SCIENTIFIC WORDS

Their Structure and Meaning

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An Explanatory Glossary of about 1,150
Word-elements (roots, prefixes,
suffixes) which enter into the
formation of Scientific
Terms

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INTRODUCTION

A ZOOLOGIST has described Man as:

> 'metazoan, triploblastic, chordate, vertebrate, pentadactyle, mammalian, eutherian, primate'.

A chemist has written that:

> 'in the formation of mono-substitution products of benzoic acid the halogen takes up the meta-position with respect to the carboxyl'.

From a technical dictionary we read that a carbuncle is:

> 'a circumscribed staphylococcal infection of the subcutaneous tissues'.

Such passages as these are probably unintelligible to the non-scientist and might even puzzle a scientist if he specialised in a totally different field. They are, however, sensible statements of certain scientific facts. Their difficulty lies in the concepts which are involved—concepts with which the reader may not be familiar—and also in the technical terms which are used. A reader who does not understand such terms should not be tempted to dismiss the passages as mere technical jargon. If he is thoughtful he might well ask a number of questions about the specialised words of science.

Why do scientists use such unfamiliar, and apparently difficult, words? Why do they need a special vocabulary of their own?

What is the nature of the specialised words of science? What are their origins? Are they just fanciful inventions or have they been sensibly and logically constructed?

Are these words necessarily unintelligible to all but the scientific expert or can an ordinary educated person, who knows a little science, make some sense of them and gain at least a general idea of their meanings?

The Purpose and Nature of Scientific Words

The development of an appropriate vocabulary is essential to the development of any subject. Words are the elements of language; language is the vehicle of ideas. By silent language thoughts are developed in the mind, and by written or spoken language thoughts are communicated to others.

It is obvious that a scientist must have names by which to identify and refer to the various chemical substances, minerals, plants, animals, structural units, instruments, etc., with which he deals. He must have suitable adjectives for describing these things and suitable verbs for defining their behaviour.

He also needs suitable names by which to identify the various abstractions with which he deals—processes, states, qualities, relationships, and so on. Thus, after Faraday had investigated the passage of electric currents through different solutions and noted the resulting liberation of chemical substances, the term *electrolysis* was invented. This one word was a kind of shorthand symbol for the process; it 'pinned down' the process and conveniently embraced its many aspects. From then on it was possible to think about the process and to talk about it to others. Similarly, the single term *symbiosis* conveniently summarises a biological state; *diathermancy* identifies a physical quality.

Many scientific words are of this kind. Without the name (or technical term) a concept remains vague and ill-defined; the scientist is hindered in his mental processes, in his recording of what he thinks and does, and in his communication with others.

In his communication a scientist is mainly concerned with the exact and logical expression of that which he wishes to pass on to another. His purpose is to inform (as clearly as possible), not to excite emotion. It follows that each of his words must have a precise meaning, and one meaning only, so that there is no risk of confusion or ambiguity. Of course he must know himself what his words mean and he must assume that the person with whom he communicates attaches the same meanings to them. (If he is communicating with a person who is unlikely to understand his specialised terms he must take care not to use them, even if that may mean some loss of precision or elegance. A number of 'popular' science talks fail because the speaker, often an expert scientist, thoughtlessly uses words which the ordinary person does not understand.)

The meanings of many ordinary words of our language are not single and precise. Although the original, basic meanings may be clear, the words have acquired a range of meanings over the years. Thus the familiar word *fair* has somewhat different meanings when used to describe the weather, a person's hair, an action or decision, or a boy's performance at school; some words (e.g. *rude*) suffer a significant change in meaning. Hence a scientist avoids the ordinary words of the language; he prefers his own words. These words can then be rigorously defined and given the necessary precision of meaning.

The use of words which are 'set apart' from everyday life also enables the scientist to avoid evoking irrelevant and distorting associations. Some ordinary words convey more than their literal meanings; they evoke further images, emotions and reactions on the part of the hearer or reader. (Thus *red*, basically a word denoting a certain colour, may conjure up thoughts and feelings relating to danger, to blood, or to a particular political outlook.) The specialised words of science, if used in their proper contexts, are largely free from distorting associations. It is interesting to note that when a scientific term, originally well-defined, becomes a word of ordinary speech, it usually suffers a widening of meaning and acquires a number of associations. Thus criticism (as well as sulphuric acid) may be *vitriolic*, a man may be *electrified* into action, and people may claim to be *allergic* to all sorts of things and conditions. The word *atomic*, whose meaning is quite clear to the scientist, may conjure up in the public mind a picture of widespread destruction or of unlimited power.

