

- ⁵ Burnstock, G., *Pharmacol. Rev.*, **21**, 247 (1969).
⁶ Campbell, G., in *Smooth Muscle* (edit. by Bülbiring, E.), 451 (Edward Arnold, London, 1970).
⁷ Burnstock, G., and Iwayama, T., in *Progress in Brain Research* (Elsevier, Amsterdam, in the press).
⁸ Burnstock, G., Campbell, G., Satchell, D. G., and Smythe, A., *Brit. J. Pharmacol.*, **40**, 11 (1970).

Milliard or Gillion?

SIR,—When a word has become ambiguous it should be discarded. Attempts

to reimpose precision could ultimately be successful, but there will be an inconvenient phase in which, though a writer may know what the word should mean, there is no certainty that readers will be in the same happy state. The word billion seems to be irrevocably lost. Boroughs's suggestion (*Nature*, **229**, 142; 1971) that the vague word "milliard" should be defined as 10^9 is unsatisfactory because it is already current and readers will not, for a time, know whether it is being used precisely or not. May I repeat the suggestion

(*Nature*, **220**, 312; 1968) that we should make use of the lucky accident that M is both the internationally agreed symbol for 10^6 and the initial letter of million. G and T are the symbols for 10^9 and 10^{12} and could be used to form the new and therefore unambiguous words gillion and tillion.

Yours faithfully,

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Obituary

Professor A. S. Besicovitch

ABRAM SAMOILOVITCH BESICOVITCH, Rouse Ball professor of mathematics at Cambridge from 1950 to 1958 and a Fellow of Trinity College, died on November 3, 1970.

He was born in 1891 and studied at St Petersburg, later teaching there and at Perm. He left the USSR in 1925 and worked in Copenhagen with Harald Bohr, who had recently built up his theory of continuous almost-periodic functions. In collaboration with Bohr and independently, Besicovitch enlarged the concept of almost periodicity to wider classes of functions. With an appropriate definition, a generalized almost-periodic function possesses a Fourier series and it satisfies Parseval and Riesz-Fischer theorems and also a Cantor theorem of uniqueness. Besicovitch brought all these investigations into a book in 1932.

Besicovitch was one of the most powerful mathematical analysts of his generation. He has been described as a master of intricate construction. An early illustration of this gift was his example—published in 1922 in a Russian journal which did not reach other countries—of

a plane set made up of linear segments of length 1, one in every direction, having zero Jordan measure. He saw later that this set could be adapted to solve Kakeya's problem of finding the figure of least area in which a segment of unit length can be rotated through a complete revolution. By rotating a pencil on a table, the reader may guess that the figure sought is a three-cusped hypocycloid, having area $\pi/8$. The paradoxical truth is the existence of figures of arbitrarily small area.

In the 1930s Besicovitch wrote many papers on plane sets of points which have finite length in the sense of Carathéodory's linear measure. The density of such a set E at a point x can be defined by the limit of the linear measure of the part of E within a circle centre x divided by the diameter of the circle. Sets may be regular or irregular. A regular set behaves like a rectifiable curve, having a tangent at almost every point. An irregular set has positive density in every sector drawn from almost every one of its points. The first proofs of such theorems were long and complicated and they exemplify one of Besicovitch's aphorisms, "A mathematician's reputation rests on his bad proofs". In later

papers he replaced some of his pioneering bad proofs by more elegant good proofs.

Hausdorff measure was a topic to which Besicovitch returned repeatedly, using the concept to refine results about sets of points and real functions. Suppose, for instance, that x is a number for which infinitely many rationals m/n exist differing from x by less than $1/n^q$, where q is less than one; then the set of x has Hausdorff dimension $2/q$.

In 1945 Besicovitch's gift for intricate construction led him, to his own surprise, to another paradox. He defined in space a surface homeomorphic with a disk (or a sphere), which has three-dimensional measure equal to 1 (say) but arbitrarily small surface area in the Lebesgue-Fréchet sense of the lower bound of approximating polyhedra. This led him to the view that results based on the Lebesgue-Fréchet notion of area must be recast in terms of Hausdorff plane measure. He and his pupils carried out a large part of this programme.

