

Gates on "The Disposal of Domestic Wastes in Rural Areas" effectively summarizes the scope of this wide ranging symposium, held in Washington DC in 1966, on environmental pollution in the United States. The meeting was sponsored by the American Association for the Advancement of Science, the American Society of Agronomy, the American Society of Animal Science and other relevant professional societies. There are thirty contributions from a wide variety of disciplines and organizations; the papers are grouped under four heads: air quality, water quality, soil pollution, human and animal wastes.

Under air quality, industrial, domestic or automotive pollutants, in particular sulphur oxides, ozone, fluorides, peroxyacyl nitrates (PAN), ethylene, chlorine and nitrogen dioxide, are discussed, as well as airborne pathogens (possibly foot and mouth disease, for example), wind drift of agricultural pesticides, radioactive fall-out, and wind erosion. Under water quality, such pollutants as pesticides, leached fertilizer residues, household wastes, including detergents, food processing and other industrial effluents, soil in run-off water and its resultant sedimentation and salinity, receive attention. The section on soil pollution has papers on radioactive fall-out, heavy metal contamination, pesticides and their bio-degradation, and nitrogen compounds and their leaching on which Stout and Buran offer one of the few quantifiable models in the book. Finally, there are useful contributions on the disposal of the excreta of livestock and humans, and on other household wastes.

This is an important book on a growing problem that is found in all industrial societies, most of which also have advanced agricultures, intensively using fertilizers and pesticides. Therefore, although the subject is restricted to the United States, the content is of international value.

Most of the papers are short reviews, defining a particular problem and outlining counter-measures; few report original research. There are full bibliographies, and good author and subject indexes. The book would have been more useful if it had included a concluding synoptic paper, and if it had more diagrams and flow charts. In fact, the interactions within the various links of, and along, human and other food chains receive only passing attention, even in qualitative terms. Quantification and evaluation of the balance of advantages between pollution, higher living standards and greater food output must come in the future. Possibly, as E. H. Castle (page 251 ff) and Gates suggest (page 383), cost-benefit analysis and systems analysis offer useful approaches in a field where synoptic quantification is difficult and rare and emotions common.

A. N. DUCKHAM

## BIOLOGICAL EDUCATION

### *Journal of Biological Education*

Vol. 1, Nos. 1-4 (March, June, September, December 1967). (London and New York: Academic Press, 1967. Published for the Institute of Biology.) Annual subscription, 60s.

THIS new journal was dedicated to those engaged in biological teaching in schools, technical colleges, colleges of education, universities and other institutions. The appearance of the first volume in March 1967 was welcomed by teachers of biological subjects at all levels.

The periodical set out to establish a forum for the interchange of experience and ideas in current biological education, and it has made a good beginning. So far most of the advertised features have been represented and there has been a refreshing variety in content and in the treatment of themes. The high standard maintained over the first year's issue has come to be recognized and expected.

It might be rash to suppose that any one publication could provide worthwhile material for readers with such widely ranging interests. What need does it supply which was not already met by such periodicals as *The School Science Review*, *School Natural Science*, *Biology and Human Affairs*, and the numerous more specialized biological or educational journals, all of which are concerned wholly or in part with biology or education or both? The two peculiar merits of this periodical are: extensive, in that its features and articles range over the whole (or almost whole) of biological education, and intensive, in that it concentrates attention on biological science rather than on science at large. Policies of biological education often lack coherence and continuity. Divisiveness in aims and methods between teaching at one level and another has sometimes led to frustration and wasted effort. Through this new journal as, I think by no other means, biology teachers in different establishments may be made aware of what is going on elsewhere in work related to their own. This knowledge and understanding should lead to a very fruitful unification of endeavour and continuity of purpose from one stage of biological learning to the next.