In addition to precision of meaning and freedom from associations, most scientific words have a third quality: by their form and structure they reveal something of their meanings. Many scientific words are logically built up from simpler word-elements (usually of Greek or Latin origin) and the general meaning of the whole can be inferred from an understanding of the parts. Some terms, in fact, are self-explanatory if the Latin and Greek roots are known; they have only to be 'translated' for their meanings to become apparent.

Thus a *quadrilateral* is clearly a four-sided figure, *entomology* is the study of insects, *gastrectomy* is the cutting out of the stomach (or part of it). In the case of a large number of words the full or precise meaning may not be directly disclosed but the general meaning is apparent and the word is seen to 'make sense'. Thus *cyanosis* indicates a state (possibly a morbid state) of blueness; it is a sensible word to use to denote the blue condition of the skin which results from insufficient oxygen in the blood. A *xerophyte* (literally "a dry plant") is one which is adapted for living in very dry conditions; a *hydrophyte* is one which lives on the surface of, or submerged in, water. A *polymer* consists of "many parts"; the term is an appropriate one for a giant molecule which is built up from a large number of simple units.

In a similar way, many chemical names are essentially descriptions of the compounds which they denote. Thus whereas the common name *aniline* for a certain oil discloses nothing about the nature of the compound (except, perhaps, that it is vaguely related to indigo), the chemical name *aminobenzene* immediately indicates the molecular composition and structure.

Scientific language, to be efficient, must be universally intelligible. The classical languages, Latin and Greek, are so fundamental to the civilised world that words constructed from elements of these languages are readily understood the world over. (Even if scientists know little of the classical languages, they can easily learn to 'translate' the scientific terms which they may meet.) Most scientific terms are effectively international.

Sources of Scientific Words

Scientific words in English may conveniently be divided, from the standpoint of their origins, into three groups:

(*a*) those taken from the ordinary English vocabulary;
(*b*) those taken virtually unchanged from another language;
(*c*) those which have been invented.

The third group is by far the largest.

Just as the cricketer has taken certain everyday words, such as *run*, *over*, *maiden*, from the general English vocabulary and given them specialised meanings within the context of his game, so the scientist has occasionally taken ordinary English words and endowed them with specialised meanings. *Energy*, *work*, *power*, *salt*, *base*, *fruit* are examples of such words. They are unsatisfactory as scientific terms because they lack the essential qualities which we have described. Although the scientist may give them precise meanings, they are liable to be interpreted more loosely (or even differently) by the non-scientist. They are not free from irrelevant associations; they reveal little of their meanings by their forms; and usually, they are not understood outside the English-speaking countries. There are not many words of this kind but, unfortunately, most of them stand for concepts of fundamental importance.

The English language contains a number of words which have been taken from another language with little or no change of spelling. Amongst them are *café*, *morgue*, *souvenir*, *trek*, *marmalade* and *agenda*. Practically all the scientific words of this kind have been taken from Latin or Greek. As examples of Latin words we may note *axis*, *fulcrum*, *larva*, *radius*, *locus*, *nimbus*, *cortex*. Many parts of the human body, e.g. *cerebrum*, *pelvis*, *cornea*, have Latin names. There are fewer unaltered Greek words—*thorax*, *stigma*, *iris*, *helix* are examples—but it should be noted that many terms adopted in Latin form, e.g. *trachea*, *bronchus*, *phylum*, were themselves based on Greek. Many of the Greek or Latin terms have retained their original meanings but in some cases the meanings have been restricted and rendered more precise.

The largest group of scientific words are those which have been invented. The advance of science during the last few centuries has been so rapid and so extensive that no language has been capable of providing, ready-made, all the words which were required. Further, the classical languages do not contain words appropriate to modern discoveries, inventions and concepts. (There is no Latin word, for example, for photography!) Hence the scientist has had to invent new words for his own purposes.

