普通高等教育电气信息类规划教材

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自动化专业英语教程

Professional English for Automation

主　编　王彩霞

参　编　刘明华　蔡　宁　吴　韬　等

机械工业出版社

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本书涵盖了自动化专业的各个发展方向，内容新颖、全面。全书共分22个单元，其主要内容包括自动化专业介绍、本专业的学习目标要求以及主要学习内容、控制系统的构成、开环控制和闭环控制、系统稳定性的定义、劳斯稳定判据、根轨迹分析法、系统设计思路和步骤、电力、电路、电路基本定律、微控制器、PID控制、PLC以及伺服系统等。同时，本书也对专业英语的词汇、语法、符号，阅读方法，翻译技巧，英文科技论文的构成和写作要点进行了详细介绍。本书在每篇文章后都附有词汇表、难点分析和注解，可以更好地帮助读者理解和自学。

本书可作为自动化专业本科生及研究生专业英语课程的教材，也可供有关工程技术人员参考。

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前　　言

《自动化专业英语教程》（*Teaching Materials of Technology English in Automation*）是为满足自动化专业英语教学而编写的适合本科生使用的教学用书。该教程的目的是为了增进自动化等电子信息类专业学生对专业英语知识的理解和掌握，以提高学生利用专业英语进一步进行学习交流的能力，提高学生对专业英语科技论文等资料的阅读、翻译以及写作能力。

本书主要选取和本专业基础教学密切相关的专业英语知识作为教学内容，共有 22 个单元，每个单元包括课文、生词和专业术语，专业英语语法知识以及长难句解析。每个单元分为两大部分，即专业英语阅读和专业英语的相关语法知识。阅读部分每个单元有 Text A 和 Text B 两篇课文作为阅读和翻译的素材。课文内容丰富、题材广泛、语言通俗易懂，能满足不同层次的学习对象对专业英语的学习需求。语法知识部分主要介绍专业英语的词汇、语法等内容，并重点介绍了专业英语翻译和写作的方法。

本书作为面向 21 世纪高等院校自动化专业英语教学的教材，侧重于专业英语在学习中的应用。本课程建议授课学时为 36 课时，并要求学生先修大学英语以及自动控制原理课程。本书适合本科及研究生层次电气自动化、生产过程自动化、电力系统自动化和电气控制技术类专业的学生使用，也可供相关专业的工程技术人员参考学习。

参加本书编写工作的同志还有西北民族大学的周志文、马安仁、王晓燕、刁晨，另外浙江工业大学衢州学院的朱秋琴也参与了本书部分章节的编写。

由于编者水平有限，书中难免存在不妥之处，敬请读者批评指正，并提出宝贵意见。

编　　者

目　录

Unit 1 Science and Sub-disciplines of Natural Sciences

Text A

What Is Science

The word "science" is from a Latin verb meaning "to know". When we speak of science, we speak of a way of understanding the world by describing and explaining **natural phenomena**, because this is the way of acquiring knowledge.① To achieve this scientist makes initial observations and then follows a series of steps, known as the scientific method (Fig. 1-1), so that conclusions can be drawn on the observations made. This process allows knowledge to be gained in an organized way. All proper scientific research is carried out following the scientific method and scientific research articles are written with this method in mind. It is essential that any Chinese person aspiring to be a scientist is familiar with this method also. An appreciation of the process of the scientific method is valuable to the understanding of scientific academic English.

