Chambers Concise Dictionary of Scientists

钱伯斯简明科学家词典〔英〕

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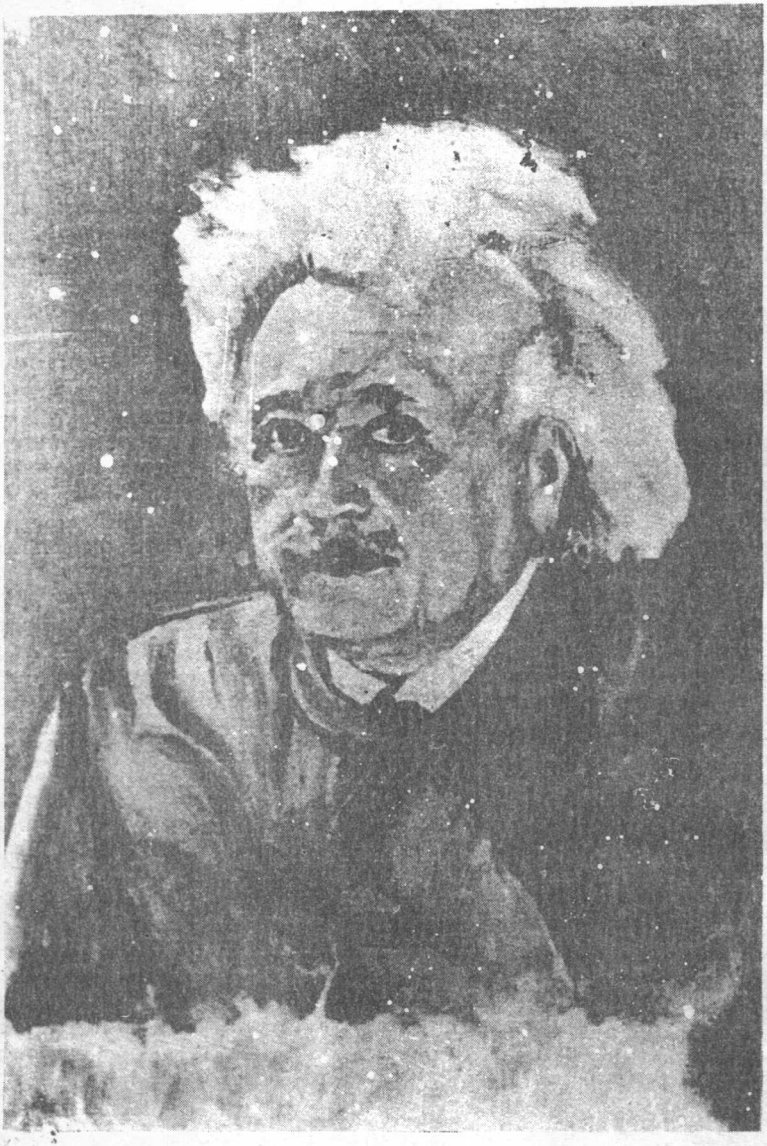

Albert Einstein in the 1930s

Reproduced from an oil painting by his friend and doctor in Berlin, Janos Plesch, by courtesy of Professor P. H. Plesch.

Contents

Preface

The biographies in this book cover men and women whose names are famous in the physical, life, earth and space sciences, and in mathematics. The people profiled are linked, in many cases by name, with scientific laws, units, and effects, chemical reactions, diseases, and mathematical methods, and we include these. We have also included those explorers, engineers, physicians and surgeons who were substantial innovators as applied scientists; scientists whose distinction lies in their use of established techniques are not included. Neither are teachers, administrators, social scientists, in general, nor philosophers.

In recording major discoveries in science, the book covers much of the history of science. Science, however, is not merely a series of clearly successful investigations by talented individuals. Many investigations are valuable precisely because they set a challenge which leads to new evidence, which then establishes a new view—but only until this in turn is modified. In a sense there is no stable final position embodied in scientific 'laws', only a present state of experiment and theory; laws in science are not proved, but they can be firmly disproved; our body of well-received scientific knowledge is that which still, despite challenge, survives.