It is very rare for a scientist to make up a word 'out of his head'; the term *ester* for a compound formed by the interaction of an alcohol and an organic acid was perhaps such an invention. A small but interesting group of terms comprises those based on proper names. In the naming of the chemical elements recourse has been made to the names of places (as in *polonium, ytterbium*), of gods and goddesses (as in *thorium, vanadium*), of planets and asteroids (as in *uranium, cerium*), and of scientists themselves (as in *curium, gadolinium*). Scientists' names have also been used to provide the names of units (e.g. *watt, volt, gauss, joule*) and hence the names of measuring instruments (e.g. *voltmeter*). Among the other terms based on the names of scientists are *daltonism, nicotine, bakelite* and *mendelism*. A number of plants, e.g. *fuchsia, dahlia* are named after botanists.

In his task of inventing new terms, however, the scientist has usually turned to the classical languages for his raw material. He has taken 'bits and pieces'—roots, prefixes, suffixes—from these languages and joined them together to form the terms he needed. Thus, when he needed a general name for animals such as snails and slugs which apparently walk on their stomachs, he took the Greek roots *gast(e)ro-* (stomach) and *-pod* (foot) and formed the new word *gastropod*. When he wanted a word to describe a speed greater than that of sound he took the Latin prefix *super-* (above, beyond) and the Latin root *son-* (sound) and coined the adjective *supersonic*. Thousands of scientific words have been built up from classical word-elements in this way.

It may be asked why the scientist should have turned to the classical languages for the words and word-elements which he needed. By turning to a language other than his own he was certainly able to find words and elements which were distinct from those of ordinary speech but he turned to the classical languages for an important historical reason. The fifteenth and sixteenth centuries witnessed that great revival of classical learning which is commonly called the Renaissance. Latin was regarded as the universal language of scholarship; it was the 'perfect' language of philosophy, theology and science. This classical tradition persisted into the seventeenth century—both Harvey and Newton wrote their great works in Latin—and it was not until towards the end of that century that English was fully accepted as an adequate and suitable language for a scholarly exposition of science.

During this period many Latin words were taken into the scientific vocabulary and many new words were constructed (chiefly in the form of Latin words) from classical elements. The tradition of using the classical languages as a source of scientific words remains.

Greek was not used in the same way as a medium of expression but it was held in respect as the language of the people who at one time led the world in art, science and philosophy. Moreover, it provided a particularly suitable basis for scientific language. It had been developed by a long line of philosophers as a medium for accurate expression and its elements were such that derivatives and compounds were readily formed. The scientists therefore mainly went to the Greek for the new terms which they needed (though, as has been pointed out, the terms were at one time often framed in Latin form). Greek is still the source of most of the new terms of science and more than half of the words of the great vocabulary of science are ultimately of Greek origin.

The Formation of Scientific Words from Classical Word-elements

Despite the enormous size of the modern vocabulary of science, the basic elements from which the words have been constructed are comparatively few. This book lists about 1,150 word-elements. They have produced, and will go on producing, tens (or probably hundreds) of thousands of words. A large proportion of the words have been built up from a much smaller number of elements. (The greater part of the vocabulary of medicine and anatomy—perhaps 30,000 words—has been constructed by the use of only about 150 standard word-elements and the names of the parts of the body.) Many elements appear in a range of words distributed among a number of different sciences. Thus the element *pter-* (Gk. *pteron*, wing) appears in the names of many sub-classes of insects (e.g. *Diptera*, *Lepidoptera*), of certain types of aircraft (e.g. *helicopter*) of a group of chemical substances (e.g. *methopterin*) and in the name of a mesozoic flying reptile (*Pterodactyl*).

As will be seen from the Glossary, the word-elements are generally used in forms which are specially adapted to word-building. Thus the Greek noun *nephros* (kidney) is used in the combining-form *nephro-* (or *nephr-* before a vowel). Let us take this root and look at the range of words which have been built up from it. We may suffer from *nephropathy* (disease of the kidney), *nephralgia* (pain in the kidney), *nephritis* (inflammation of the kidney) or *nephroptosis* (a dropping of the kidney). We may undergo the surgical operations of *nephrotomy* (a cutting of the kidney), *nephrectomy* (a cutting out), *nephrorrhaphy* (a sewing up) or *nephropexy* (a fixing in place). Yet more terms will be found in a medical dictionary. We might like to invent a few more terms ourselves. The kidney can suffer the processes of *nephrothermolysis* (being cooked) and *nephrophagy* (being eaten)! The root has also been used in forming the names of excretory structures in certain lower animals. In an Earthworm, for example, each normal segment contains a pair of excretory organs which have been called the *nephridia* (literally, the little kidneys).