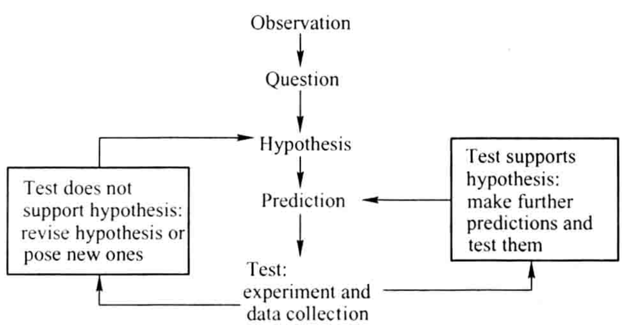

Fig. 1-1 Scientific Method

The scientific method is essential to technology English. The first step in the scientific method is to make general observations. You may then gain some idea about what you have observed, and you may have a question from which you could make a prediction on what the outcome might be. What you predict, however, may or may not be right. You must first test the different alternatives to your idea (or theory) so that your answer is not biased. However an idea or a theory is usually not testable. For instance you cannot test the theory of **evolution** itself, because evolution is a theory and not a tangible thing (that is, it cannot be touched and is not obviously visible). Therefore the question derived from your idea needs to be turned into a **hypothesis** that can be tested. For example, you can touch flowers and see their colors, and so you can collect their seeds and test the hypothesis that when seeds of red and white pea flowers are crossed, the flowers of offspring have a certain ratio of pink, red, and white color. You can easily count the seeds that produce the flower color, therefore you can compare (i. e. test) them. The hypothesis, if supported by the results after testing, may be used as evidence to support the original idea. Thus if the ratio of red, white and pink flowers of offspring matches to that predicted, it can be taken as evidence for the theory of evolution, because evolution means change through generations.

Without hypothesis testing, ideas about nature (e. g. evolution and creation by God) are mere **speculations** which any person can make. You cannot base your conclusion or claims on intuition, unqualified speculation or emotion.[②] Using these to explain something is not very convincing, and consequently would not be scientific. Science is therefore really about gathering evidence to explain natural phenomena.

There are actually two types of hypothesis when conducting an experiment: a research hypothesis and a null hypothesis (Fig.1-2). A research hypothesis is a statement that you think is true. But because science must be unbiased, testing what you think is true would be biased. The null hypothesis, which states that the test will show no difference in what is being compared (or no relationship between given variables), is an impartial or unbiased statement that is used for testing instead. If the test rejects the null hypothesis, i. e. the null hypothesis is shown to be incorrect, the data may be considered supportive of the research hypothesis. That is why the research hypothesis is also known as the alternative hypothesis. While there is only one null hypothesis for each test, there may be more than one alternative hypothesis.

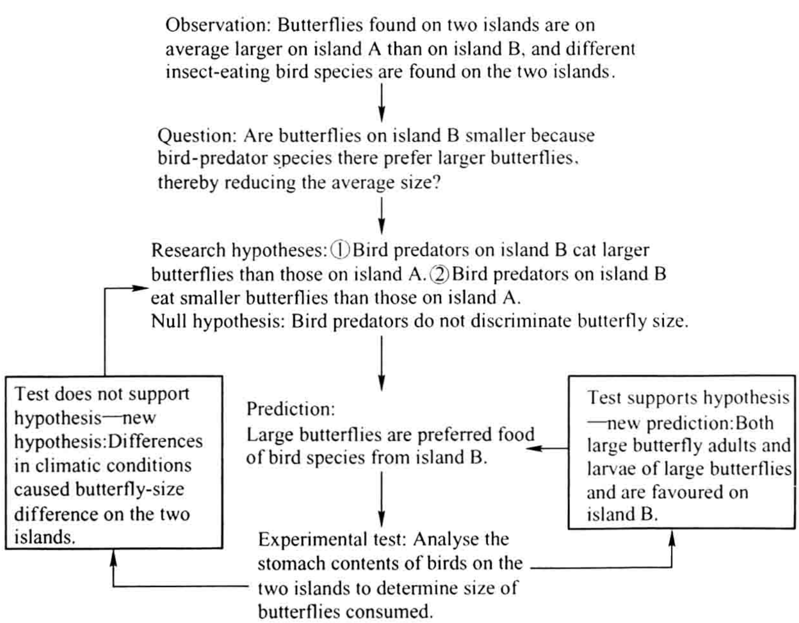

Fig. 1-2 An Example on the Application of Scientific Method

The study of science is not just memorizing and reiterating a large amount of facts and theories, it is about experimentation using the scientific method. Experimentation, through the application of the scientific method, can make pursuit of knowledge enjoyable to the students. To the established scientist, there is nothing more satisfying than solving mysteries and delving into the complexity and fascination of nature.