In trying to convey an impression of Besicovitch's magnificent mathematical gifts, no one could forget that they were matched by gifts of humanity which endeared him to pupils and friends and especially to young children.

Announcements

University News

Professor G. Slaney has been appointed to the Barling chair of surgery, University of Birmingham, in succession to Professor A. L. d'Abreu who retires this year. Professor O. L. Wade has been appointed to the newly established chair of clinical pharmacology and Dr E. H. Ashton to a chair of anatomy established for one tenure only. The title of professor of reproductive endocrinology has been conferred on Dr P. Eckstein.

Dr S. R. Stitch has been awarded a personal professorship in steroid endocrinology by the University of Leeds.

Dr H. Smith, University of Manchester, has been appointed to the chair of plant physiology in the Faculty of Agricultural Science, University of Nottingham.

Dr A. T. Cowie has been appointed head of the Physiology Department, National Institute for Research in Dairying, University of Reading, in succession to the late Professor Folley.

Appointments

Professor Alwyn Williams, Queen's University of Belfast, has been appointed a trustee of the British Museum (*Natural History*), in succession to Professor O. M. B. Bulman.

Dr Philippe Shubik, Eppley Institute for Research into Cancer, University of Nebraska, and James S. Gilmore, jun.,

Gilmore Broadcasting Corporation, Kalamazoo, have been appointed to the National Advisory Cancer Council of the US National Institutes of Health.

The following have been appointed vice-presidents of the Royal Society: Sir Frederick Bawden, Rothamsted Experimental Station; Sir Bernard Katz, University College London; Sir Harrie Massey, University College London; Sir Harold Thompson, University of Oxford; Professor W. R. S. Doll, University of Oxford; Professor F. Hoyle, University of Cambridge; Dr J. M. Menter, Tube Investments Limited.

Miscellaneous

Professor P. M. Maitlis, McMaster University, has been awarded the 1970

Steacie prize in the natural sciences for his work in organometallic chemistry.

Professor Frank Press, Massachusetts Institute of Technology, and **Sir Richard Woolley**, astronomer royal, have been awarded gold medals of the **Royal Astronomical Society**. The Eddington medal has been awarded to **D. G. King-Hele** and the Jackson-Gwilt medal to **A. W. J. Cousins**.

ERRATUM. In the article "Effect of Mineral Adjuvant on Lymphocyte Cooperation in the Secondary Antibody Response to a Hapten-Protein Conjugate" by Samuel Strober (*Nature*, **228**, 1324; 1970), the word "deoxynucleoprotein" in line 4 should read "dinitrophenol". The description of the article on the contents page should have stated that mineral adjuvant obviates, not enhances, lymphocyte cooperation in the secondary antibody response to a hapten-protein conjugate.

ERRATUM. The price of the book *The California Earthquake of April 18, 1906* (Carnegie Institution of Washington) which was reviewed in the December 19 issue of *Nature* (**228**, 1231; 1970) is \$12.50 and not \$87 as was stated.

ERRATUM. In the review entitled "Views of Deafness" by J. D. Hood (*Nature*, **229**, 68; 1971), the first sentence should have read "Sensorineural hearing loss is the name given to deafness resulting either from some disorder of the inner ear, or, more rarely, from a lesion of the central nervous pathways to the brain".

International Meetings

March 9-10, **Appendages of the Skin**, Eastbourne (Society of Cosmetic Chemists of Great Britain, 56 Kingsway, London WC2).

March 15, **Collagen Club Meeting**, Cambridge (Dr C. I. Levene, Dunn Nutritional Laboratory, Milton Road, Cambridge).

March 16-18, **Electrical Safety in Hazardous Environments**, London (Institution of Electrical Engineers, Savoy Place, London WC2R 0BL).

March 22-24, **Biomathematics and Computer Science in the Life Sciences**, Houston (Office of the Dean, University of Texas Graduate School of Biomedical Sciences at Houston, Division of Continuing Education, PO Box 20367, Houston, Texas 77025, USA).

March 23, **Radiation Hazards**, London (Professor J. H. Martin, Department of Medical Biophysics, The University, Dundee DD1 4HN).

March 30-April 1, **Electrochemical Engineering**, Newcastle upon Tyne

(ECES, 16 Belgrave Square, London SW1).