Prefixes which indicate degree, position or number are of particular value in word-building. Thus we may suffer from *hyperpiesis* (high blood pressure) or from *hypopiesis* (low blood pressure), the two terms being formed by the addition of contrasting prefixes to the same root. Similarly, the *ectoplasm* is the thin protoplasm near the outside of a cell and the *endoplasm* is the denser protoplasm well within the cell. The *Apoda* have no legs, the *Decapoda* have ten, and the *Myriapoda* have many. Radio valves may be classified as *diodes* (two electrodes), *triodes* (three electrodes) . . . *pentodes* (five electrodes) . . . *octodes* (eight electrodes), and so on.

Often both Greek and Latin elements with the same meaning are available. Thus a flesh-eating animal may be described as *sarcophagous* (Gk.) or *carnivorous* (L.); both *hypodermic* (Gk.) and *subcutaneous* (L.) mean under the skin. Occasionally slight differences of meaning have been arbitrarily assigned to corresponding words of different origins. There is no rule as to whether Greek or Latin elements should be used in word-building though often the Greek elements fit together more easily.

Sometimes both Greek and Latin elements are combined in the same word. *Television* is a well-known example; the prefix *tele-* (from afar) is Greek and the root *vis-* (seeing) is Latin. (The 'all-Greek' word *teleorama* would have been more satisfying to the purists but it is unlikely to be adopted.) The formation of 'hybrid' words of this kind may be considered objectionable if 'pure' alternatives are readily available and equally convenient. Thus the term *odoriphore** is a needless hybrid; the 'all-Greek' term *osmophore* would serve just as well. There appears to be no justification for the invention of the hybrid word *pluviometer* (rain gauge) when two all-Greek terms, *hyetometer* and *ombrometer*, are available. And chemists still seem not to have made up their minds whether to use Latin or Greek prefixes of number before the Latin root *-valent*.

Undoubtedly some hybrids have been formed because of thoughtlessness or ignorance, but many have been formed because certain prefixes and suffixes have become well known and have been found to be convenient. Thus the familiar Greek root *-meter* (measurer) has been added to all sorts of stems, e.g. to a Latin stem in *audiometer* and to an English stem in *weatherometer*. (Note the insertion of the *o* before *-meter*; in all-Greek terms an *o* normally arises as the ending of the stem.) The Greek element *-logy* (often regarded as *-ology*) is now freely added to stems of various kinds and origins; the three common medical elements *-itis* (inflammation), *-oma* (growth, tumour) and *-osis* (morbid state) are not infrequently added to Latin stems (e.g. as in *gingivitis*, *fibroma*, and *silicosis*). Certain prefixes of classical origin, e.g. *re-*, *pre-*, *micro-*, *sub-*, *tele-*, are still 'living' and are freely used in combination with words of any origin, e.g. in *re-oxidise*, *pre-Cambrian*, *microfilm*, *substandard* and *telecommunication*.

The process of word-building has certainly resulted in some peculiar-looking words, e.g. *heterochlamydeous*, *otorhinolaryngology* and *postzygapophysis* (in which one prefix of Latin origin and two of Greek have been added to the Greek word *physis*), but many of them readily break down into their component parts and reveal their meanings. Some of the ugliest words, perhaps, are found in the field of medicine but the longest words are the names given to certain chemical compounds. *Tetrahydronaphthylamine*, with twenty-three letters, is a very humble example; some names contain over sixty letters. These long names, however, are easily understood by a chemist, for they are logically constructed and provide detailed descriptions of the compounds to which they are given.