In his article (1 (2); June 1967), "Crisis in Biology", Dr K. F. Dyer urges that more provision should be made for training in medicine, agriculture and certain aspects of "orthodox" biology, such as marine biology—which, he claims, do not now receive recognition commensurate with their economic and social importance. Similarly, one might suggest that this journal, admirable in conception, catholic in breadth of interest and setting a high standard of scholarship, could with advantage include from time to time articles embodying that broader interpretation of biological education mentioned by Dr H. P. Ramage (1 (2); June 1967) in his article, "Principles and Perspectives for Educational Biology". A high proportion of the children in our secondary schools study biology less perhaps as a specialist science than as one of the liberal arts, and on the values and attitudes engendered by their education depends the climate of thought and opinion in which biology, pure and applied, will develop until the end and over the turn of this century.

E. J. VINNICOMBE

## OBITUARIES

### Professor W. B. Pennington

PROFESSOR W. B. PENNINGTON died suddenly on March 3 at the age of 44. He was professor of pure mathematics at the University College of Wales, Aberystwyth, a post which he had held since 1961.

William Barry Pennington was educated at Loughborough Grammar School and Jesus College, Cambridge, which he entered as a scholar in 1941. He was classed as a wrangler in Part II of the mathematical tripos in 1943 and then left Cambridge to serve as a radar officer in the Royal Navy Volunteer Reserve. He returned to Cambridge in 1946 to take Part III, and began research on the analytical theory of numbers under the supervision of the late A. E. Ingham; for this he obtained his PhD in 1951. After spending two years at Harvard University as Choate Memorial Fellow and later as Benjamin Peirce Instructor in Mathematics he returned to a research fellowship at Jesus College. He was appointed to a readership in the University of London (Westfield College) in 1953 and held this post until he went to Aberystwyth.

Pennington was elected to the council of the London Mathematical Society and appointed editor of its journal in 1955. He remained on the council until his death. The expansion of the society and the increase in growth of its activities and influence owe much to his untiring efforts.

Pennington's list of publications was small, but included substantial contributions to the analytic theory of numbers

and other related analytic topics. Perhaps his best known work is his paper on the order of magnitude of Ramanujan's function  $\tau(n)$ . This function is defined by the power series expansion

$$\Delta(z) = \sum_{n=1}^{\infty} \tau(n)z^n = z\{ (1-z) (1-z^2) (1-z^3) \dots \}^{24}$$

as the  $n$ th coefficient of the "discriminant" function  $\Delta$ , which plays an important part in the theories of elliptic and modular functions and their applications to representation problems in the theory of numbers. Pennington was concerned with the behaviour of the sum function

$$T(x) = \sum_{n \leq x} \tau(n)$$

for large  $x$ . The exact order of magnitude of this oscillatory function is still unknown, and it is likely that the best known estimate,  $T(x) = O(x^{59/110})$ , is capable of improvement. Pennington was interested in finding how large (both positively and negatively)  $T(x)$  could be infinitely often and he succeeded in showing<sup>1</sup> that the upper and lower lines of  $T(x)/x^{25/4}$  are  $+\infty$  and  $-\infty$ , respectively. This implies the weaker result that the estimate  $T(x) = O(x^{25/4})$  is false. The gap between the two indices 25/4 and 59/10 is extremely difficult to fill and any progress will require new ideas of a very powerful nature. Pennington's work on this problem is based on some earlier work of Ingham and his analysis contains several very interesting and elegant ideas.

Three of his other papers are on summability of series and involve ideas of a number-theoretic type. Although he did not publish any more work on  $\tau(n)$ , he continued to be fascinated by the many unsolved problems connected with this function. Those who have heard him lecture on this subject will remember the clarity of his exposition and the way in which he transmitted his enthusiasm to his audience.

He organized and took part in many musical activities, for he had a deep love for music and a fine baritone voice. He is survived by his wife and four daughters.

R. A. RANKIN

<sup>1</sup> Pennington, W. B., *Proc. Cambridge Philos. Soc.*, **47**, 668 (1951).

## University News

The **California Institute of Technology** has received an award of \$216,000 from the US National Science Foundation for an "Ultra High Resolution Nuclear Magnetic Resonance Spectrometer", a chemistry research instrument which will be used to analyse the structure, bonding and conformation of molecules. This is the first installation of its kind at an academic institution in the United States.

