J. R. Ewer & G. Latorre
陈华 魏锡荣 何钟森 孙庭芳 译注

A course in basic scientific English

基础科技英语教程

〔英汉对照本〕

A Course in
Basic Scientific English

J. R. Ewer Department of English, University of Chile
and
G. Latorre School of Engineering, University of Chile

基础科技英语教程

〔英汉对照本〕

陈 华 魏锡荣
何钟森 孙庭芳 译注

安徽科学技术出版社

责任编辑：王才强
封面设计：陈乐生

基础科技英语教程

〔英汉对照本〕

陈　华　魏锡荣
何钟森　孙庭芳　译注

安徽科学技术出版社出版
（合肥市跃进路1号）
安徽省新华书店发行　安徽新华印刷厂印刷

开本：787×1092　1/32　印张：8.25　字数：175,000
1984年8月第1版　1984年8月第1次印刷
印数：00,001－20,000
统一书号：9200·12　定价：1.15元

Introduction

PURPOSE AND SCOPE OF THE COURSE

Purpose

The purpose of this course, as its title indicates, is to teach students of scientific subjects (including medicine, engineering and agriculture) the basic language of scientific English. This basic language is made up of sentence patterns, structural (functional) words and non-structural vocabulary which are common to all scientific disciplines and form the essential framework upon which the special vocabulary of each discipline is superimposed. Once this basic language has been mastered—together with the principal word-building devices (prefixes and suffixes) also presented in this book—the acquisition of these special vocabularies presents very little difficulty, since they are mainly *international* words and therefore very similar to those already used in the student's own language.

Nature of the linguistic material presented

The material incorporated in the course has been selected, for the most part on a frequency basis, from the scrutiny of more than three million words of modern scientific English of both American and British origin.[1] This sample covered ten broad areas of science and technology (physics, chemistry, biology, geology and geomorphology, medicine, engineering, sociology, economics, psychology and agriculture) and represented the types of literature likely to be consulted by students or graduates of science—university textbooks, professional papers and articles, scientific dictionaries and semi-popularizations. Whilst the principal criteria for the inclusion of items were frequency and range, a certain amount of material was selected for other reasons, e.g. because of their usefulness as describers or definers, because they were members of a group or set, or because, though not unduly frequent, they were essential or non-substitutable (as is the case with the Present Continuous tense, for example).[2]

Grading and flexibility

Although it is assumed that students using this course have already received a certain amount of training in English at school or in a language institute, the material included has, in its presentation, been graded in length and complexity. Hence the most frequently used and simple structures have been introduced first, the whole of the corresponding Unit being written as far as possible exclusively in terms of the structure being presented (thus, for example, all the verbs appearing in Unit 1 are in the Present Simple Tense, which is the main structure in this unit). The length of the reading passages—and therefore of the amount of material they contain—increases progressively, from about 450 words in the early units to nearly three times

[1] It should be stated that, as far as scientific English is concerned, no significant difference was found between these two varieties of English. The few minor points of variance occurring in the course itself are explained.

[2] Further details are given in *English Language Teaching*, Vol. XXI, No. 3.

this length in later ones. There is a fair amount of repetition of phrasing within each individual unit and this repetition is carried over to the exercise sections of the following unit or two, so that revision of the immediately preceding work goes on all the time. The special Revision Units (Nos. 5 and 10, revising the material presented in Units 1–4 and 6–9 respectively, and the General Revision Units Nos. 11 and 12, reviewing the principal elements of the course as a whole) will, it is hoped, constitute a valuable aid in this very necessary task of consolidation.

Since individual students and even whole classes of students may show a good deal of variation with regard to the knowledge of English they bring to the course or the speed with which they work, an effort has been made to make the course flexible enough to cover these contingencies. This has been done by giving a wide choice of exercises in the Word Study and Structure Study sections, by incorporating additional suggestions for exercises in the Teacher's Notes, by including a Discussion and Criticism section designed to give students the opportunity to produce continuous English based on the contents of the reading passages, and by adding a Supplement of extracts from the original literature of modern science.