It is not easy to explain the nature of these chemical names without presupposing a fair knowledge of chemistry. Perhaps one simple example will help the reader to appreciate the way these

* *Odori'phore*—"odour bearer"—a group of atoms which confer a particular smell on a chemical compound.

names are constructed. The molecule of benzene (C_6H_6) consists of a ring of six carbon atoms to each of which is joined a hydrogen atom. If two (*di-*) of the hydrogen atoms are replaced by chlorine atoms, the compound is conveniently called *dichlorbenzene*. There are, however, three forms of dichlorbenzene depending upon the relative positions of the two chlorine atoms. The forms can be distinguished by the use of appropriate prefixes. Thus one form, a substance sometimes used for protecting clothes from moths, is known as *para-dichlorbenzene*.

The Analysis and Interpretation of Scientific Words

Not many people are in the position of needing to invent new scientific words. A scientist may need to do so occasionally, particularly if he is researching in a new field. Sometimes a manufacturer invents a pseudo-scientific name (often a verbal monstrosity) for his products, apparently to make them seem more attractive. The layman is never called upon to invent scientific words.

All kinds of people, however, may find themselves needing to interpret the meanings of scientific words. The scientist may meet new terms invented by other scientists; he may meet words which are unfamiliar to him because they are in specialised fields outside his own. The student frequently meets words which are strange to him but which he must learn and understand in order to progress in his studies. And, in these modern times, the layman meets scientific words in his newspapers, in advertisements, and through television.

It must be recognised at the outset that a reader (or listener) cannot understand a discourse on a subject if he lacks the necessary background knowledge; he must be able to meet the author 'part way'. This is true of all kinds of reading. One cannot fully understand a passage of Shakespeare if one lacks the background which he presupposed when fashioning his metaphors; one cannot follow an account of the working of a synchrotron if one knows nothing about electric fields and particles. Similarly, one cannot interpret the meaning of a word if one has an inadequate understanding of the subject to which it relates. The term *melanosporous* must remain unintelligible if one does not know what spores are, and *stereo-isomerism* cannot be understood by one who knows nothing about molecular structure. (This does not mean, however, that it is impossible to understand that which is outside one's immediate knowledge and experience. One's knowledge can be extended by building up from that which is known. The concept of *stereo-isomerism*, for example, could be explained to a layman if care were taken to build up his knowledge step by step.)

Words which are pure Latin or pure Greek, and which cannot be broken down into simpler parts, do not readily disclose their meanings; one either knows the meanings or one does not. Thus one cannot infer the meaning of *tibia*, *thallus*, or *soma* merely from the spelling. It has been shown, however, that the majority of scientific words have been constructed from simpler word-elements and thus, from an understanding of the parts, one may deduce the meaning (or at least the general sense) of the whole. This is, indeed, one of the virtues of scientific words.

The criticism is sometimes made that deduction of meaning on the basis of etymology may be misleading. It is true that some scientific terms are misnomers; they were coined in the light of knowledge which is now known to be inaccurate. Thus *vitamins* are not amines, the *maria* of the Moon are not seas, and *oxygen* is not necessarily a producer of acids. Many minerals have been misnamed. With the great majority of scientific terms, however, etymology can be of great value in the deduction of meaning.

As has already been pointed out, the meanings of a large number of scientific words are directly revealed by simple translation. *Conchology* is obviously the study of shells, a *lignicolous* fungus is clearly one which lives on wood, and what else can *hypodermic* mean than under (or below) the skin? *Antiseptic*, *microphyllous*, *anemometer*, *centripetal*, *pentadactyl*, *hyperglycaemia* are among the thousands of scientific words whose meanings may be readily deduced by simple analysis. It is possible that by simple translation one might occasionally miss some subtle shade of meaning or of application but one would nevertheless gain a useful idea of what the words denote.

There are thousands of other words, of course, whose full meanings cannot be determined by simple deduction. Thus *pericardium* clearly means "round the heart", but we cannot deduce exactly what it is; an *electrometer* is apparently an instrument for measuring electricity but we cannot tell what property of electricity it measures. The word *isotope* tells us no more than that 'it' is in the same place as something else. The translation of the names given to plants and animals is often of no help in identification; we cannot recognise *Myosotis* by translating the name as "mouse ear" nor do we know what *Oligochaeta* are even if we deduce that they have "few bristles".

Even if a scientific word does not reveal its full meaning on simple analysis, it is seen to 'make sense' when its full meaning has been explained. It is not an unintelligible assembly of letters. It is seen to fit in with its meaning; it is more easily recognised on another occasion, it is more easily remembered; its relation to other similar words will be appreciated. An understanding of structure and derivation converts an unintelligible word into one which makes sense.

