internal diameter, 1·5 cm diameter thickness with three attached eyelets for the bridles and rope lead attachments. The three bridles are each 57 cm in length attached to a swivel, and the nylon rope leads are to take a 25 kg weight under normal usage, though a 40 kg weight is desirable under conditions when the wire angle would exceed 25°. It is recommended that a flowmeter (*TSK* or equivalent) should be fitted from three points on the ring and accurately centred 14·25 cm from the rim. The codend should be a light-weight bucket (7·5 cm diameter) of polyvinyl chloride or brass, fitted with windows of the same mesh as the net, and with a volume of 150–200 c.c. (when plankton is required alive a volume of 500 c.c. is preferable), but for use in very rich waters a bag of the same mesh as the net is more convenient. The filtration efficiency of this net is 94 per cent. It should be used vertically, lowered at 60 m/min and hauled 45 m/min which should give a towing duration of 4·5 min for 200 m water column during which time clogging should not normally reduce the efficiency of the net to less than 85 per cent. Where possible a second flowmeter should be attached outside the rim to give an indication of efficiency, and if this is less than 85 per cent the haul should not be considered as quantitatively representative.

Working party 2 also recommends taking two simultaneous samples, or splitting the sample into two halves, one for biomass determination by the Lovegrove method[2,3] and one for counting and taxonomic analysis. It also recommends more research into net design, water flow, plankton behaviour and patchiness, and on net material. The development of telemetering depth-flowmeters, and electrical methods of opening and closing nets, are desirable as well as research into the effect of shock waves arising from the ship and noise on plankton sampling.

Working party 3 considered that an encased high-speed sampler would be the best sampler for their size range of organisms, but that none of current design was near enough to the ideal. It recommended further research to produce a suitable design and suggest the features to be considered as ideals, although it must be realized that some compromises may be necessary to make it a workable and practical design. In the meantime it recommends a net with a mouth opening of 1 m², the net made of monofilament nylon of 1 mm mesh aperture having a cylindrical forward part 57 cm and a conical after part 200 cm in length and strengthened with six longitudinal tapes not more than 2 cm wide. It should have a throat of sailcloth not more than 12 cm wide wrapped around the ring, which should be of galvanized tubing of about 2 cm outside diameter and with three bridles equal in length to the mouth diameter. A flowmeter should be fitted in the mouth area 25 cm from the ring and the collecting bucket should be light in weight. This net should be towed at 2–3 knots using a sinker of 40 kg or an equally efficient depressor. The organisms sampled by this net would overlap those taken by the net designed by working party 2 mainly for biomass determination. Use of the 1 mm mesh advocated by working party 3 has the advantage that it is possible to filter far greater quantities of water and so sample the larger species which are usually less abundant. These will be retained relatively free from contamination by those great quantities of small organisms which interfere with sorting and which by adhering during fixation make taxonomic separation difficult. The report from this working party also recommends further research to find the best means of telemetering information from the sampler to the surface and telemetering control signals to the sampler.

Working party 4 considered that the organisms in its size range (about 2–20 cm) would be best termed micronekton rather than macroplankton as this would reduce confusion with the range considered by working party 3. Gelatinous organisms and other animals greater than 10 cm will occur in the catches and these must be considered separately from the main sample. The working party considered that of the methods available only one sampler has widespread use—the Isaacs–Kidd Midwater Trawl—though it notes that as there is no method of measuring the volume of water filtered it is only semi-quantitative. The net should be large and the 6 ft. or 10 ft. net (that is, depressor spread) should be used according to the available shipboard facilities. The mesh should be 0·5 in. (12·5 mm) stretched nylon supported within an outer net of about 2·5 in. (6·5 cm) knot to knot. The use of mixed or graded meshes is deprecated even though the catch is maintained in better condition if the codend is preceded by a short length of 3 mm mesh (any resulting small organisms in the catch could be disregarded).

The speed of the ship should be maintained at 3 knots, wire should be paid out at 40 metres/min, hauled at 40 metres/min for oblique tows or 60 for horizontal tows. Oblique hauls should sample 200–0 m depth and for thorough depth sampling by horizontal tows sampling should be at 50 m intervals to 1,000 mm and 250 mm intervals beyond. The use of a depth-time recorder or depth telemeter is a prerequisite of midwater sampling because accurate knowledge of the depth of fishing is essential to a proper interpretation of the data. A flowmeter should be used to measure the relative length of tow.

The reports of all four working parties are to be collated into one which will be published in due course as a Unesco monograph.

J. H. FRASER

[1] *Rapp. Cons. Intern. Explor. Mer*, **153** (1962).
[2] *Rapp. Cons. Intern. Explor. Mer*, **153**, 86 (1962).
[3] In *Some Contemporary Studies in Marine Science*, edit. by Barnes, H., 429 (George Allen and Unwin, Ltd., London, 1966).

OBITUARIES

Patrick B. Kennedy

PATRICK BRENDAN KENNEDY, first professor of mathematics at the University of York, died suddenly on June 8, 1966, aged only 37. He was born at Cork and educated there at North Monastery and later University College. After obtaining an M.A. at Cork he went to the then University College of the South-west at Exeter to study the theory of functions of a complex variable, and this subject remained one of his main interests. His Ph.D. thesis was stimulated by a conjecture of M. H. Heins, which he disproved, and contained a discussion of the minimum growth of an integral function with k symptotic values together with counter-examples to show that all his theorems were the best possible. To construct these counter-examples he provided a method for approximating certain subharmonic functions by logarithms of integral functions which proved then and is now a most valuable tool. The distinction of this work was recognized when after a short period as assistant lecturer at Aberystwyth and lecturer at Cork he was appointed professor of mathematics at Cork in 1956. He was appointed to the chair at York in 1963.

Kennedy had a delightful Irish humour, which always made him charming company, but he was nevertheless an extremely serious person and drove himself hard. He took a strong personal interest in all his students. He found it hard to delegate work to his junior colleagues, feeling that they should not be overburdened with chores but should have the opportunity for their own researches. He was also keenly interested in all matters of education and had been a member of the teaching committee of the Mathematical Association. At the time of his death he was writing two books, conducting the first degree examinations at York and also acting as external examiner at Cork. He is survived by his wife, whom he married in 1954, and three children.

W. K. HAYMAN