**Dr C. W. Miller**, Associated Electrical Industries, Manchester, has been appointed to succeed Professor Poynton as head of the department and professor of physics in the **City University**.

The title of professor has been conferred on **Dr D. A. Price Evans**, at present senior lecturer in the department of medicine at the **University of Liverpool**.

**Dr G. S. Brindley**, University of Cambridge, has been appointed to the Fitzmary chair of physiology at the **Institute of Psychiatry, London**.

The **Science Research Council** has awarded a grant of £630,000 over four and a half years to the Department of Computer Science, **University of Manchester**, for the study of computer systems design in its widest sense.

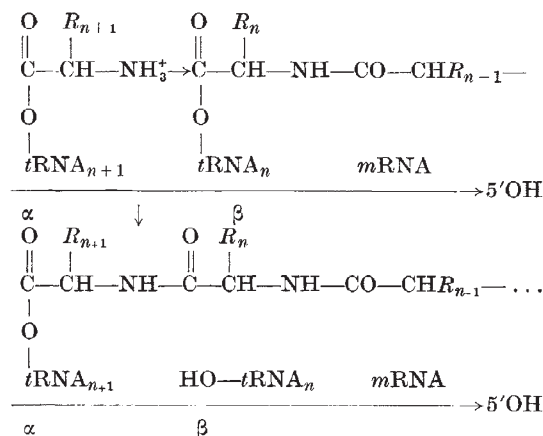
The **Otto Meyerhof** chair of molecular biology has been established at the **Weizmann Institute of Science** by the Volkswagen Foundation in honour of Otto Meyerhof, the German Nobel Laureate. **Professor Leo Sachs**, head of the institute's department of genetics, has been appointed first holder of the chair.

## Appointments

**Dr L. R. Shepherd**, formerly deputy chief executive of the OECD High-Temperature Reactor Project (Dragon), has been appointed chief executive to the project in succession to **Mr C. A. Rennie**, who has relinquished his appointment to act as a consultant, primarily in the field of high temperature reactor technology.

**ERRATUM.** In the article "Submillisecond Radio Intensity Variations in Pulsars" by H. D. Craft, jun., J. M. Comella and F. D. Drake (*Nature*, **218**, 1122; 1968) the last sentence of the first paragraph should read "Similar short time structure for CP 0950 at a frequency of 2,295 MHz was also reported at the conference by R. D. Ekers and A. T. Moffet. J. H. Taylor has reported observations of occasional circularly polarized pulses made on a lower frequency and with a longer time constant." In the eighth line of the fifth paragraph the total power in the fine structure should read: the total energy in the fine structure.

**ERRATUM.** In the article "Stepwise Reconstruction of a Ternary Complex in Protein Synthesis" by Michael Jost, Nadja Shoemaker and Hans Noll (*Nature*, **218**, 1217; 1968) the formula in the first paragraph was incorrect; it should be



## CORRESPONDENCE

### New Name for the Kilogram

SIR,—If, as seems likely, a new name for the kilogram within the SI system of units is to be selected, I would like to add my support to the most attractive suggestion (in my opinion) yet proposed: the name "quilo" with symbol "q" (Fulton, M., *Nature*, **218**, 707; 1968). C. W. Allen (*Nature*, **218**, 209; 1968) has suitably narrowed the possibilities, but the suggestion "baram" is ugly and not easily remembered.

The arguments advanced in favour of "kilo", symbol "k", by P. J. Groenen (*Nature*, **218**, 797; 1968) are dubious. "Milli-" and "metre" both have the symbol "m", but quite different names and functions; Groenen's suggestion introduces the same symbol with the same name for both multiple and unit. "kq" avoids the objections to "kk".

Yours faithfully,

I. G. C. DRYDEN  
(Editor of *Fuel*).

The British Coal Utilisation Research Association,  
Randalls Road,  
Leatherhead, Surrey.