The main purpose of this book is to provide an explanatory list of the more important word-elements which enter into the formation of scientific terms. By the use of this list, and with the help of the illustrative examples, the reader should be able to break down and interpret many of the scientific terms which he meets and to 'make sense' of thousands of others. Let us take a few words in illustration.

The word *photometer* readily breaks down into the elements *photo-* (light) and *-meter* (a measurer); it is evidently the name of an instrument for measuring some quality (e.g. intensity) of light. The word *geomorphology* breaks down into the elements *geo-* (Earth), *morpho-* (form, shape) and *-logy* (which may be interpreted as 'the study of'); geomorphology is thus the study of the shape of the Earth (actually of the origin and nature of its surface shape and features). The term *gastromyotomy* breaks down into its elements *gastro-* (stomach), *myo-* (muscle) and *-tomy* (cutting); we deduce that gastromyotomy is the surgical cutting of the muscles of the stomach. Similarly, we deduce that *nephro'ptosis* is a dropping of the kidney and that *arterio'sclerosis* is a hardening of the arteries. We understand why lines on a map passing through places which have the same temperature are called *isotherms* (*iso-*, equal, *therm-*, heat) and so deduce the meanings of *isobar*, *isoneph*, *isohyet*, and similar terms. Having learned that the element *cyto-* indicates a cell, we can make sense of such terms as *cyto'logy*, *cyto'genesis* and *cyto'lysis*.

Let us take one example to illustrate how a long chemical name may be interpreted. What can be made of the name *polytetrafluoroethylene*? As is often useful when analysing chemical names, we work from right to left. We start with *ethylene*, the name of a well-known hydrocarbon (hydrogen-carbon compound) with the chemical formula C_2H_4. *Tetra-fluoro-* indicates that four fluorine atoms are taking the place of four (in this case all) hydrogen atoms in the molecule. So we reach a compound which may be represented by the formula C_2F_4. The prefix *poly-* in chemical names indicates that a giant molecule, as in a 'plastic', has been built up by the joining together of a large number of simple units.

Polytetrafluoroethylene is, in fact, a 'plastic' substance built up from C_2F_4 units, known commercially as P.T.F.E. or Teflon.

An understanding of the structure and origin of a word is not only a guide to its meaning; it is often a guide to its spelling. No schoolboy who understands the origin of the word *bicycle* should ever spell it wrongly. Nor should he wonder whether to put one *s* or two in such words as *disappear*, *disappoint* and *dissolve*. There must clearly be two *n*'s in *innocuous*—one from the prefix and one from the root—but only one in *inoculate*. The word *desiccate* should never be a notorious spelling difficulty. As the science student or layman learns the commoner word-elements and recognises their presence in the words he meets, he is also learning how to spell the words. The spelling of such words as *anaesthetic*, *diarrhoea*, *dysentery*, *haemorrhage*, *paraffin*, *parallel*, *psychoneurosis*, *rhododendron* should present no difficulties if their origins are understood.

The criticism may be made that in these days few scientists, and few laymen, are acquainted with the classical languages and hence they cannot analyse words in the ways we have described. In former times a scientist was often a man who, having received an education in the classics, subsequently devoted himself to scientific studies. He was well able to invent the new words which he needed and to interpret words invented by others. Nowadays, however, a scientist usually knows little or nothing of the classics (and, let it not be overlooked, the classicist usually knows nothing of the sciences).

We live in a scientific age; an understanding of science is at least as necessary to the make-up of an educated man as a knowledge of the arts. More and more people need to understand the words of science. This does not mean that traditional courses of Latin and Greek should therefore form a part of everyone's education but it indicates the desirability of teaching the more important roots which enter into the formation of English, and especially scientific, words. A study of 'Words and their Origins', with a bias towards scientific words, should form a part of the normal work of all our secondary schools.

NOTES ON THE GLOSSARY

THE glossary lists about 1,150 word-elements (roots, prefixes, suffixes) which enter into the formation of scientific terms. (Very common elements, e.g. *un-*, *-ation*, *-able*, which are sure to be known to the reader, are not included.)

