BIOPHYSICS

Automatic Equipment for the Collection and Processing of Data from Geiger-Müller Counters

During a radioisotopic investigation of ion accumulation processes in marine algae it became apparent that a considerable amount of data required to be collected over extended periods of time. Automatic equipment was therefore devised both for the collection and preliminary processing of the information.

Geiger counters (type *GM*4) with their aluminium end-windows protected by epoxy-resin paint are fixed directly above algal sections contained in shallow cavities through which seawater incorporating the radioisotope being studied is rapidly circulated. (A description of the section holder and circulator assemblies is being submitted for publication elsewhere.) The voltage pulses from probe units to which sets of the Geiger counters are sequentially connected are recorded on a standard tape recorder at a tape speed of $1\frac{7}{8}$ in. per sec., the frequency response at this speed being adequate to record without loss of counts from a probe unit with 500 μsec. paralysis time. The number of Geiger counters in a sequence, the periods for which counts are taken and the interval between successive count periods can be pre-set on a programming unit. As the tape recorder motors are switched on only for a duration determined by the programming unit (in practice 1 min. longer than the count period) a single spool of tape can accommodate large numbers of count periods, for example, a 2,400-ft. spool can permit the recording of more than 120 sets of counts of 1-min. duration on each of its two tracks. Originally the reproduction of this data in usable form was a time-consuming task despite the utilization of a playback speed eight times that of recording, but recently a simple data-processing machine has been completed.

The pulses replayed from the two tracks of the magnetic tape are fed into two scalers each provided with dividing circuits, the division ratios corresponding to the times for which the original counts were recorded. The scalers thus indicate directly the counts per minute on their main registers. Each scaler has a subsidiary register on which the dead-time correction factor is automatically computed. On receipt of a signal which is recorded on the tape at the end of each count period and which is isolated by a two-stage frequency-selective network, a read-out and print-out sequence is initiated. In addition to printing out the counts per minute and the dead-time correction factors, a solenoid-operated calculating machine also prints the starting count per minute for each Geiger counter selected in the original sequence together with counter identification numbers. The calculating machine can perform simple operations on the data being printed out such as producing automatically a difference between the newly determined count per minute and starting count per minute. In the majority of cases, this difference is sufficiently satisfactory for direct graphical representation to indicate the course of an experiment without the application of the dead-time correction factor though, if required, the data for dead-time correction are immediately available without reference to tables. On completion of the print-out sequence the scaling and computing circuits are automatically reset.

This simple computing equipment, while designed specifically to deal with tape-recorded data, can be used with advantage for routine Geiger counting wherever large numbers of samples have to be dealt with and is thus felt to be of wider interest.

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Identification of Ultracentrifugal Components in Human Plasminogen Preparations

Samples of human plasminogen, prepared according to the method of Kline[1], have been subjected to ultracentrifugal analysis[2]. The patterns observed contained two sedimenting peaks. The slower peak constituted approximately 70 per cent of the total area and had a sedimentation constant, $s_{20,w}$, of 4·28 *S*, extrapolated to infinite dilution. The faster peak, which was much broader and resolved poorly from the main component, had a sedimentation constant of about 7–10 *S*. It was merely assumed that plasminogen was to be identified with the 4·3 *S*-component, and on this basis, along with other data, molecular size and shape were estimated. We now report direct evidence to substantiate this assumption.

The proteolytic activity was measured by casein assay, essentially according to Remmert and Cohen[3], except that the casein concentration was 2 instead of 4 per cent. The concentration of protein in the sample being assayed was measured by light absorption at 2800 Å., using 14·0 as extinction coefficient[2]. The activity is therefore expressed as casein units/mgm. protein.

Sedimentation studies were made in a Spinco model *E* ultracentrifuge, using an analytical cell with a 2° sector to minimize the volume required, and a standard fixed-partition cell for separation of components. These runs were made on samples that had been dialysed against acid-saline (0·15 *M* sodium chloride + 0·01 *N* hydrochloric acid, *p*H 2).

In an early separation experiment, a solution at 1·4 per cent concentration was run in the separation cell until the fast component had apparently gone past the partition. After terminating the run, samples were obtained from the top compartment ('Top') and the bottom compartment ('Bottom'), 0·2 ml. each, and diluted with 1·5 ml. of acid-saline. These dilutions were measured for protein content and assayed on casein. A sample of the initial solution was allowed to stand at room temperature during the run ('Warm control') and another solution was kept refrigerated ('Cold control'). These were similarly diluted and assayed. The results are shown in Table 1. This experiment is adequate proof that the proenzyme is to be associated with the slow component. If it were in the fast peak, the activity in 'Top' should be considerably reduced, although not to zero, since the boundary is quite broad; instead