Text B

Sub-disciplines of Natural Sciences

Science is a large, multidisciplinary branch comprising many fields of study. Within each science field, there occur many branches that science students may specialize. Below are some examples of sub-disciplines of the natural sciences:

1. Biological Sciences

✧ **molecular** biology, genetics, evolutionary biology

✧ microbiology, **histology**, cell biology

✧ **botany**, zoology, **entomology**, **parasitology**, **mycology**, **taxonomy**

✧ medicine, **anatomy and physiology**, **neurophysiology**, immunology

✧ biochemistry, biotechnology

✧ **marine biology**, **freshwater** biology

✧ agriculture, **agronomy**, animal science, **veterinary science**

✧ **ecology**, environmental science, conservation biology

✧ **bioinformatics**

2. Physical Sciences

✧ physics

mechanics, **optics**, **acoustics**, **electromagnetism**, nuclear physics, particle physics, quantum physics, fluids and plasmas, mechanics, solid-state physics, theoretical physics

✧ chemistry

analytical chemistry, electrochemistry, materials science, biochemistry, organic chemistry, inorganic chemistry, **spectroscopy**, stereochemistry, industrial chemistry

✧ astronomy, **astrophysics**, **cosmology**

✧ Earth sciences

geology, geography, **hydrology**, oceanography, soil science, **limnology**, **paleontology**, **mineralogy**, **crystallography**

Even within the sub-disciplines there are more specific areas of study. For example, ecology covers areas as population ecology, community ecology, ecosystem ecology, landscape ecology, environmental science, nature conservation, evolutionary biology, ecophysiology (or environmental physiology) behavioral ecology, etc. Medicine may include such areas as dentistry, pathology, cardiology, as well as immunology, microbiology, parasitology, anatomy and physiology, etc.

Non-natural sciences include mathematics, health science, sports science and many others. Mathematics itself does not require experimental test of own theories and hypotheses, but it is essential to science—it plays an important role in the scientific method and in the expression of scientific models, such as in hypothesis testing and data analysis and in generation of mathematical models for prediction.③ Some subject areas attach "science" to their name because they want to be seen as rigorous that the science term implies. "Social sciences", which studies human behaviors and societies, and "political science", which studies how people obtain or compete for power to use in governing a country are examples of "sciences" based more on opinion and persuasion rather than following the scientific method.[4] An extreme example is "creation science", which has very little in common with the scientific method at all.

The science brand is often incorrectly used to mean "modernization" or "high technology". "Computer science" is an example. It is normally not considered a true science field for the same reason why "political science" is not considered a science field, although it does have a strong grounding in mathematics.[5]

New Words and Expressions

natural phenomena 自然现象
evolution [ˌiːvəˈluːʃ(ə)n; ˈev-] *n.* 演变；进化论；进展
hypothesis [haɪˈpɒθɪsɪs] *n.* 假设；[逻]前提，假想
speculation [ˌspekjʊˈleɪʃn] *n.* 投机；推测；思索；投机买卖
molecular [məˈlekjʊlə] *adj.* [化学] 分子的；由分子组成的
histology [hɪˈstɒlədʒi] *n.* 组织学
botany [ˈbɒtəni] *n.*植物学
entomology [ˌentəˈmɒlədʒi] *n.* 昆虫学
parasitology [ˌpærəsɪˈtɒlədʒi] *n.* 寄生虫学
mycology [maɪˈkɒlədʒi] *n.* 真菌学
taxonomy [tækˈsɒnəmi] *n.* 分类学；分类法
anatomy and physiology 解剖生理学；解剖学与生理学
neurophysiology [ˌnjʊərəʊfɪzɪˈɒlədʒi] *n.* 神经生理学
marine biology 海洋生物学
freshwater [ˈfreʃwɔːtə] *n.* 淡水；内河；湖水 *adj.* 淡水的；无经验的
agronomy [əˈgrɒnəmi] *n.* 农学；农艺学；农业经济学
veterinary science 兽医；兽医学
ecology [ɪˈkDlədʒi] *n.* 生态学；社会生态学
bioinformatics *n.* 生物信息学；生物资讯
optics [ˈɒptɪks] *n.* [光] 光学
acoustics [əˈkuːstɪks] *n.* 声学；音响效果，音质
electromagnetism [ɪˌlektrəʊˈmægnɪtɪz(ə)m] *n.* 电磁；电磁学
spectroscopy [spekˈtrɒskəpi] *n.* [光] 光谱学
astrophysics [ˌæstrə(ʊ)ˈfɪzɪks] *n.* 天体物理学
cosmology [kɒzˈmɒlədʒi] *n.* [天] 宇宙论；宇宙学
hydrology [haɪˈdrɒlədʒi] *n.* 水文学，水文地理学
limnology [lɪmˈnɒlədʒi] *n.* 湖沼生物学，湖沼学
paleontology [ˌpælɪɒnˈtɒlədʒi] *n.* 古生物学

