

tific and Specialised Personnel, he organised the recruiting of scientists to work on the atomic energy and radar projects as well as other research connected to work on the war effort. In this period, Dr Carmichael later said, he spent more than a year of nights on a sleeping car between Boston and Washington. He was also President of the American Psychological Association from 1939–40.

After the war, he was a member and Vice-Chairman of the National Advisory Committee for Aeronautics, the predecessor of the National Aeronautics and Space Administration. President Eisenhower named Dr Carmichael Ambassador Extraordinary when he represented the United States at an international conference at The Hague that wrote a treaty for the protection of cultural property in time of war.

In the course of his academic career, Dr Carmichael published numerous papers on reading and visual fatigue, perceptual assimilation, the development of a kitten's ability to land on its feet, and other aspects of behavioural development related to the functions of the sense organs. Dr Carmichael also collaborated with H. C. Warren on the book *Elements of Human Psychology* (Houghton Mifflin, 1930), which was used as an introductory book for years in many major universities and colleges. They also collaborated on a *Dictionary of Psychology* (Houghton Mifflin, 1934). His later writings include *Basic Psychology*, which he wrote in 1957 to set out his point of view for the educated general reader. *Carmichael's Manual of Child Psychology*, of which he wrote part, went through a third edition in 1970.

On January 1, 1953, Dr Carmichael became Secretary of the Smithsonian, the seventh scientist to direct an institution, founded in 1846 with a bequest from the English scientist James Smithson, "for the increase and diffusion of knowledge among men". Dr Carmichael, during his 11-year tenure as Secretary, was notably successful in obtaining appropriations from Congress to foster programmes of exhibit modernisation for the Institution's museums. Under his leadership the Institution received \$36 million in Federal funds for a Museum of History and Technology, the Smithsonian's first new building in 50 years.

In 1964, at the age of 65, he insisted on retiring from the Smithsonian. He was then offered the post at the National Geographic Society. There he directed \$1.2 million in annual grants for research into sciences. His projects involved him in many activities, including the work of Dr Louis S. B. Leakey at Olduvai Gorge in Tanzania. He also worked closely with Baroness Jane van Lawick-Goodall, whose pioneering

study of wild chimpanzees broke new ground in the study of animal behaviour. Primatology was long an interest of Dr Carmichael and he had served as President of the International Primatological Congress.

He also served as President of the American Philosophical Society from April 1970–73, and was elected to several scientific organisations abroad, including the Ergonomics Research Society of the Royal Society of Arts in England, and the Société Française de Psychologie. In 1972 the National Academy of Sciences bestowed its highest award, the Hartley Public Welfare Medal, on Dr Carmichael "for eminence in the application of science to the public welfare".

Walter Rudolf Hess

PROFESSOR WALTER RUDOLF HESS, Nobel Laureate for Physiology and Medicine for 1949, the man who brought to light the functional organisation of the diencephalon, died at the age of 92 on August 22, 1973, in his home at Ascona, Switzerland.

In 1917, at the early age of 36, he became Professor of Physiology at the University of Zurich, and in this capacity Director of the Institute of Physiology, a post which he held until his retirement in 1951. He very soon became one of Europe's leading physiologists, and with great drive and energy promoted this branch of science on an international scale. Thus, foreseeing the importance of research on the adaptation of the human body to the conditions of high altitude, he founded in 1931 the international *Hochalpinen Forschungsinstitut Jungfrauojoch*. In 1938 he was delegated to organise and preside over the 16th International Congress of Physiological Sciences in Zurich. His strong personality succeeded in keeping the meeting on an entirely scientific base despite the political troubles of that time.

In his scientific work, W. R. Hess combined analytical experimentation with great synthetic power, which enabled him to view the data he obtained within the larger frame of the purposeful organisation of biological phenomena. This was already manifest in his early investigations on the viscosity of blood and general haemodynamics, but even more so in his work regarding the regulation of circulation and of respiration, concepts which were laid down in two monographs in 1930–31. It was this search for the organising principles which led W. R. Hess to begin experimentation with electrical stimulation in the brain stem—the diencephalon; his aim being to explore the autonomic

centres which govern the adaptation of circulation and respiration to the different needs of the organism during rest and work. Hess himself said that he wanted to dedicate only one year to this problem, but the work grew and was extended over twenty-five years to form what is known today as his life's work. He perfected the method of circumscribed stimulation and coagulation of subcortical structures in the unrestrained animal in 1932, and after delimitating the reactive zones in the hypothalamus concerned with regulation of circulation and respiration—results obtained in the anaesthetised animal in 1932—he proceeded to systematically explore the entire diencephalon and adjacent portions of the mesencephalon in the freely-moving awake cat.