The oral approach

The approach used throughout the book is essentially an oral one, in view of the fact that: (a) oral repetition (in context) is the most effective way of fixing material, even for purely recognition purposes; (b) much more work can be accomplished orally than in written form, over a given period; (c) oral work adds variety and interest to the lessons. As many teachers will be aware, there are also two additional factors operating in various parts of the world which lend urgency to this emphasis upon oral work —firstly, the number of English-speaking specialists visiting non-English-speaking countries to give lecture-cycles or direct seminars is increasing rapidly, and the widespread failure of students or local specialists to understand oral scientific English, and be able to communicate themselves, is robbing these countries of much of the value which would otherwise be gained from these visits; secondly, in spite of the growing number of scholarships and fellowships to English-speaking countries, many first-rate science students are failing to obtain them because of their lack of knowledge of the language. This again is a serious loss of human resources.

Further aims of the course

In addition to the purely language-teaching aims outlined above, the course is designed to stimulate critical thought and foster the habits of clear exposition and the impartial examination of evidence; at the same time an attempt has been made to encourage students to take an active interest in their own discipline and its relationships with other sciences and with society as a whole. Thus it is hoped that it will serve a broadly educational purpose as well as its specific linguistic one.

LIBRARY SUGGESTIONS

The effectiveness of the course will be much increased if an adequate reference library can be provided. Some suggestions—mainly referring to inexpensive paperbacked editions—are as follows:

Language

1 Dictionaries

FLOOD & WEST *Elementary Scientific and Technical Dictionary*, Longmans
(explains over 10,000 scientific terms within a vocabulary of less than 2000 words; illustrated)

The English Duden, Bibliographisches Institut, Mannheim, and Harrap
(very complete picture-dictionary which includes the main sciences and many branches of engineering)

Chambers Technical Dictionary, Chambers
(available in English-English or multilingual form)

2 Pronunciation Drilling

CLAREY & DIXSON *Pronunciation Exercises in English*, Regents Publishing Co.

Science

1 General Science and the Scientific Attitude

PYKE *The Boundaries of Science*, Penguin
BECK *The Simplicity of Science*, Penguin
CONANT *Science and Common Sense*, Yale Paperbacks
CANNON *The Way of an Investigator*, Norton
HILDEBRAND *Science in the Making*, Columbia Paperbacks
EDGE (ed.) Experiment: a series of scientific case-histories, B.B.C.
NEWMAN (ed.) *What is Science?* Washington Square

2 Mathematics

PEDOE *The Gentle Art of Mathematics*, Penguin
SAWYER *Mathematician's Delight*, Penguin
ADLER *The New Mathematics*, Signet
SUTTON *Mathematics in Action*, Harper Torchbooks

3 Statistics

WALLIS & ROBERTS *The Nature of Statistics*, Collier
HUFF *How to Lie with Statistics*, Gollancz
REICHMANN *The Use and Abuse of Statistics*, Penguin

4 Physics

ANDRADE *Physics for the Modern World*, Barnes & Noble
ISAACS *Introducing Science*, Penguin
BITTER *The Education of a Physicist*, Heinemann
BEISER *Physics for Everybody*, Everyman

5 Chemistry

PORTER *Chemistry for the Modern World*, Barnes & Noble
LESSING *Understanding Chemistry*, Signet
HUTTON *Chemistry*, Penguin
JAFFE *Chemistry Creates a New World*, Pyramid

6 Earth Sciences

DURY *The Face of the Earth*, Penguin
CRONEIS & KRUMBEIN *Down to Earth*, Phoenix
SWINNERTON *The Earth Beneath Us*, Penguin
RAPPORT *The Crust of the Earth*, Signet

7 Social Sciences

SIMPSON *Man in Society*, Random House
KLUCKHOHN *Mirror for Man*, Premier
WRIGHT MILLS *The Sociological Imagination*, Evergreen Books
KARDINER *They Studied Man*, Mentor
LIPSET *Political Man*, Anchor
MEAD (ed.) *Cultural Patterns and Technical Change*, Mentor
BERELSON (ed.) *The Behavioral Sciences Today*, Harper Torchbooks

8 Economics

SOULE *Ideas of the Great Economists*, Mentor
ROSTOW *The Stages of Economic Growth*, Cambridge Paperbacks
ROBINSON *Economic Philosophy*, Penguin
THEOBALD *The Rich and the Poor*, Mentor