mineralogy [ˌmɪnəˈrælədʒi] *n.* 矿物学

crystallography [ˌkrɪstəˈlɒgrəfi] *n.* [晶体] 结晶学

专业英语概述

英语（文字称为英文）属于印欧语系中日耳曼语族下的西日耳曼语支系，是由古代从欧洲大陆移民大不列颠岛的盎格鲁、萨克逊和朱特部落的日耳曼人所说的语言演变而来的，并通过英国的殖民活动传播到世界各地。由于英语在历史上曾和多种民族语言接触，它的词汇从一元变为多元，语法也从“多屈折”变为“少屈折”，语音也发生了规律性的变化。根据以英语作为母语的人数计算，英语是世界上使用最广泛的第二语言，是联合国的工作语言之一，也是欧盟和许多国际组织的官方语言。以英语为母语的人数位居世界第三位。世界上60%以上的信件是用英语书写的，50%以上的报纸杂志是以英语呈现的。在 19 世纪和 20 世纪，英国和美国在文化、经济、军事、政治和科学上的领先地位使得英语成为一种国际语言。英语也是与计算机联系最密切的语言。大多数编程语言都与英语有联系，而且随着互联网的出现，英文的使用更为普及。

目前英语已经成为国际通用语言。很多国家和地区都将英语指定为官方交流语言。在世界性国际会议、论坛和学术研讨会上，在国际商务谈判和国际商贸合同文本里，在外资企业或合资企业工作中，英语已成为重要的交流工具。随着世界经济一体化的迅速发展，我国更加广泛融入国际社会，与世界各国在政治、经济、文化等领域的交流活动日益频繁，与英语专业有关的行业如外贸、外交、海关、旅游、管理等涉外工作部门获得前所未有的发展契机。而且由于 20 世纪科学技术的飞速发展，各国技术情报资料大量涌现，国际上学术交流日益频繁。据统计，目前用各种语言出版的专业科技期刊约四万多种，并且还在以每年一千多种的速度增加。我国近年来也主持召开了大量的国际学术会议，并出版了一定数量的英文专业杂志。对于计算机、自动控制、电子类专业而言，85%以上的专业科技资料都是以英文形式出现的。因此，专业英语的学习，对于科技人员吸收最新科技情报，参与国际科学技术交流非常重要。

科学技术本身的性质要求专业英语与专业内容相互配合，相互一致，这决定了专业英语与普通英语有很大的差异。专业英语的主要特点是它具有很强的专业性，懂专业的人用起它来得心应手，不懂专业的人用起来则困难重重。由于各个领域的专业英语都是以表达科技概念、理论和事实为主要目的，因此，它们必然存在许多共同的特点。与普通英语相比，专业英语很注重客观事实和真理，并且要求逻辑性强，条理规范，表达准确、精练、正式。在文章结构方面，专业英语要做到逻辑严谨，层次分明；在用词方面，专业英语要具备大量专业词汇和专业术语；在语法方面，专业英语要保持非人称的语气和客观的态度，较多地使用被动语态，并采用图表等非语言因素的表达手段。

其主要特点如下：

1）复杂长句多、复合句多以及被动语态多。

2）用虚拟语气表达假设或建议。

3）前后缀出现频率高、缩略词和节略词等使用频繁。

4）介词短语多，缩写使用频繁。

5）大量的名词化结构。

6）希腊词根和拉丁词根比例大。

7）专业术语多、技术词汇多、合成新词多。

8）插图、插画、表格、格式、公式、数字所占比例大。

9）非限定动词（尤其是分词）使用频繁。

与专业英语相关的专业文献很多，如理工科的专业文献有文摘、论文、专著、教科书、研究报告、专利说明书、标准、产品样本和说明书等，其中，论文、专著和教科书的语言风格相近，又因主要阅读对象是科技人员，更应该作为专业阅读课的主要内容。阅读文摘是阅读其他文献的前提；专利文献一方面要阐述技术问题，另一方面又涉及权益，因此具有法律文体的特点，在语法上比较难，学习中需要注意。

