science and mathematics.

calculus /ˈkælkjuləs /n. 微积分

11. The scientific discoveries of Newton and the philosophical system of the French mathematician and philosopher René Descartes[45] provided the background for the materialistic science of the 18th century, in which life processes were explained on a physicochemical basis. Confidence in the scientific attitude carried over to[46] the social sciences andinspired the so-called Age of Enlightenment,

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[37] Andreas Vesalius 维萨里(1514-1564); [38] Gerolamo Cardno 卡尔达诺(1501-1576);
[39] Evangelista Torricelli 托里拆利(1608-1647); [40] Christiaan Huygens 惠更斯(1629-1695);
[41] Robert Boyle 玻意耳(1627-1691); [42] Otto von Guericke 居里克(1602-1686);
[43] Issac Newton 牛顿(1642-1727); [44] Gottfried Wilhelm Leibniz 莱布尼兹(1646-1716);
[45] Rene Descartes 笛卡尔(1596-1650); [46] carry over to 转移到

which **culminated** in the French Revolution of 1789. The French chemist Antoine Laurent Lavoisier[47] published *Traité élémentaire de chimie* (Treatise on Chemical Elements, 1789), with which the revolution in **quantitative** chemistry opened.

culminate /'kʌlmineit/ *v*. 达到极点

quantitative /'kwɔntitətiv/ *adj*. 定量的

12. Scientific developments during the 18th century paved the way for the following "century of correlation," so called for its broad generalizations in science. These included the atomic theory of matter postulated by the British chemist and physicist John Dalton[48]; the **electromagnetic** theories of Michael Faraday[49] and James Clerk Maxwell[50], also of Great Britain; and the law of the conservation of energy, **enunciated** by the British physicist James Prescott Joule[51] and others.

electromagnetic /i'lektrəumæg'netik/ *adj*. 电磁的

enunciate /i'nʌnsieit/ *v*. 清楚地或确切地，解释，表述

13. The most comprehensive of the biological theories was that of evolution, put forward by Charles Darwin[52] in his *On the Origin of Species by Means of Natural Selection* (1859), which stirred as much controversy in society at large[53] as the work of Copernicus. By the beginning of the 20th century, however, the fact, but not the **mechanism**, of evolution was generally accepted, with disagreement centering on the genetic processes through which it occurs.

mechanism /'mekənizəm/ *n*. 机理

14. But as biology became more firmly based, physics was shaken by the unexpected consequences of **quantum** theory and relativity. In 1927 the German physicist Werner Heisenberg[54] formulated the so-called uncertainty principle, which held that limits existed on the extent to which, on the subatomic scale, coordinates of an individual event can be determined. In other words, the principle stated the impossibility of predicting, with precision, that a particle such as an electron would be in a certain place at a certain time, moving at a certain velocity. Quantum mechanics instead dealt with **statistical** inferences relating to large numbers of individual events.

quantum /'kwɔntəm/ *n*. 量子

statistical /stæ'tistikəl/ *adj*. 统计的

Fields of Science

15. Knowledge of nature originally was largely an **undifferentiated** observation and interrelation of experiences. The Pythagorean scholars distinguished only four sciences: arithmetic, geometry, music, and astronomy. By the time of Aristotle, however, other fields could

undifferentiate /ˌʌndifə'renʃieit/ *vt*. 不加区分

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[47] Antoine Laurent Lavoisier 拉瓦锡 (1743-1794); [48] John Dalton 道尔顿(1766-1844);
[49] Michael Farady 法拉第(1791-1867); [50] James Clerk Maxwell 麦克斯韦(1831-1879);
[51] James Prescott Joule 焦耳(1818-1889); [52] Charles Darwin 达尔文; [53] at large 普遍的;
[54] Werner Heisenberg 海森堡(1901-1976);

also be recognized: mechanics, **optics**, physics, **meteorology**, zoology, and **botany**. Chemistry remained outside the mainstream of science until the time of Robert Boyle in the 17th century, and geology achieved the status of a science only in the 18th century. By that time the study of heat, magnetism, and electricity had become part of physics. During the 19th century scientists finally recognized that pure mathematics differs from the other sciences in that[55] it is a logic of relations and does not depend for its structure on the laws of nature. Its applicability in the **elaboration** of scientific theories, however, has resulted in its continued classification among the sciences.

optics /'ɔptiks /n. 光学
meteorology /mitiə'rɔlədʒi / n. 气象学
botany /'bɔtəni / n. 植物学
elaboration /i'læbəreiʃən /n. 详细描述;细节

16. The pure natural sciences are generally divided into two classes: the physical sciences and the biological, or life, sciences. The principal branches among the former are physics, astronomy, chemistry, and geology; the chief biological sciences are botany and zoology. The physical sciences can be subdivided to identify such fields as mechanics, **cosmology**, physical chemistry, and meteorology; physiology, **embryology**, **anatomy**, **genetics**, and **ecology** are subdivisions of the biological sciences.

17. All classifications of the pure sciences, however, are **arbitrary**. In the formulations of general scientific laws, **interlocking** relationships among the sciences are recognized. These interrelationships are considered responsible for much of the progress today in several specialized fields of research, such as **molecular** biology and genetics. Several interdisciplinary sciences, such as biochemistry, biophysics, biomathematics, and bioengineering, have arisen, in which life processes are explained physicochemically. Biochemists, for example, synthesized **deoxyribonucleic acid** (DNA); and the cooperation of biologists with physicists led to the invention of the electron microscope, through which viruses and gene **mutations** can be studied. The application of these **interdisciplinary** methods is also expected to produce significant advances in the fields of social sciences and behavioral sciences.

cosmology /'kɔsmɔlədʒi /n. 宇宙学
embryology /ˌembri'ɔlədʒi /n. 胚胎学
anatomy /ə'nætəmi /n. 解剖
genetics /dʒi'netiks /n. 基因学
ecology /i'kɔlədʒi /n. 生态学
arbitrary /'ɑ:bitrəri /adj. 任意的
interlock /'intəlɔk /v. 连接;互锁
molecular /məu'lekjulə /n. 分子
deoxyribonucleic acid /di:'ɔksiˌraibəunju:'kli:ik æsid / 脱氧核糖核酸
mutation /mju'teiʃən /n. 改变
interdisciplinary /intə'disipli:nəri /n. 跨学科的

18. The applied sciences include such fields as aeronautics, electronics, engineering, and metallurgy, which are applied physical sciences, and **agronomy** and medicine, which are applied biological sciences. In this case also, overlapping branches must be recognized. The cooperation, for example, between **iatrophysics**

agronomy /ə'grɔnəmi /n. 农艺学
iatrophysics /ˌiætrə'fiziks /n. 医疗物理学

[55] in that 因为,由于

(a branch of medical research based on principles of physics) and bioengineering resulted in the development of the heart-lung machine used in open-heart surgery and in the design of artificial organs such as heart chambers and valves, kidneys, blood vessels, and inner-ear bones. Advances such as these are generally the result of research by teams of specialists representing different sciences, both pure and applied. This interrelationship between theory and practice is as important to the growth of science today as it was at the time of Galileo.

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