9 Biology and Biochemistry

WADDINGTON *Biology for the Modern World*, Barnes & Noble
WORTH & ENDERS *The Nature of Living Things*, Signet
WINOKER *General Biology*, Littlefield
ASIMOV *The Chemicals of Life*, Signet

10 Medicine

MARGERSON *Medicine Today*, Penguin
CALDER *Medicine and Man*, Signet
ATKINSON *Magic, Myth and Medicine*, Premier
BROCKINGTON *World Health*, Penguin

11 Psychology

ADCOCK *Fundamentals of Psychology*, Penguin
EYSENCK *Uses and Abuses of Psychology*, Penguin
CROW *Readings in General Psychology*, College Outlines
CROW *Outline of General Psychology*, Littlefield

12 Engineering

(Note: Paperbacks on Engineering are very scarce: the few listed below are, however, very good)

WILLIAMS & FORBES *Building an Engineering Career*, McGraw-Hill
FINCH *The Story of Engineering*, Anchor
CROSS *Engineers and Ivory Towers*, McGraw-Hill

13 Agriculture

(As for Engineering, paperbacks on Agriculture are practically non-existent. The following may provide useful related reading)

FISHWICK *Teach Yourself Farming*, English Universities Press
STORER *The Web of Life*, Signet

It is further suggested that lists of publications on agriculture should be obtained from:

(a) U.S. Department of Agriculture, Washington, U.S.A.

(b) Her Majesty's Stationery Office, London, England, as the bulletins, etc. issued are varied and cheap.

14 Journalism

(Students of journalism should, of course, be encouraged to read in all branches of science; the books listed under 'General Science' above are particularly suitable. Some more specialized books are listed below)

UNESCO *The Training of Journalists*, UNESCO
THOULESS *Straight and Crooked Thinking*, Pan Books
LEDERER *A Nation of Sheep*, Crest Books
GOLDWIN *Towards the Liberally Educated Executive*, Mentor
WILLIAMS *Communications*, Penguin
HOGGART *The Uses of Literacy*, Penguin
THOMPSON *Discrimination and Popular Culture*, Penguin

15 History of Science

FORBES *A History of Science & Technology*, Vol. 2, Penguin
HALL *A Brief History of Science*, Signet
CRANE *Giants of Science*, Pyramid
PLEDGE *Science since 1500*, Harper
MASON *A History of the Sciences*, Collier

16 Experimental Methods

BEVERIDGE *The Art of Scientific Investigation*, Vintage Paperbacks
WILSON *Introduction to Scientific Research*, McGraw-Hill

17 Instruments

ADLER *The Tools of Science*, Day

18 Science and Society

RUSSELL *The Impact of Science on Society*, Simon & Schuster
SNOW *The Two Cultures*, Mentor
BERKNER *The Scientific Age*, Yale

19 Report-writing

COOPER *Writing Technical Reports*, Penguin

20 Careers in Science & Technology

GOLDSMITH *Careers in Technology*, Penguin

21 Bibliography of Scientific Paperbacks

Teachers who wish to extend their reference library or compile more specialized reading-lists of low-priced books should consult:

DEASON *A Guide to Science Reading*, Signet
Paperbacks in Print, Whitaker

Contents

Unit 1

THE SCIENTIFIC ATTITUDE

What is the nature of the scientific attitude, the attitude of the man or woman who studies and applies physics, biology, chemistry, geology, engineering, medicine or any other science?

We all know that science plays an important role in the societies in which we live. Many people believe, however, that our progress depends on two different aspects of science. The first of these is the application of the machines, products and systems of applied knowledge that scientists and technologists develop. Through technology, science improves the structure of society and helps man to gain increasing control over his environment. New fibres and drugs, faster and safer means of transport,[1] new systems of applied knowledge (psychiatry, operational research, etc.) are some examples of this aspect of science.

The second aspect is the application by all members of society, from the government official to the ordinary citizen, of the special methods of thought and action that scientists use in their work.