Scientific ideas reflect, and are part of, the attitudes and needs of their time and place; the study of the history of science in isolation is convenient but, in a sense, false. Some trends are clear. For example, early anatomy is much linked with the Italian Renaissance interest in art; while, in contrast, it was technical skill of a different kind which later introduced and developed three devices which have been of vast importance in science: the telescope, microscope, and spectroscope, in their various forms. It is also clear that ideas and devices often have no single discoverer. In such cases, we have tried to select the individual who made something workable, and who knew that this had been achieved.

In many areas of science, the major outlines were drawn in the 19th century, and much work in the 20th century has been directed towards developing this inheritance. So, a number of our entries deal with men (and some women) born in the 19th century. However, although the overall shape of biology, chemistry, geology and physics dates from then, it is at the interfaces between them that much 20th-century science has grown. Nuclear physics, molecular biology, computer science and space science are essentially 20th-century creations and many of our entries are for people working in these newer areas. This raises some difficulties; for example, many ideas of modern physics and mathematics are complex, and appreciation of them requires specialist knowledge; while the high cost of 'big science' has led to extensive team-work, in which it is not always possible to select key individuals in a traditional manner. Thus, it may be very difficult to write a book like this in the 21st century; but we believe it is still possible and useful to make the attempt now.

Acknowledgements

We have used too many sources of information to list them here. Autobiographies and biographies have been used where these are available; most of the living scientists have been able to check the accounts given of them and their work, and we are grateful to them for doing this. The *Dictionary of Scientific Biography* (editor-in-chief, C. C. Gillispie, published by Charles Scribner's Sons, New York, 1970-80, 16 vols.), has been much consulted, as have the *Biographical Memoirs of Fellows of the Royal Society* and the *Nobel Lectures*.

We are indebted to Professor T. E. Allibone, CBE, FRS, for permission to reproduce the photograph of Chadwick and Kapitsa, and to Professor P. H. Plesch for the frontispiece portrait of Einstein. We are particularly grateful also to Mr R. P. Moore, and to Professor P. C. Kendall and other friends and colleagues in the University of Keele who have helped in a number of ways: especially Mr F. M. J. Doherty, Professor W. Fuller, Professor I. M. L. Hunter, Dr E. D. Morgan, Mr M. J. Phillips, Mrs M. G. Pritchard, Mr D. B. Thompson, and Dr H. S. Torrens; and to Mrs Stella Pierce of Industriarts of Bath for locating engraved portraits, and Mr Xu Hourong of the Central Translation Bureau of the People's Republic of China for translations. We are grateful also to all our subjects who located and loaned portraits of themselves, most of which are published here for the first time. The photograph of Stephen Hawking is reproduced by permission of Manni Mason's Pictures. We are much indebted to Alastair Fyfe Holmes of Chambers who has been so encouraging and helpful at every stage.

Conventions and Symbols

Dates of scientists before Christ (BC) are usually not precisely known, and the dates we give are approximate. The entries are listed in the alphabetical order of their surnames. Translations of names from other alphabets can often be made in more than one way, and we give the most usual form. Names with prefixes are listed in the form commonly used; e.g., van de Waals (not Waals), and Liebig (not von Liebig). Where a man has multiple forenames, his lesser-used names are bracketed. When a scientist is mentioned in another's entry and also has an entry of his own, the name is first given in italic type. Scientific laws, units, effects, reactions and diseases which are linked with names of scientists are indicated in bold type for ease of location within the entry. Being often modest, scientists did not generally give their own names to these things; this was done by others. Laws are expressed in modern form, replacing words which are now outdated by their modern equivalents.

In giving the nationalities of scientists, we have usually used modern names for countries, and we have taken some note of where they spent their lives; e.g. Einstein, born in Ulm, went to school in Munich (also in Germany) and to college in Switzerland where he worked until he was over 50, before moving to the US; he became an American citizen 10 years later. We describe him as a German-Swiss-American theoretical physicist. For early scientists, the description 'Greek' is used for those of Hellenic culture and who wrote in Greek; some lived in Sicily, Asia Minor or Egypt. Again, 'Arabic' is used in a similar sense for Arabic writers; nationality in our modern sense is inappropriate here also.

In some cases, the name entry covers more than one member of a family, either through the generations (e.g. the Monros) or through marriage (the Coris) or as siblings (the Herschels).