March 30-April 2, **Fluid Sealing**, Coventry (H. S. Stephens, 5th ICFS, British Hydromechanics Research Association, Cranfield, Bedford).

April 15-16, **Industrial Innovation through Contract Research**, Newcastle upon Tyne (T. W. Ditchburn, University of Newcastle upon Tyne, 6 Kensington Terrace, Newcastle upon Tyne NE1 7RU).

April 18-23, **Solvent Extraction**, The Hague (ISEC 71, 14 Belgrave Square, London SW1).

April 22-23, **Annual Congress and Scientific Exhibition of the British Institute of Radiology**, London (British Institute of Radiology, 32 Welbeck Street, London W1M 7PG).

April 26-28, **Motorways in Britain Today and Tomorrow**, London (Conference Department, Institution of Civil Engineers, Great George Street, London SW1).

April 28-30, **Modern Steam Plant Practice**, The Hague (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1).

April 28-May 2, **Protides of Biological Fluids**, Bruges (Dr H. Peeters, Simon Stevin Instituut, Jerusalemstraat 34, B.8000, Brugge, Belgium).

May 16-21, **Biological Significance of Transplantation Antigens**, Rovinj, Yugoslavia (Dr J. G. Howard, Department of Experimental Immunobiology, Wellcome Research Laboratories, Langley Court, Beckenham, Kent).

May 18-21, **Debating Electronics**, London (Industrial Exhibitions Ltd, 9 Argyle Street, London W1V 2HA).

June 14-18, **European Association of Radiology Congress**, Amsterdam (Secretariat, c/o Holland Organization Centre, 16 Lange Voorhout, The Hague, Holland).

June 15-17, **Textiles for Comfort**, Manchester (Mr J. K. Jackson, Shirley Institute, Didsbury, Manchester M20 8RX).

June 21-25, **Oil and Colour Chemists' Association Technical Exhibition**, London (R. H. Hamblin, Oil and Colour Chemists' Association, Wax Chandlers' Hall, Gresham Street, London EC2V 7AB).

June 29-July 16, **Geophysical Fluid Dynamics** (summer school), Bangor (Dr S. A. Thorpe, National Institute of Oceanography, Wormley, Godalming, Surrey).

July 5-24, **Our Buildings (Shells) and the Human Settlements**, Athens (P. Psomopoulos, International Programs, Athens Center of Ekistics, Box 471, Athens, Greece).

July 12-16, **Time of Flight Mass Spectrometers**, Salford (Dr D. Price, Department of Chemistry and Applied Chemistry,

University of Salford, Salford, Lancashire M5 4WT).

July 12-16, **Enzymes and their Use in Analysis and Clinical Diagnosis**, Cambridge, Massachusetts (Director of the Summer Session, Room e19-356, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA).

July 19-22, **Endocrine Polypeptide Hormones and their Secreting Cells**, London (Dr G. V. Foster, Endocrinology 1971, Royal Postgraduate Medical School, Ducane Road, London W12).

August 16-September 3, **Differential Geometry, Differential Topology and Applications**, Halifax, Nova Scotia (Canadian Mathematical Congress, 985 Sherbrooke Street West, Montreal 110, Quebec, Canada).

August 23-27, **Medical and Biological Engineering**, Melbourne (Dr David Dewhurst, Department of Physiology, University of Melbourne, Parkville, Victoria, Australia 3052).

September 5-12, **Conference of Women Engineers and Scientists**, Turin (Dr A. E. Amour, Corso Vinzaglio 14, 10121 Torino, Italy).

September 6-8, **Photochemistry**, Bordeaux (Professor J. Jousset-Dubien, Faculté des Sciences de Bordeaux, 351 Cours de la Liberation, 33 Talence, France).

September 7-10, **Organic Geochemistry**, Hannover (Dr H. Wehner, Bundesanstalt für Bodenforschung, 3 Hannover-Buchholz, Postfach 54, Germany).

September 8-9, **High Voltage Insulation in Vacuum**, London (Meetings Officer, The Institute of Physics and the Physical Society, 47 Belgrave Square, London SW1).