What are these special methods of thinking and acting? First of all, it seems that a successful scientist is full of curiosity—he wants to find out how and why the universe works. He usually directs his attention towards problems which he notices have no satisfactory explanation, and his curiosity makes him look for underlying relationships even if the data available seem to be unconnected. Moreover, he thinks he can improve the existing conditions, whether of pure or applied knowledge, and enjoys trying to solve the problems which this involves.

He is a good observer, accurate, patient and objective and applies persistent and logical thought to the observations he makes. He utilizes the facts he observes to the fullest extent. For example, trained observers obtain a very large amount of information about a star (e.g. distance, mass, velocity, size, etc.) mainly from the accurate analysis of the simple lines that appear in a spectrum.

He is sceptical—he does not accept statements which are not based on the most complete evidence available—and therefore rejects authority as the sole basis for truth. Scientists always check statements and make experiments carefully and objectively to verify them.

Furthermore, he is not only critical of the work of others, but also of his own, since he knows that man is the least reliable of scientific instruments and that a number of factors tend to disturb impartial and objective investigation (see Unit 8).

Lastly, he is highly imaginative since he often has to look for relationships in data which are not only complex but also frequently incomplete. Furthermore, he needs imagination if he wants to make hypotheses of how processes work and how events take place.

These seem to be some of the ways in which a successful scientist or technologist thinks and acts.

[1] *transportation* in U.S.A.

Comprehension

1 Name some sciences.
2 Name two ways in which science can help society to develop.
3 Give some examples of the ways in which science influences everyday life.
4 What elements of science can the ordinary citizen use in order to help his society to develop?
5 How can you describe a person who wants to find out how and why the universe works?
6 What is the role of curiosity in the work of a scientist?
7 Name some of the qualities of a good observer.
8 Give an example of how observed facts are utilized to the fullest.
9 How does a sceptical person act?
10 How does the scientist act towards (a) evidence presented by other people, (b) evidence which he presents in his own work?
11 What do you know about the data which the scientist often has to use? How does this affect his way of thinking?
12 For what other purposes does a scientist need imagination?

Word Study
WORD-BUILDING

A common way of making new words in English is by adding standard combinations of letters to existing words, either at the beginning (prefixes) or at the end (suffixes). By noting these carefully, you will find it is easy to make large increases in your recognition vocabulary.

1 The suffix *-ist*

A person who studies and applies

- geology is a geolog*ist*
- biology is a biolog*ist*
- sociology is a .....
- ..... is a chem*ist*
- anthropology is a .....
- ..... is a psycholog*ist*
- archaeology is a .....
- ..... is a ecolog*ist*
- agronomy is a .....

2 The suffix *-(i)an*

A person who studies and applies

- mathematics is a mathematic*ian*
- statistics is a .....
- ..... is an obstetric*ian*

But

A person who applies the study of

- economics is an economist
- engineering is an engineer
- architecture is an architect
- medicine is a doctor[1]

[1] Usually *physician* in U.S.A.

3 The suffix *-ion*

This suffix converts a verb into the corresponding noun. The following are some examples which occur in our first passage:

VERB	NOUN
to act	act*ion*
to apply	applicat*ion*
to observe	observat*ion*

More examples of this suffix are given in the Word Study section of Unit 2.

EXERCISE (a) Form nouns from the following verbs:

to imagine; to attract; to direct; to construct; to connect; to relate; to fluctuate.

(b) Form verbs from the following nouns:

conversion; suggestion; production; definition; operation; reduction; population.

NOTE: to join—junction; to destroy—destruction; to query—question; to transmit—transmission.

4 The prefixes *in-* and *un-*

These prefixes are used to make an adjective negative, e.g. '*in*complete' (l. 45) means 'not complete'; '*un*connected' (l. 24) means 'not connected'.

EXERCISE (a) Using *in-*, make the following negative:

accurate; capable; direct; essential; frequent.

(b) Using *un-*, make the following negative:

able; stable; usual; critical; reliable; successful; imaginative; true.