Teamwork has become very common in the 20th century. In such cases, the research has been outlined in one entry only, with cross-references to the principal co-workers who did not necessarily play a smaller part. We do not normally list the prizes and honours awarded, except Nobel Prizes. Book titles are usually given in English translation, except for a few classics. Where we note that a man or woman was educated in a named city, we normally mean in the university or polytechnic there.

The International System of Units (SI) is used; and for chemical names the form now most used by chemists (which is not always the IUPAC preferred name) is given.

Certain symbols are defined as needed; a list of common symbols is given on p. 10.

c	velocity of light in vacuum
e	unit of electronic charge
g	acceleration of free fall due to gravity (in vacuum)
h	Planck constant
K	thermodynamic temperature unit (kelvin)
kg	kilogram (SI unit of mass)
km	kilometre
m	metre (SI unit of length)
n	neutron
N_A	Avogadro constant
p	proton
p	pressure
s	second (SI unit of time)
t	tonne (megagram, i.e. 1000 kg)
STP	standard temperature and pressure; 298 K and 760mm Hg.
T	temperature (on absolute scale)
V	volume
A.U.	astronomical unit of distance; the mean Earth-Sun distance

Mathematical symbols

ln	logarithm to base e
log	logarithm to base 10
π	pi; ratio of circumference to diameter of a circle
$=$	equal to
$\neq$	not equal to
$\approx$	approximately equal to
$<$	less than
$>$	greater than
$\leqslant$	less than or equal to
$\geqslant$	greater than or equal to
$\ll$	much less than
$\gg$	much greater than
ab	a multiplied by b
a/b	a divided by b
$\lvert a \rvert$	magnitude of a (without regard to sign)
a^n	a raised to power n
i	$(-1)^{1/2}$
Σ	sum of the terms
e	base of Napierian logarithms, 2.71828 . . . (Euler's number)
exp x or e^x	exponential of x

List of Illustrations

A

ABBE, Ernst

1840-1905

German physicist and developer of optical instruments

Abbe was professor of physics and Observatory Director at Jena. He worked on optical theory, and with Carl Zeiss (an instrument maker) and Otto Schott (a glass maker) was able to improve several devices. These include the **Abbe condenser** for converging light on microscope specimens; the achromatic lens, which is free from colour distortion (1886); and the **Abbe refractometer.** From 1888 he was the sole owner of the Zeiss company, whose optical instruments were of the highest standard.

ABEGG, Richard

1869-1910

German physical chemist

Abegg's Rule (for which he is best remembered) states that each element has a positive valence and a negative valence, whose sum is 8. This idea reflects in primitive form the 'octet rule', i.e., the trend shown by most elements of the 2nd and 3rd (short) periods to attain an outer octet of electrons, but even as a mnemonic it applies only to elements of the 4th to 7th Periodic Groups.

ABEL, (Sir) Frederick (Augustus)

1827-1902

British chemist: expert on military explosives

An early pupil of *Hofmann* at the Royal College of Chemistry, he became chemist to the War Department in 1854. He showed that guncotton (obtained by nitrating cotton) could be made safe by removing traces of acid, which if not removed led to instability. In 1889 with *Dewar* he invented 'cordite', a mixture of guncotton and nitroglycerin gelatinized with propanone and petroleum jelly, which became the standard British military propellant. It produces little smoke on firing, an important advantage in a battlefield.

ABEL, John Jacob

1857-1938

American biochemist: detected adrenalin, and crystallized insulin; isolated amino acids from blood

An Ohio farmer's son, Abel studied very widely in Europe before returning to Johns Hopkins University, equipped with a wide knowledge of chemistry, biology and medicine, as professor of pharmacology. He studied the adrenal hormone now known as adrenalin; and in 1926 first crystallized insulin and showed it was a protein and contained zinc. He was the first to isolate amino acids from blood, in 1914. He did this by passing blood from an artery through a cellophane tube immersed in saline; the amino acids dialysed through the tube, and the blood was returned to a vein of the animal. The proof that amino acids are present in blood is fundamental in animal biochemistry; and the method used led the way towards dialysis in the treatment of kidney disease.