September 9-11, **Photosensitization in Solids**, Sarlat, Dordogne (Jean Bourdon, Kodak-Pathe, Centre de Recherches, 94 Vincennes, France).

September 20-25, **Astronautical Congress**, Brussels (Mr P. Contensou, International Astronautical Federation, 250 Rue Saint-Jacques, 75 Paris 5, France).

September 27-October 1, **Automatic Control and Computers in the Medical Field**, Brussels (Secretariat de l'IBRA, 3 rue Ravenstein, B.1000 Brussels, Belgium).

October 4-6, **Turbulence in Liquids**, Rolla (G. K. Patterson, Department of Chemical Engineering, University of Missouri-Rolla, Rolla, Missouri 65401, USA).

October 24-29, **Aviation and Space Medicine**, Tel Aviv (Dr I. Glazer, El Al Israel Airlines, Lod Airport, Israel).

November 2-4, **Salinity and Water Use**, Canberra (Dr T. Talsma, CSIRO Division of Plant Industry, PO Box 109, Canberra City, ACT 2601, Australia).

British Diary

Monday, January 25

Changes and the Future in Electrical Engineering (7.30 p.m.) Mr S. Z. de Ferranti, Institution of Electrical Engineers, at the Free Trade Hall, Manchester. (Faraday Lecture.)

Computer Graphics and the Electrical Engineer (6.30 p.m.) Mr M. Clayton and Mr D. W. Davis, Institution of Electrical Engineers, at Liverpool Polytechnic, Byrom Street, Liverpool.

Concorde Electronics (6.30 p.m.) Mr H. Hill, Institution of Electrical Engineers, at Salisbury and South Wiltshire College of Further Education, Salisbury.

The Mechanism of Genetic Recombination (5.30 p.m.) Dr H. L. K. Whitehouse, University of London, in the Anatomy Lecture Theatre, University College London, Gower Street, London WC1.

Tuesday, January 26

Consideration of the Relative Values of True and Infrared Colour Aerial Photography for Geological Purposes, Dr J. A. E. Allum; **Geology and Evaluation of Placer Gold Deposits in the Klondike Area, Yukon Territory**, Mr B. W. Hester; **An Inter-Laboratory Survey of the Accuracy of Ore Analysis**, Mr B. Lister and Dr M. J. Gallagher (5 p.m.) Institution of Mining and Metallurgy, at the Geological Society, Burlington House, Piccadilly, London W1.

Control Equipment Systems Design in the United Kingdom Power Industry (conference) Institution of Mechanical Engineers, at 1 Birdcage Walk, London SW1.

Decimalization—the Eighteenth-Century Origins (1.20 p.m.) Dr W. A. Smeaton, University of London, in the Botany Theatre, University College London, Gower Street, London WC1.

Electronics—Its Future in Navigation (7.30 p.m.) Mr F. S. Stringer, Institution of Electrical Engineers, at Livingstone Tower, Strathclyde University, Glasgow. (Silvanus P. Thompson Lecture.)

L-dopa Metabolism in Man (5.30 p.m.) Dr M. Sandler, University of London, at the Institute of Child Health, 30 Guilford Street, London WC1. (Sixth of fifteen lectures on "The Scientific Basis of Medicine" organized by the British Postgraduate Medical Federation.)

Metallurgical Problems at the CEGB (7.45 p.m.) Mr M. G. Gemmil, Leeds Metallurgical Society, at the Houldsworth School of Applied Science, The University, Leeds.

The Application of Fracture Mechanics to Fatigue Crack Propagation (6 p.m. discussion) Institution of Mechanical Engineers, at 1 Birdcage Walk, London SW1.

The Chemical Control of Plant Growth (5.30 p.m.) Professor R. L. Wain, FRS Royal Institution, at 21 Albemarle Street, London W1. (Lecture for Sixth Form Pupils from Schools in London and the Home Counties. To be repeated on January 27, February 2 and 3.)

The Design and Construction of the Ocean Terminal, Hong Kong (5.30 p.m.) Mr S. E. Faber, Mr J. C. Faber and Mr J. M. Thomas, Institution of Civil Engineers, at Great George Street, London SW1.

The Open University (7 p.m.) Professor J. J. Sparkes, Institution of Electrical Engineers, at the North Staffordshire Polytechnic, Stafford.