专业英语的主要侧重点在于阅读和翻译，即通过大量阅读英文资料，对英文资料进行正确的理解和翻译，在此基础上不断提高利用英语撰写专业学术论文的能力。随着社会和经济的发展，我国学者同国外专家直接进行口语学术交流的机会也越来越多，包括日常交谈、技术谈判、学术交流、学术讲座、专题报告、国际会议等。所以在阅读和翻译的基础上，对英语口语学术交流能力进行训练也是十分必要的，以便在国际性的学术会议上用英语作报告、进行学术讲演或者学术交流。

Notes

① When we speak of science, we speak of a way of understanding the world by describing and explaining natural phenomena, because this is the way of acquiring knowledge.

参考译文：当我们谈到科学时，我们指的是一种通过对自然现象的描述和解释来了解世界的方法，因为这是获取知识的途径。

② Without hypothesis testing, ideas about nature (e. g. evolution and creation by God) are mere speculations which any person can make. You cannot base your conclusion or claims on intuition, unqualified speculation or emotion.

参考译文：没有对假设的验证，关于大自然（例如进化论和上帝创造世界）的观点也只是任意一个人都可以做出的猜测而已。不能以直觉、无条件的推测和感情作为结论的根据。

③ Mathematics itself does not require experimental test of own theories and hypotheses, but it essential to science—it has an important role in the scientific method and in the expression of scientific models, such as in hypothesis testing and data analysis and in generation of mathematical models for prediction.

参考译文：数学本身不需要通过实验来验证其理论和假设，但是对于科学来说它是最根本的。数学在科学方法和科学模型的表达模式如在对假想的验证、数据分析以及预测数学模型的建立中都起着很重要的作用。

④ “Social sciences”, which studies human behaviors and societies, and “political science”, which studies how people obtain or compete for power to use in governing a country are examples of “sciences” based more on opinion and persuasion rather than following the scientific method.

参考译文：研究人类行为和群体的“社会科学”和研究人类如何获得或竞争为在国家管理过程中需用的能力的“政治科学”正是基于个人观点和信念而不是遵循科学方法的“科学”例子。

⑤ It is normally not considered a true science field for the same reason why “political science” is not considered a science field, although it does have a strong grounding in mathematics.

参考译文：尽管它（计算机科学）也具有很强的数学基础，但和“政治科学”不被认可为是科学的原因相同，正常情况下计算机科学也不是真正的科学。

Unit 2 Why Learn Scientific English

Text A

Major Scientific Discoveries and Inventions

Since the Industrial Revolution in the 18th century, science has progressively developed important influences on the life of people throughout the world. Technological achievements such as the motor vehicle, refrigerator, television and computer are just some examples of use of scientific knowledge for practical purposes which we have now taken for granted. The refrigerator, for example, was based on the scientific concept of evaporative cooling, in which latent heat is released during evaporation as the air carries off water vapor. Instead of water, the refrigerator performs cooling using chemicals.

Perhaps the more well-known breakthroughs of scientific research are those that led to medical advancement which saves lives, such as the discovery of penicillin, open-heart surgery, radiotherapy and eradication of the disease smallpox. There occurs other scientific research which has shaped our modern society (Tab. 2-1), like those that led to the synthetic materials such as plastics which many of us encounter daily, the various forms of agricultural practices which maximize crop yield, the treatment of water fit for human consumption, and the list goes on.