ABEL, Neils Henrik

1802-1829

Norwegian mathematician: pioneer of group theory; proved that no algebraic solution of the general fifth-degree equation exists

Abel was the son of a Lutheran minister. In 1821 he went to Oslo to study at the university, but his father's death forced him to give this up in order to support the large family of which he was the eldest; he was extremely poor throughout his life. In 1825 he visited Germany and France, and with Leopold Crelle founded Crelle's *Journal* in which much of his work was published, since Abel could not persuade the French Academy of Sciences to do so. Having failed to find a university post in Germany, and with his health failing due to tuberculosis, he returned to Norway, where he died shortly afterwards aged 26. Two days later a letter from Crelle announced that the professorship of mathematics at Berlin, one of the most prestigious posts in the mathematical world, had been awarded to him.

Despite his tragically early death Abel largely founded the theory of groups, and in particular commutative groups which were later known as **Abelian groups**. He also showed that the general fifth degree equation is not solvable algebraically (ironically *Gauss* threw this proof away unread when Abel sent it to him). He revolutionized the important area of elliptic integrals with his theory of elliptic and transcendental functions, and contributed to the theory of infinite series.

ADAMS, John Couch

1819-1892

English astronomer: predicted existence of Neptune

As the son of a tenant farmer, Adams had financial problems in entering Cambridge, but his career was successful and he remained there throughout his life.

By 1820 it had become apparent to astronomers that the motion of Uranus could not be explained by *Newton's* law of gravitation and the influence of the known planets alone, since a small but increasing perturbation in its orbit had been observed. Whilst still an undergraduate, Adams proved that the deviation had to be due to the influence of an eighth, undiscovered, planet. He sent his prediction for its position to *Airy*, the Astronomer Royal, who was sceptical of its value and ignored it. Only when *Leverrier*, in France, announced similar results nine months later did Airy initiate a search by James Challis at the Cambridge Observatory, based on Adams's prediction. The planet, now named Neptune, was however found first by Johann Galle in Berlin in 1846, using Leverrier's figures. A bitter controversy about the credit for the prediction soon developed. Adams's precedence was eventually recognized, despite his taking no part in the debate. He turned down the subsequent offers of a knighthood and the post of Astronomer Royal.

ADAMS, Walter Sydney

1876-1956

American astronomer: discovered first white dwarf star

Adams was born in Syria, where his American parents were missionaries, but he returned with them when he was nine and was educated in the US and in Europe.

Adams's work was principally concerned with the spectroscopic study of stars. He showed how dwarf and giant stars could be distinguished by their spectra, and established the technique of spectroscopic parallax to deduce a star's distance. In 1915 he observed the spectrum of Sirius B, the faint companion of Sirius, and discovered it to be an exceptionally hot star. Since it is only eight

light-years distant he realized that it must therefore be very small (otherwise it would be brighter), and hence of very high density. Sirius B proved to be a 'white dwarf', and the first of a new class of stellar objects; such stars are the final stage in the evolution of stars of similar mass to the Sun, and which have collapsed to form extremely dense objects.

Adams also searched for the relativistic spectral shift expected from a heavy star's presumed intense gravitational field. This he succeeded in finding in 1924, thereby proving his hypothesis about the nature of Sirius B and strengthening the case for *Einstein's* general relativity theory as well. Adams spent most of his working life at the Mount Wilson Observatory in southern California, and was its Director from 1923 until 1946.

ADDISON, Thomas
1793-1860

British physician: a founder of endocrinology

A graduate in medicine from Edinburgh and London, his early work included the first clear descriptions of appendicitis, lobar pneumonia, and the action of poisons on the living body. In 1855 his small book *On the Constitutional and Local Effects of Disease of the Supra-renal Capsules* described two new diseases: one is 'pernicious' anaemia; the other, also an anaemia, is associated with bronzing of the skin and weakness, and is known as **Addison's disease**. He found that cases of the latter showed post-mortem changes in the suprarenal capsules (one on top of each kidney). Later, physiological studies by others showed that the supra-renal capsules are glands, now known as adrenal glands and which produce a complex group of hormones. Addison's disease was the first to be correctly attributed to endocrine failure (i.e., disorder of the ductless glands of internal secretion).

ADRIAN, (Baron) Edgar Douglas
1889-1977

English neurophysiologist: showed frequency code in nerve transmission

Adrian began his research in physiology in Cambridge before World War I, but in 1914 he speedily qualified in medicine and tried to get to France. In fact he was kept in England working on war injuries, and his later work was a mixture of 'pure' research and applications to medical treatment.

