THE ENGLISH WE USE FOR SCIENCE

A Selection of Texts, with Exercise for Language Practice

R. A. CLOSE

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R.A.C.

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* i = less advanced; ii = average standard; iii = more advanced. See note on page 5.

Exercises at the end of each passage.

INTRODUCTION FOR THE TEACHER

EXPLANATION

For whom this book is intended. Its standard

As users of this book, the author has in mind students and professional practitioners who need English as a medium in their work in science (including medicine) and technology. A thorough study of this book should bring students up to and above the level required for the Science Texts paper of the examination for the Cambridge Certificate of Proficiency in English, or for examinations of similar standard.

The special problems of English for students of science and technology

"The English We Use", first published in 1961 and now widely adopted for English practice, exploits a selection of actual texts of general, scientific and literary interest. Exercises on the texts were devised as training in the accurate understanding of English *speech*, and in the command of vocabulary, grammar, idiom and style in composition. The present book has been designed to provide English practice specifically for students whose main subject is a scientific one. Those who are looking for such material and who have some idea of the problems involved will want to know on what assumptions this book has been based. There are four:

1. The students' first concern with English is to understand modern scientific *writing*. They must above all be able to read text-books and articles on their subject. In any case, the English we generally use for science is a written language, composed of carefully prepared statements for the record, not of spontaneous colloquial talk. Later, the students may wish to follow lectures, hear explanations, take part in oral discussion, and write reports

and articles themselves, in this form of English. The exercises in this book have therefore been devised mainly as studies in a form of written English, and then as training in hearing that kind of English spoken and in using it in original speech and writing. However, ever since the great impetus it received in the seventeeth century, scientific English in England itself has more than once been deliberately brought into close affinity with the language of every-day speech.* This has helped to give scientific English its vitality. Accordingly, the texts in this book include radio broadcasts and television talks in which the speakers are conveying scientific information and ideas by the medium of English popular in tone and meant to be listened to. Students are recommended first to try to understand these pieces, as far as they can, by hearing them spoken, and then to study them as examples of this tendency to keep scientific English in touch with the living tongue. However, they are advised to model their own written English on texts which were intended for printed publication.

2. With so much of absorbing interest to do in their own field, the students will have time and attention only for those features of English that are strictly relevant to their needs. English can serve a great variety of purposes and be a life-time's study even for scholars speaking it as their mother-tongue. Students of highly-specialised sciences, learning English as a foreign language, must ignore many aspects of it that would delight, say, linguists and literary critics. The author has tried to bear that in mind; and so should the teacher using this book. Vocabulary, construction and terminology that are needed for other purposes might be quite irrelevant for this. The criterion of relevance should be: "What is conventionally regarded *today* as essential for the effective communication of scientific information and ideas?" Note the emphasis on *today*. Most of the passages in this book were written after 1950, and several of them after 1960. Students who wish to read the scientific English of

* This has happened, again, in our own times. Compare Text No. 45 in this book, written in 1963, with No. 35, written some forty years earlier.

earlier generations are advised to leave that till later—to get a good grounding in acceptable current English first.

3. The science students' problem with regard to English is not so much one of specialist terminology as of the kind of vocabulary, grammar, syntax and idiomatic devices that are used in scientific English generally. Their chief difficulty becomes obvious when they know the specialist terms but cannot understand or formulate statements in English in which those terms occur. The business of the teacher of scientific English is therefore first to see that his students have a basic English vocabulary and a general understanding of the English linguistic system. In other words, they must begin by mastering those elements of English that would serve for *any* of the great variety of purposes mentioned above. Then they must concentrate on the material commonly used for scientific purposes; and, lastly, on the particular idiom of their own special field. There are thus three stages in scientific English:

a. a foundation that could serve for *any purpose;*
b. a superstructure that could serve for *any scientific purpose;* and
c. a later superstructure serving *some special scientific purpose.*

The author assumes that his students have completed the first stage and are at, or ready to proceed to, the second—or *obliged* to proceed to it in any case. The second is the important stage that this book aims at consolidating. The third is left to the students themselves and their scientist teachers, who are the people most competent to deal with specialist terminology and to explain what it really means.

