

definition of the second in terms of a hyperfine transition in caesium-133.

Barrell's work on atomic standards has been a major contribution to the transformation that methods and standards of measurement have undergone in the past 30 years, leading to much improved precision and accessibility of standards, with all that implies for reliability, convenience and economy in physics and engineering.

He himself made notable contributions to engineering applications, especially of interferometric methods for calibrating engineers' gauges.

As Superintendent of the Standards Division, Barrell brought together into an effective team many groups working on problems of measurement in the National Physical Laboratory and he particularly encouraged the first steps that were taken to relate electrical standards to measurement of frequency. He was an inspiring leader of his division and many important pieces of work depended greatly on his encouragement. The high regard in which the metrological work of the National Physical Laboratory is held internationally is the result of the foundations Barrell and his predecessors laid in their choice of programmes and people.

In his younger days Barrell was a keen member of the National Physical Laboratory hockey club, the standing of

which has always been high; in later years he took up amateur acting and shone in character parts, for example in "The Crucible" and "The School for Scandal".

Distinguished scientist, international leader, inspiring Superintendent as he was, by most of those who knew him Barrell will be remembered for his encouragement and support but above all for his friendship.

Announcements

University News

Professor S. J. Prias, National Institute of Economic and Social Research, has been appointed visiting professor in econometrics in the Department of Social Science and Humanities, **The City University**.

Professor Phillip A. Griffiths has been appointed professor of mathematics in **Harvard University**. **Dr. George Brooks Field** has been appointed professor of astronomy at Harvard, and will succeed **Professor Alexander Dalgarno** as director of the Harvard College Observatory in 1973.

Dr A. C. T. North has been appointed professor of molecular biophysics in the

Astbury Department of Biophysics, **University of Leeds**.

Professor E. A. Bell, University of Texas, has been appointed to the chair of biology tenable at King's College, **University of London**. The title of professor of zoology has been conferred on **Dr J. L. Cloudsley-Thompson**, in respect of his post at Birkbeck College, and that of professor of haematology on **Dr J. G. Humble**, in respect of his post at the Westminster Medical School.

Professor Colin Kaplan, head of the Microbiology Department, **University of Reading**, has been appointed dean of the Faculty of Science.

Dr J. D. Woods, Meteorological Office, Bracknell, has been appointed to the chair of physical oceanography at the **University of Southampton**.

Appointments

Professor J. Wreford Watson, University of Edinburgh, has been appointed a member of the **Social Science Research Council**.

Dr Eric J. Gibson has been appointed an assistant director of the Building Research Establishment and head of **Princes Risborough Laboratory**.

Continued from p. 19

therapy for reasons which are not clear at present. This group includes many patients with brain tumours, soft tissue sarcoma, adenocarcinoma of the stomach and intestine and some melanomas. Locally advanced carcinoma of the cervix and bladder are also rarely cured by existing methods, and the recurrence of these tumours after treatment presents an extremely difficult problem which is not amenable to further radiotherapy or chemotherapy. If the cause of failure lies in the unfavourable radiobiological properties of radiation with low LET, use of radiation of higher LET might make a significant difference and certain groups might show a dramatic response to the new form of treatment. It is clear, however, that the possible advantages of radiation with high LET are of a speculative kind, and in any individual case they may instead turn out to be disadvantages. The presence of hypoxic cells in many tumours is the only reason for which radiation with high LET is certain to be advantageous, and even this may be an illusion because fractionation of low LET therapy may of itself eliminate the resistant hypoxic component¹⁶. It is to be hoped that the trial of fast neutron therapy at present in progress at the Hammersmith Hospital¹⁷ will in due course answer the question of whether radiation with high LET has any radiotherapeutic advantage.

It is important to notice, however, that the case for heavy ions and mesons does not rest solely on the high LET of the radiation in the region of the peak. The distribution with depth of biologically effective dose is so very much closer to the ideal than anything which can be achieved with X-rays or electrons that improved therapeutic results must follow from this alone. This will be most marked in the case of very deep-seated cancers such as those of the bladder and the uterus.

It has by now become clear to everyone in the field of

cancer research that the idea of a single wonder drug—a "cure for cancer"—is a mirage. Progress in the control of this group of diseases has taken the form of many small steps, each giving improvement in one facet of the problem and all taken together representing an important advance. Introduction of radiotherapy with heavy ions or negative pions will be a substantial step on the road.

I thank many of my colleagues for advice about several aspects of this article.

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Dr W. Stanley Brown, Bell Laboratories, Arthur W. Elias, 3i Company/Information Interscience Incorporated, F. G. Kilgour, Ohio College Library Center, Mrs M. S. Morris, Allied Chemical Corporation, and **Dr Harrison Shull**, Indiana University, have been appointed to the **Chemical Abstracts Service Advisory Board**, and **John Griffith**, IBM Corporation, has been reappointed.