Structure Study

SIMPLE PRESENT TENSE

The main structure in the passage is the Simple Present Tense. Remember that this tense is used:

(i) for actions in the present which happen usually, habitually or generally, e.g. 'He usually *directs* his attention towards problems which he notices have no satisfactory explanation' (ll. 20–21);

(ii) for stating general truths, e.g. 'science *plays* an important role in the societies in which we live' (ll. 4–5); or for stating scientific laws, e.g. Water *freezes* at 0°C.;

(iii) for describing processes in a general way, e.g. A scientist *observes* carefully, *applies* logical thought to his observations, *tries* to find relationships in data, etc.

EXERCISE (a) Fill in the blanks in the following and repeat aloud several times:

I make	accurate experiments	... check	the validity of statements
They ...		... check	
She ...		... checks	
The scientist ...		... check	
Scientists ...		... check	
We ...			
You ...			

I think	logically	... observes	accurately
He ...		... observe	
They ...		... observes	
We ...		... observe	
She ...		... observes	
You ...			

(b) Add as many verbs and appropriate complements as possible, chosen from the passage and the Word Study section, to the following subjects: the scientist, scientists, we,

e.g. The scientist USES
Scientists USE
We USE
reliable instruments

(c) Repeat Exercise (b) above using the same set of verbs and complements, but using new subjects chosen from the passage or the Word Study section, e.g. *Physicists* use reliable instruments.

The Negative The Simple Present Tense forms the negative by the use of *do not* or *does not* before the main verb, e.g.

I, you *do not*	KNOW the importance of science.
He, she *does not*	
We, they *do not*	

EXERCISE (d) Fill in the blanks in the following and repeat aloud:

I do not accept	incomplete evidence
You ... not accept	unreliable information
We ... not accept	inaccurate statements
A scientist ... not accept	authority in science
They ... not accept	

(e) Repeat Exercise (a) above, using the negative.

The Interrogative The Simple Present Tense forms questions by the use of *do* or *does* before the subject of the main verb, e.g.

Do	I	KNOW the importance of science?
Does	you / he / she	
Do	we / they	

EXERCISE (f) Repeat Exercise (d) above, using the question form.

(g) Put the verbs in brackets into their correct forms:

1 A statistician (apply) mathematics in his work.
2 You (accept) incomplete evidence?
3 The evidence (seem) incomplete.
4 The government official (use) objective methods?
5 Trained observers usually (utilize) data to the fullest.
6 He always (try) to look for underlying relationships in collections of data.
7 A scientist always (think) logically?

SUBSTITUTION TABLES
Simple Present Active

A Affirmatives

1	2	3	4	5	6	7
A scientist						
A technologist		uses	mathematics			
A researcher		employs	complex instruments			
An investigator		needs			his	
	often		imagination	in		work
They		use	statistical		their	
Scientists		employ	methods			
You		need	new apparatus			
Researchers						

B Negatives

1	2	3	4
A physicist			
A biologist			
He			
An engineer	does not	use	unreliable instruments
		employ	inaccurate observation
Scientific workers	do not	apply	unsuccessful techniques
I			
We			
Biochemists			

C Questions

1	2	3	4	5	6
Does	a specialist an agronomist he a medical worker	sometimes	develop require	new	instruments? techniques?
Do	mathematicians geologists they psychologists		need use		methods? ideas?

Discussion and Criticism

1 Do you think there are other special ways of thinking and acting, used by scientists? If so, comment and explain.

2 Do you think some of these ways are more important than others? If so, give reasons.

3 Do you know of any famous scientist whose work demonstrates some or all the qualities mentioned in the passage? Give details.

4 Try to say something about the work of some of the scientists mentioned in the Word Study section.

5 In what ways do other sciences affect the particular science you study yourself? Give examples.

6 Do you agree that it is important to train the non-scientist to think in a scientific way (ll. 14–17). Give good evidence for your point of view.

7 Do you agree that 'man is the least reliable of scientific instruments' (ll. 40–41)? Give examples.

8 Give a clear explanation of what you think the word 'authority' (l. 36) means.

BIBLIOGRAPHY

CANNON *The Way of an Investigator*, Norton.
WILLIAMS-ELLIS *Modern Scientists at Work*, Harrap.
BURLINGAME *Scientists behind the Inventors*, Avon Books.
CROSS *Engineers and Ivory Towers*, McGraw-Hill Paperbacks.