Tab. 2-1 Major Scientific Discoveries in the 20th Century and Up to Present

Years	Major scientific discoveries	Major inventions
1900s	function of white blood cells, buffer solutions, mammalian sex chromosomes XX and YY, Avogadro's number	vacuum cleaner, air conditioning, **electrocardiogram**, first powered flight, plastic, radio broadcasting, color photography, electric washing machine
1910s	diffraction of **Roentgen rays**, role of **chromosomes**, first vitamins, continental drift theory, **isotopes**, theory of relativity, structure of the atom, mass, **spectroscope**	neon light, stainless steel, detergent, frozen food, refrigerator, sonar, talking motion pictures demonstrated
1920s	insulin, **carcinogenic effect** of UV radiation, penicillin, Big Bang theory, **oestrogen**	broadcasting, television, liquid-fuelled rocket, aerosol sprays, Geiger tube, synthetic rubber
1930s	**electrophoresis**, radio astronomy, molecular orbital theory, cortisone, imprinting in young animals, nuclear fission	jet engine, color film and movie, electron microscope, FM radio, radar, photocopying, nylon, automatic transmission for cars
1940s	Krebs cycle, function of DNA, carbon dating, role of genes in controlling chemical reactions, ultrasound to scan foetus	helicopters, silicon solar cell, nuclear reactor, microwave ovens, **transistors**, general purpose computers
1950s	different RNAs in organisms, double-helical model of DNA, structurally modified antibiotics, sodium pump in nerve transmission, polio vaccine, cause of Down's syndrome	color television, **hovercraft**, solar-powered battery, video tape recorder, satellite, modems, microchip, laser, contraceptive pill, **heart pacemaker**
1960s	**quasars** and **pulsars**, genetic code, human growth hormone, live-virus vaccine against **German measles**, successful heart transplant	audio cassette tapes, electronic calculator, space flight, diesel-engine passenger car, word processor, optical disc, fiber optics, domestic microwave oven
1970s	restriction enzymes, genetic engineering, in vitro fertilisation, **smallpox** eradicated, monoclonal **antibiotics**, test-tube baby	floppy and compact disc, personal computer and supercomputer, printers, microprocessor, space station, CAT scanner, mobile phones
1980s	HIV responsible for AIDS, Hepatitis B vaccine, polymerase chain reaction, DNA fingerprinting, black holes confirmed	space shuttle, internet, high temperature superconductor, CD-ROM, X-ray laser, **coaxial** cable, artificial satellite
1990s	genetically modified food, cloning from adult cells, antimatter proven	World Wide Web, DVD, Hubble space telescope, nanotechnology
2000s	gene control by **RNA**, **nanocircuits**, synthetic virus, human genome project completed, cloning of human embryo	iPod, artificial heart and liver, hybrid petrol-electric passenger car, toy robot

The importance of science to modern societies cannot be underestimated. Scientists are forever seeking and discovering answers to the questions that concern people, the environment, and even the universe. Are vaccines available to prevent a disease? Is there a method that can maximize crop yields? How do we rid of pollutants in our drinking water? What can we do about global climatic changes? Can we invent a building material that can withstand extreme weather conditions? As a scientist, you may provide answers to these or other questions asked by the society.

Text B

Importance of Technology English

Technology English is essential for you. It is necessary to communicate any new findings, achievements, ideas and predictions to other scientists, governments and the general public.[①] This need has led to a huge range of the literature being dedicated to science. Results of scientific research are often documented and communicated through international journals, a vast majority of which are in English. In fact, more than 90% of scientific articles are written in English, even though only half of them come from authors in English-speaking countries. This means nearly all scientific research is communicated through English regardless of the nationality of researchers. Certainly the most reputable international journals are in English. Therefore if you want to read the best science articles, you must know how to read in English, and if you want to write the results of your research to an international audience, then your article must be in English. Publishing in an English-language journal allows a broader readership and better recognition. If you publish your article in Chinese, then only Chinese people can read your work. If you are an active scientist who wants to either develop or retain a reputation in your area of research, you have a greater chance of achieving this if you can present, write and discuss your topic in English. Even if you are not directly involved in research, it is likely that in your work you will encounter books written in English. If you are a graduate student, you would be required to summarize your thesis or dissertations in English.

In China today, if you are serious about becoming a respected scientist, you must be able to communicate in English. Competition for academic positions is high, with increasing number of local students graduating and foreign-trained students returning. It is not surprising that many local students and young scientists in China finish up working in a different profession from the one they preferred or had trained for. Of those who are dedicated to a career in science, overseas training or work becomes an attractive option. However, only the top students (and those with wealthy relatives) are able to obtain scholarships to finance their tuition fees. Not surprisingly, because of their good training, cross-cultural intellectual experience and command of English, foreign-trained PhD students (and researchers with experience in a foreign country) are often favored over local-trained scientists in obtaining preferred jobs upon their return. Whichever direction you take, an ability to communicate in English would be a distinct advantage. In science, it is not just plain English you need to know, and not just technology English either, but scientific technology English.[②]