4. The time that science students can spare for preliminary language learning is strictly limited, and teachers must resist the temptation to prolong it. With the minimum of delay, the students will wish to—perhaps have to—begin reading the kind of English that is actually used in scientific literature. That kind of English may be complicated, in spite of the tendency, noted above, to keep it plain; and scientists, like other human beings, sometimes

write carelessly or pretentiously. (They can also write with superb efficiency, and will no doubt prove to be well represented amongst the best masters of English in the twentieth century.) It would of course be easier for the students if the tendency to simplify scientific English were accelerated—and if everybody agreed to restrict themselves to the same simplified system. But, until this happens, we must accept scientific English as it is. This book is concerned with the English we really use for science and that is the kind of English that many people have to understand. If the students find the texts in this book out of their depth, then obviously they should have had more preliminary practice. However, to give them that practice, it may not be necessary—or possible—to take them back to elementary English without scientific content. With a little preparation on the teacher's part, they may be able to get all the preliminary practice they need from the book itself, i.e. from real scientific material. An indication of how this could be done is given on page 9.

Choice and grading of the texts

Since the object is to consolidate the students' knowledge of the kind of English that could serve for any scientific purpose, the texts chosen for this book cover subjects of general scientific interest—of interest, too, to any educated layman in this day and age. This, incidentally, avoids the difficulty of trying to cater especially for each one of a wide range of specialist subjects. In any case, certain highly specialist writing is so compact with technical terms and formulae as to leave little scope for language practice. It belongs therefore to the last of the three stages mentioned above. Students using this book are expected to study all the passages (though not necessarily in the order given, as some passages are easier than others). Not only would their command of English gain from a study of all the pieces, but there is between one of the subjects and another a correlation which they would be wise to consider; and this would be a natural topic for discussion.

The author has accordingly selected fifty-two pieces of general,

and considerable, appeal, taking his material mainly from British scientific journals. The wealth of modern scientific writing in English is so vast that it would be easy to say that other passages and subjects might have been included. It has proved less easy to find pieces of sufficient general interest that lend themselves to systematic language practice. A great many fascinating articles were read, included in a preliminary selection, but in the end discarded before the final choice was decided upon.

The passages have been graded as follows: i=less advanced; ii=average standard; iii=more advanced. Such a grading is bound to be arbitrary and will certainly not suit everybody: so much depends on the personal interests of the student, and on his linguistic and cultural background. The teacher, or even the student himself, will be the best judge of which pieces to choose for study, and of the order in which they should be taken. If in doubt, take the Grade i pieces first, then proceed to Grade ii.

Characteristics of scientific English generally

The object of this book is to give examples of scientific English and opportunities for practising it—not to analyse it. However, some of its salient features should be underlined so that teachers and students can concentrate on the most relevant. It has certain distinct characteristics with regard to vocabulary and syntax; and morphology plays an important part in it. For example:—

1. *Names of things.* Science is concerned with *matter, elements, substances, objects, solids, liquids, gases.* Such words, and many names of different elements, substances, etc., are in everyday use, though they are also fundamental to scientific vocabulary. Other names are more likely to occur only in a scientific context, and these are usually derived from Greek (Gr.) or Latin (L.), or occasionally from Arabic (Ar.) e.g. *oxygen, hydrogen* (Gr.), *carbon, molecule* (L.), *alkali* (Ar.). Some idea of how these words have been formed is given in the passage "The Discovery of Oxygen" (page 78).

Explanation

This is all a question of vocabulary, and the words concerned are usually called *nouns.*

2. *Words describing things, i.e. indicating their shapes, measurements, properties, qualities or conditions.* Such words are: *round, square, long, short, heavy, light, rough, smooth, dry, wet.* That is also a question of vocabulary and those words are called *adjectives.* Note, however, that in determining whether an object is long or short, heavy or light, we are concerned with its *length* or *weight* (nouns). In space, the object becomes *weightless* (adjective), in which case we are concerned with its *weightlessness* (noun). In the formation of *length, weightless* and *weightlessness,* we are concerned with morphology, and in particular with the addition of suffixes (*-th, -less, -ness*) to a root (*long, weight*).