Every physiologist is familiar with the film of Hess's cats manifesting autonomic, motor and affective-behaviour effects upon electrical stimulation within the diencephalon. Not so familiar, even today, to many a physiologist are the basic conclusions derived by Hess from his experimental work.

Hess's view of two opposing ergotrophic and trophotropic systems was based on the following observations. Stimulation in the caudal portion of the hypothalamus, besides producing an increase in blood pressure and activation of respiration, also produces a general arousal of the animal which is associated with increased locomotor activity 'Bewegungsdrang'. Stimulation in the predominantly more rostrally lying portions of the hypothalamus and of the septum, besides yielding a decrease of blood pressure and an inhibition of respiration, produces responses which are related to food intake, digestion, excretion and thermoregulation. Thus the former effect—the ergotrophic reaction—includes both the autonomic and somatomotor responses which are activated simultaneously during effort, and therefore with expenditure of energy. The latter effect, however, the trophotropic reaction, subserves restitution of the spent energy and guarantees the balance of the internal environment. A behaviour primarily associated with restitution is sleep, and Hess conceived sleep as a distinct type of behaviour; an active process which is governed by the central nervous system. This view has been confirmed by further research, although the narrow concept of a discrete sleep centre in the thalamus can no longer be upheld today.

The various motor effects of the head and trunk produced from the thalamus and adjacent mesencephalon are related to the regulation of posture. This subcortically organised motor system provides an indispensable support for the execution of voluntary movements by counterbalancing the forces exerted by these movements. Hess called this sys-

tem the ereismic, or supporting, motor system.

The affective-behaviour responses were obtained by Hess from the so-called intermediate zone of the hypothalamus and included the affective defence reaction (rage reaction) culminating in a purposeful and directed attack of giving way to sudden flight. Hess strongly defended the point that the rage reaction produced by electrical stimulation in the intact animal is due to an affective re-tuning of the animal and is therefore distinct from the sham rage observed in the decorticated preparation. This view has been largely confirmed today by electrical stimulation of subcortical structures in man, resulting in emotionally tuned reactions. It is mainly the pioneer work of Hess on affective behaviour which stimulated further research in laboratories throughout the world—research which today provides the neurological basis for psychology.

During his emeritus years, Hess was able to devote all his time to the subject of central representation of behaviour and psychic experience, a problem which had preoccupied him all his life. It may therefore be appropriate to close this short tribute by quoting the closing words of his last book *Psychologie in biologischer Sicht*. "... so ergibt sich die Folgerung, dass der Inhalt des subjektiven Erlebens überhaupt an den Bau des Gehirnes und die Eigenschaften der strukturellen Elemente gebunden ist und dass nur solche Bewusstseinsinhalte entwickelt werden können, welche in der Organisation des Gehirnes ihre Entsprechung haben."

Announcements

Appointments

P. N. R. Usherwood, of the University of Glasgow, has been appointed to the chair of zoology at the University of Nottingham.

Professor Israel Dostrovsky has been elected President of the Weizmann Institute of Science.

International Meetings

January 1–4, **The Association for Science Education Annual Meeting** (B. Nicholl, Esq., ASE Annual Meeting Secretary, Newman College, Birmingham B32 3NT).

January 2–4, **11th Annual Solid State Physics Conference** (Meetings Officer, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX).

January 3–4, **69th Ordinary Meeting of the Society for General Microbiology** (Meetings Assistant, Society for General Microbiology, Harvest House, 62 London Road, Reading RG1 5AS).

January 3–4, **Molecular Beam Kinetics Group** (Professor C. W. Nutt, Department of Chemical Engineering, Heriot-Watt University, Chambers Street, Edinburgh EH1 1HX).

January 4, **British Society for the History of Science** (The Assistant Secretary, The British Society for the History of Science, 47 Belgrave Square, London SW1X 8QX).