Miscellaneous

Alfred P. Sloan Foundation research fellowships have been awarded to the following young scientists: **B. R. Barrett**, University of Arizona (physics); **J. E. Gunn**, California Institute of Technology (astrophysics); **Hans C. Andersen**, Stanford University (chemistry); **C. Denson Hill**, Stanford University (mathematics); **A. M. Nur**, Stanford University (geophysics); **V. Petrosian**, Stanford University (astrophysics); **A. Kas**, University of California, Berkeley (mathematics); **T. Lam**, University of California, Berkeley (mathematics); **R. McKenzie**, University of California, Berkeley (mathematics); **H. F. Schaefer**, University of California, Berkeley (chemistry); **J. I. Silk**, University of California, Berkeley (astrophysics); **G. N. LaMar**, University of California, Davis (chemistry); **V. L. Trimble**, University of California, Irvine (astrophysics); **D. A. Evans**, University of California, Los Angeles (chemistry); **S. J. Putterman**, University of California, Los Angeles (physics); **D. S. Sigman**, University of California, Los Angeles (biochemistry); **R. L. Vold**, University of California, San Diego (chemistry); **J. C. Wheeler**, University of California, San Diego (chemistry); **M. Shub**, University of California, Santa Cruz (mathematics); **L. L. Miller**, Colorado State University (chemistry); **W. C. Lineberger**, University of Colorado (chemistry); **J. E. Faller**, Wesleyan University, Middletown (astrophysics); **L. Corwin**, Yale University (mathe-

tics); **R. P. Geroch**, University of Chicago (mathematical physics); **D. Chandler**, University of Illinois (chemistry); **S. Chang**, University of Illinois (physics); **R. P. Kaufman**, University of Illinois (mathematics); **W. O. McClure**, University of Illinois (neurochemistry); **J. T. Yardley**, University of Illinois (chemistry); **A. Weitsman**, Purdue University (mathematics); **D. N. Coucouvanis**, University of Iowa (chemistry); **W. C. Stwalley**, University of Iowa (chemistry); **D. C. Polahd**, Johns Hopkins University (chemistry); **S. Kerpel-Fronius**, University of Maryland (neurochemistry); **B. M. Zuckerman**, University of Maryland (radioastronomy); **R. C. Clarke**, Boston University (chemistry); **R. A. Laursen**, Boston University (bioorganic chemistry); **D. I. Lieberman**, Brandeis University (mathematics); **M. Schachner**, Harvard Medical School (neurobiology); **G. R. Kempf**, Harvard University (mathematics); **J. A. Osborn**, Harvard University (chemistry); **J. E. Pilcher**, Harvard University (physics); **W. P. Reinhardt**, Harvard University (chemistry); **C. M. Bender**, MIT (applied mathematics and theoretical physics); **J. W. Negele**, MIT (physics); **D. A. Garelick**, Northeastern University (physics); **R. B. Hallock**, University of Massachusetts (physics); **W. C. McHarris**, Michigan State University (nuclear chemistry); **A. J. Ashe**, University of Michigan (chemistry); **B. J. Evans**, University of Michigan (crystallography); **M. Raban**, Wayne State University (chemistry); **F. P. Calaprice**, Princeton University (physics); **W. Carithers**, Columbia University (physics); **J. L. Gross**, Columbia University (mathematics); **R. W. Guernsey**, Columbia University (physics); **A. J. Chorin**, New York University (applied mathematics); **R. E. Zigmond**, Rockefeller University (neurochemistry); **D. M. Hanson**, State University of New York (chemistry); **S. J. Osher**, State University of New York (mathematics); **F. H. Shu**, State

University of New York (astrophysics); **S. R. Simon**, State University of New York (biochemistry); **G. D. Sprouse**, State University of New York (physics); **J. W. Kalat**, Duke University (neuropsychology); **P. J. Kropp**, University of North Carolina (chemistry); **J. F. W. Keana**, University of Oregon (chemistry); **T. W. Mihalisin**, Temple University (physics); **R. Eisenberg**, Brown University (chemistry); **S. Ying**, Brown University (physics); **F. R. Harvey**, Rice University (mathematics); **D. J. Kouri**, University of Houston (chemistry); **C. N. Davids**, University of Texas (nuclear astrophysics); **E. G. Adelberger**, University of Washington (physics); **N. H. Andersen**, University of Washington (chemistry); **E. Fetz**, University of Washington (neurophysiology); **M. H. O'Leary**, University of Wisconsin (chemistry); **A. O. W. Stretton**, University of Wisconsin (molecular neurobiology); **B. C. Eu**, McGill University (chemistry); **I. Ozier**, University of British Columbia (physics); **D. R. Arnold**, University of Western Ontario (chemistry).

George Waterston, regional officer for Scotland of the **Royal Society for the Protection of Birds**, has been awarded the Society's gold medal.

Professor A. J. P. Martin, Wellcome Foundation Limited, has been awarded **Japan's Order of the Rising Sun**.

Erratum

IN the article entitled "Mechanism of Immunologically Specific Killing of Tumour Cells by Macrophages" by R. Evans and P. Alexander (*Nature*, **236**, 168; 1972), the reference number in line 11 should be to reference 4 in the bibliography; similarly in line 12 from the bottom of page 170, the reference number should be to reference 9 in the bibliography. Reference 8 in the bibliography should read: *Clin. Exp. Immunol.*, **6**, 1 (1970).

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