In the 1920s he began his best-known work. Already, crude methods were available for detecting electrical activity in nerve fibres. Adrian used thermionic valve amplifiers to reliably record nerve impulses in a single nerve fibre, and to show that they do not change with the nature or strength of the stimulus, confirming his friend K. Lewis's work of 1905 on this 'all or none' law. He went on to show that a nerve transmits information to the brain on the intensity of a stimulus by frequency modulation, i.e., as the intensity rises, the number of discharges per second (perhaps 10-50) in the nerve also rises: a fundamental discovery. He then worked on the brain, using the discovery by *Berger* in 1924 that electrical 'brainwaves' can be detected.

From 1934 he studied these brainwave rhythms, which result from the discharge of thousands of neurons and which can be displayed as an electroencephalogram (EEG). Within a few years the method was widely used to diagnose epilepsy cases, and later to locate lesions, e.g., those due to tumours or injury.

Adrian was linked with Trinity College Cambridge for nearly 70 years and did much to advance neurophysiology. He was a very popular figure; as a student he was a skilful night roof-climber, an excellent fencer, and he sailed and rock-climbed until late in life. He helped to organize a famous hoax exhibition of modern pictures in 1913. He was never solemn, moved very quickly, and claimed his own brainwaves were as rapid as a

rabbit's; as a motorist his quick reflexes alarmed his passengers. When in a hurry he would use a bicycle in the long dark basement corridors of the Physiological Laboratory. He shared a Nobel Prize in 1932.

AGASSIZ, Jean Louis Rodolphe

1807-1873

Swiss-American naturalist and glaciologist: proposed former existence of Ice Age

Agassiz owed much of his scientific distinction to the chance of his birth in Switzerland. He studied medicine in Germany, but zoology was his keen interest. He studied under *Cuvier* in Paris, and then returned home and worked with enthusiasm on fossil fishes, becoming the world expert on them (his book describes over 1700 ancient species of fish).

Holidaying in his native Alps in 1836 and 1837, he formed the novel idea that glaciers are not static, but move. He found a hut on a glacier which had moved a mile over 12 years; he then drove a straight line of stakes across a glacier, and found they moved within a year. Finding rocks which had been moved or scoured, apparently by glaciers, he concluded that in the past, much of Northern Europe had been ice-covered. He postulated an 'Ice Age' in which major ice sheets had formed, moved, and were now absent in some areas; a form of catastrophism, in contrast to the extreme uniformitarianism of *Lyell*. We now know that a series of ice ages has occurred.

In 1846 Agassiz was invited to the US to lecture, enjoyed it, and stayed to work at Harvard. He found evidence of past glaciation in North America; it too had undergone an Ice Age. His studies on fossil animals could have been used to support *Darwin's* ideas on evolution, but in fact Agassiz was America's main opponent to Darwin's view that species had evolved.

AGRICOLA, Georgius

1494-1555

German mineralogist, geologist and metallurgist: described mining and metallurgical industries of 16th century

His name is the Latinized form of Georg Bauer (both surnames are 'farmer' in English). Born in Saxony, Agricola trained in medicine in Leipzig and in Italy. The link between medicine and minerals led to his interest in the latter, and his work as a physician in Saxony put him in ideal places to develop this interest, and to extend it to mining and metal extraction by smelting, and related chemical processes. His book *The Nature of Fossils* (1546) classifies minerals in perhaps the first comprehensive system. Later he wrote on the origin of rocks, mountains, and volcanoes. His best-known book, *On the Subject of Metals* (De re metallica, 1556) is a fine illustrated survey of the mining, smelting and chemical technology of the time. An English edition (1912) was prepared by the American mining engineer H. C. Hoover (who became President of the US, 1929-33) and his wife.

AIRY, (Sir) George Biddell

1801-1892

English geophysicist and astronomer: proposed model of isostasy to explain gravitational anomalies

Airy was successful early in life, his talent and energy leading to his appointment as Astronomer Royal in 1835, a post he held for 46 years. He much extended and improved the astronomical measurements made in Britain. Airy's researches were in the fields of both optics and geophysics. He experimented with cylindrical lenses to correct astigmatism (a condition he suffered from himself); and he studied the Airy discs in the diffraction pattern of a point source of light.

In geophysics he proposed that mountain ranges acted as blocks of differing thickness floating in hydrostatic equili-