The meaning of each element is given and also its origin (usually Latin or Greek). It should be noted, however, that many words and elements whose origins are given as Greek passed into Latin before becoming part of the English language. Greek words have been written with the corresponding English letters; θ, υ, φ, χ, ψ, and the aspirated ϱ are shown as *th*, *y*, *ph*, *ch*, *ps* and *rh* respectively; γ is shown as *n* in those words (e.g. *enkephalos*, *planktos*) in which it effectively has the sound of *n*.

Wherever it is thought helpful or interesting, attention is drawn to the occurrence of an element in a familiar word of ordinary speech.

The use of each element in word-building is illustrated by a selection of scientific terms which incorporate the element. The meaning of each term is given. The terms have been selected to show:

(*a*) the various forms which the element may take;

(*b*) the use of the element in building terms in different sciences.

The glossary is not intended to be a complete scientific dictionary—it does not give all the terms which incorporate each element—but it does provide, in fact, simple explanations of several thousands of terms.

The sign ˈ is used to break up a word into its component parts in order to demonstrate the structure of the word. The sign is *not* an indication of stress nor is it necessarily a guide to pronunciation.

Double inverted commas (“ ”) are used to show literal meanings, i.e. direct ‘translations’.

Chemical formulae are given wherever they serve a useful purpose. In some cases a formula is an aid to the explanation; in many cases a formula is given to help in the identification of the substance named.

GLOSSARY OF SCIENTIFIC WORD-ELEMENTS

A

α-, ALPHA-

α, the first letter of the Greek alphabet, is sometimes added before the name of a series or group of things to denote the first member of the series or group. (The succeeding letters β, γ, . . . are used for other members.)

α-rays, alpha-rays—one of the three types of radiation given off by radioactive substances, consisting of a stream of positively charged particles (**α-particles**).

α-brass, alpha-brass—a form of brass (a solid solution of zinc in copper) containing up to about 38 per cent. zinc.

In naming organic compounds, α is sometimes used to show that a certain group of atoms is in the first of two (or more) possible positions in the molecule.

α-hydroxyˈpropionic acid — the acid (lactic acid) whose molecule is represented by the formula $CH_3.CH(OH).COOH$. The hydroxy-group (-OH) takes the place of one of the hydrogen atoms in propionic acid $CH_3.CH_2.COOH$; counting back from the characteristic acid group -COOH, the hydroxy-group replaces one of the hydrogen atoms joined to the first carbon atom. (The acid represented by $CH_2(OH).CH_2.COOH$, in which the hydroxy-group is joined to the second carbon atom, is β-hydroxypropionic acid.)

Similarly, in naphthol $C_{10}H_7OH$, an -OH group takes the place of one hydrogen atom of naphthalene $C_{10}H_8$. There are two different positions which the -OH group could occupy. Hence there are two forms of naphthol: **α-naphthol** and **β-naphthol.**

A- An alternative form of AB- (q.v.).

A-, AN-

not, without, lacking (Gk. *a-*, *an-*). (This prefix is used in the form AN- before *h* or a vowel.)

aˈcephalic—without a head.

aˈsymmetric(al) — not symmetric(al), not divisible by a line or plane (or lines or planes) into two (or more) parts exactly similar in size, shape and position.

aˈphasia—"without speech"—a disorder of speech due to disease or brain injury.

aˈsthenia—"lack of strength", **myˈasthenia**—weakness of the muscles.

aˈsphyxia — "without pulse" — suffocation.

aˈmorphous — "without shape" — not having a definite shape; (in chemistry) not having a crystalline form.

aˈneroid—"not wet"—a form of barometer which does not contain a liquid.

aˈvitaminˈosis—the state of lacking, or being deficient in, vitamins; a disease caused by such a deficiency.

anˈaemia—"lack of blood"—lack of red cells (or of the red pigment haemoglobin) in the blood.

anˈaesthesia — "lack of feeling" — a state of being made unconscious (e.g. by chloroform).

anˈaerobic—"without air living"—(organism) which lives without air.

Anˈopheles—"not helpful, i.e. hurtful" —kinds of mosquito, especially that which is responsible for malaria.

anˈhydrous — "without water" — e.g. anhydrous copper sulphate is a white powder; copper sulphate crystals contain some water and are blue.

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A large number of scientific words, taken virtually unchanged from Latin or