3. *Expressions of impersonal activity.* Science is also constantly concerned with activity, but its emphasis is on WHAT HAPPENS TO THINGS, i.e. impersonal activity, seen objectively, and not on what people do, i.e. personal activity seen subjectively. Thus:

a. Warm air rises, A ripe apple falls to the ground. (The words *rises* and *falls* are *verbs*).

b. The liquid was examined and was found to contain X. Note the use of the *passive* form of the verb, e.g. *was examined, was found,* rather than the *active form,* e.g. *I examined the liquid and found it contained X.* The passive emphasises what happens to the liquid, since what I, personally, do is not regarded as important. The passive is very frequently used in scientific writing.

c. Activity is expressed or implied in words like *cause, result, increase, decrease,* which serve as either verbs or nouns; or like *arrange, combine, compare, discover, observe, prevent, reduce* (verbs) and the corresponding nouns *arrangement, combination, comparison, discovery, observation, prevention, reduction.* An important factor in the control of scientific English is to know which words can serve as both nouns and verbs (e.g. *rise, fall, cause, result*), to know which words are normally only verbs (e.g. *arrange*) and which normally only nouns (e.g. *arrangement*), and to know what are the nouns that correspond to verbs like *arrange, combine,* etc. or the verbs that correspond to nouns like *arrange-*

ment, combination. In the formation of *arrangement, combination, comparison, discovery*, etc. we are again concerned with morphology. Note the vowel change in cases like *compare, comparison, reduce, reduction*; and the shift of stress in *obsèrve, öbservàtion, combìne, cömbinàtion*, etc.*

d. Notice that a noun is often used in preference to a verb, and this avoids either an expression of personal activity or a clumsy passive construction. Thus, instead of *When we had completed the experiment* (personal), or *When the experiment had been completed* (passive, impersonal, but clumsy), we can simply say:

On completion of the experiment.

Instead of *The patient was breathing quickly* (personal), the scientist might say:

The patient had a high respiration rate

(an impersonal, clinical observation). An adjective can likewise be used as a substitute for a verbal expression. Thus, instead of *I can* (or *cannot*) *break* (or *see, dissolve, reduce*) *this*, or instead of *This can* (or *cannot*) *be broken* (or *seen, dissolved, reduced*), we can say:

This is breakable (or *unbreakable*), *visible* (or *invisible*), *soluble* (or *insoluble*), *reducible* (or *irreducible*).

Here again, morphology plays an important role in scientific English. Note that there is no shift of stress in cases like *imàgine, imàginable*, although stress shift may occur in the noun (*imäginàtion*).

4. *Combination of ideas.* Scientific English makes frequent use of expressions in which a combination of ideas is condensed into a compound noun (e.g. *test-tube*, i.e. glass vessel in the form of a tube, used for making tests) or a grouping of nouns that has not yet been adapted as a compound (e.g. *respiration rate*, i.e. frequency with which respiration occurs). This is a common feature of English and is often found in scientific writing. New expressions on the same pattern are quickly invented, e.g. *space ship.*

* The sign ` indicates main stress (falling intonation), and ¯ secondary stress.

Explanation

Note the heavier stress and the fall in pitch* on the first element, marked thus: *tèst-tube, rëspiràtion rate, spàce-ship.* Students should be prepared for this fall in pitch* in listening to spoken English, otherwise they might miss the weaker-sounding latter part of the combination. Science uses quite complicated combinations on this pattern, e.g., *fìsh prötein prodüction* and (*hïgh precïsion*) *X-ray crystallögraphy* (both examples taken from passage No. 4, pp. 32-33; and the scientist carries this pattern into discussions in a wider field, e.g. *devèlopment actïvities* (page 25), *repàir personnël* (page 27), *enjòyment resöurces* (page 203). Note that the fall in pitch* occurs in the latter part of the combination in some expressions, e.g. *a gläss tùbe, an ïron bàr, a cöpper rìng, cötton wàste,* in which the first element refers to the substance of which the *tube, bar, ring* or *waste* consists or is made.

5. *Style: statement of fact rather than expression through imaginative figures of speech.* Ordinary talk, fiction and especially poetry are full of imaginative figures of speech. *The car shot off like a streak of lightning*: the *simile* there is picturesque but the resemblance between the movement of the car and a shot or a streak of lightning is fanciful rather than factual. Science would report the speed of the car and its rate of acceleration in terms of exact measurements of space and time. However, the figure of speech called *metaphor* is difficult to avoid completely in scientific writing. For instance the word *branch* in *a branch of mathematics* is used metaphorically: mathematics is not, in fact, a tree. Sometimes metaphor can be very effective even in scientific writing, and might well liven it up. Sometimes scientists resort to metaphor to make an imaginative or emotional appeal (as Professor Thacker does on page 25). The science student should be conscious of when he is using metaphor (as A. N. Whitehead is in the second paragraph of the passage on page 16) and he should be capable of replacing it by a statement of plain fact.

* Or rise in pitch in certain kinds of utterance, e.g. *Is this a tést-tube?*