January 5, **The Artificial Intelligence and the Simulation of Behaviour Group** (Mrs L. Daniels, Department of Computational Logic, 9 Hope Park Square, Meadow Lane, Edinburgh EH8 9NW).

January 7–8, **Conference on Technical Aspects of Air Pollution** (Mrs Sonia Withers, Centre for Extension Studies, Loughborough University of Technology).

January 7–8, **Conference on Research in Mathematics** (The Secretary and Registrar, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY).

January 7–8, **7th Public Health Engineering Conference** (John Pickford, MSc, ACGI, MICE, FIPHE, University of Technology, Loughborough, Leicestershire LE11 3TU).

January 7–8, **The Application of Lasers to the Processing and Examination of Materials** (The Meetings Officer of the Institute of Physics, 47 Belgrave Square, London SW1X 8QX).

January 7–9, **The Biology and Chemistry of the Cruciferae** (The Executive Secretary, Linnean Society of London, Burlington House, Piccadilly, London W1V 0LQ).

January 8, **The Annual Histochemistry Meeting of the Royal Microscopical Society** (The Administrator, Royal Microscopical Society, Clarendon House, Cornmarket Street, Oxford OX1 3HA).

January 8–10, **Biological Clocks and Changes in the Earth's Rotation: Geophysical and Astronomical Consequences** (W. F. Mavor, Administrative Assistant, School of Physics, The University, Newcastle upon Tyne NE1 7RU).

January 10, **25th Annual General Meeting of the Institute of Biology** (Institute of Biology, 41 Queen's Gate, London SW7 5HU).

January 10–11, **Numerical Methods for Constrained Optimisation** (The Secretary and Registrar, The Institute of Mathematics and its Applications, Maitland House, Warrior Square, Southend-on-Sea, Essex SS1 2JY).

January 14, **Measurement and Interpretation of Low Volatiles and Solubilities** (The Assistant Secretary, Society of Chemical Industry, 14 Belgrave Square, London SW1X 8PS).

January 14–18, **5th International Symposium on Magnetic Resonance** (International Society of Magnetic Resonance, The Weizmann Institute of Science, Rehovot).

January 14–18, **6th Miami Winter Symposia** (Miami Winter Symposia, P.O. Box 906, Biscayne Annex, Miami, Florida 33152, USA).

January 16, **The Economics of Natural Resource Depletion** (D. W. Pearce, Department of Economics, University of Southampton, Southampton, SO9 5NH).

January 16, **The Nature of the Scrapie Agent** (Dr J. Barber, Botany Department, Imperial College, London SW7).

January 16–April 10, **Winter College on Surface Science** (The Deputy Director, International Centre for Theoretical Physics, P.O. Box 586, 1–34100 Trieste).

January 17, **2nd National Conference on Environmental Education** (Dr J. Rose, College of Technology, Feilden Street, Blackburn, BB2 1LH, Lancashire).

January 21–23, **Hemophilia—Recent Advances in Biochemistry, Physiology, and Therapy** (Public Relations, The New York Academy of Sciences, 2 East 63rd Street, New York 10021, USA).

January 23–24, **Supramolecular Structure in Solid Polymers** (Dr E. F. T. White, Department of Polymer and Fibre Science, University of Manchester Institute of Science and Technology, Sackville Street, Manchester M60 1QD).

January 24, **Inaugural Meeting of the United Kingdom Section of the International Solar Energy Society** (Dr M. Archer, The Royal Institution, 21, Albemarle Street, London W1X 4BS).

January 29–30, **Energy: Alternatives and Risks** (Robert R. White, Director, Academy Forum, 2101 Constitution Avenue, N.W., Washington, D.C., 20418).

January 30, **Compound Semiconductor Films** (The Meetings Officer, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX).

Erratum

In the article "Refining the Earth's Pear Shape" by D. G. King-Hele and G. E. Cook (*Nature*, **246**, 86; 1973) which was published before proof corrections could be made, paragraph 1, line 7, should read "... as perigee moved successively north and south ...".

Equation (1) should read:

$$U = (\mu/r) \left\{ 1 - \sum_{n=2}^{\infty} J_n (R/r)^n P_n(\sin \phi) \right\}$$

Paragraph 8, line 1, should read "Our previous set of odd zonal harmonics, published in 1969, ...".

In reference 4, 380 should be deleted; in reference 7 delete 381.