The Role of Industry in the Training of Undergraduate Engineering Students (10.30 a.m. colloquium) Institution of Electrical Engineers, at Savoy Place, London WC2.

Wednesday, January 27

Discussion Meeting (6.30 p.m.) Society for Analytical Chemistry, Microchemical Methods Group, at Imperial College, London SW7.

Electronic Techniques in Archaeology (6.45 p.m.) Mr M. J. Aitken, Institution of Electrical Engineers, at Renold Building, UMIST, Manchester. (Silvanus P. Thompson Lecture.)

Management of RAF Electronic Engineering Projects (6 p.m.) Institution of Electronic and Radio Engineers, at 9 Bedford Square, London WC1.

Robert Boyle's "Essays of Effluvioms" 1673 (1 p.m.) Mr L. R. Day, Royal Institution, History of Science Discussion Group, at 21 Albemarle Street, London W1.

The Evaporation of Heat Sensitive Foodstuff Liquids (10 a.m. symposium) Society of Chemical Industry, Food Group—Food Engineering Panel, in the Lecture Theatre of the Zoological Society of London, Regent's Park, London NW1.

The Use and Abuse of Materials in Ocean Engineering (6 p.m.) Dr D. Birchon, Institution of Mechanical Engineers, at 1 Birdcage Walk, London SW1. (Thomas Lowe Gray Memorial Lecture.)

Thursday, January 28

Flight Recording (6.30 p.m.) Mr R. Parsons, Institution of Electronic and Radio Engineers, jointly with IEE, at the University Engineering Laboratories, Trumpington Street, Cambridge.

Angiotensin in the Central Control of Automatic Function (5.30 p.m.) Dr R. D. Lowe, University of London, at the Institute of Child Health, 30 Guilford Street, London WC1. (Seventh of fifteen lectures on "The Scientific Basis of Medicine" organized by the British Postgraduate Medical Federation.)

Laser Applications in Electronics (7 p.m.) Professor W. A. Gambling, Institution of Electrical Engineers, jointly with IERE, at the Abbey Hotel, Malvern.

Magnetism, Parts 1, 2 and 3 (1 p.m. film) Royal Institution, at 21 Albemarle Street, London W1.

Tower Clocks in Denmark (6 p.m.) Dr Hans Stiesdal, Royal Institution, jointly with the Antiquarian Horological Society, at 21 Albemarle Street, London W1.

Friday, January 29

Kinetic Determinations of Bond Dissociation Energies (1 p.m.) Dr R. Walsh, Royal Institution, Photochemistry Discussion Group, at 21 Albemarle Street, London W1.

The Proper Study of Mankind (9 p.m.) Sir Mortimer Wheeler, FRS, Royal Institution, at 21 Albemarle Street, London W1.

Saturday, January 30

Whales and Whaling (3.30 p.m.) Dr Robert Clarke, Inner London Education Authority, at the Horniman Museum, London Road, Forest Hill, London SE23.

Monday, February 1

Chatting to Computers (6.30 p.m.) Dr C. R. Evans, Institution of Electrical Engineers, London Graduate and Student Section, at Savoy Place, London WC2.

Difficulties Inherent in the Study of Gas Exchange and Circulation of Blood in the Lungs (6 p.m.) Dr H. N. Duke, University of London, at the Royal Postgraduate Medical School, Du Cane Road, London W12.

Modern Electric Motor Protection (7 p.m.) Mr W. J. Johnson, Institution of Electrical Engineers, at the Royal Star Hotel, Maidstone, Kent.

Pre-Service Component Testing of Steam Power and Process (6.15 p.m.) Mr A. J. Morton, Institution of Mechanical Engineers, at the University of Durham.

Some Aspects of the Chemistry of Metal-Olefin Complexes (6.30 p.m.) Professor Sir Ronald Nyholm, FRS, Society of Chemical Industry, at the Scientific Societies Lecture Theatre, 23 Savile Row, London W1. (Jubilee Memorial Lecture.)

The Use of Instrumentation in the Evaluation of Paint Performance (7 p.m.) Mr D. M. Bishop, Oil and Colour Chemists' Association, at the Bullock Lecture Theatre, Hull College of Technology.