Discussion : Serological techniques

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We all accept that automation is essential but it also carries penalties. One is cost, although this can be offset by centralization and reduction in unit cost per investigation; the second is loss of flexibility which may in some cases be advantageous as it represents the increase in consistency of work; and the third, that well tried and established techniques may have to be extensively modified or even abandoned. The fourth is more insidious and is the tendency to subordinate other considerations to the needs of the system. On the other hand, automation and mechanization provide the only way which will allow us to provide a better and more rapid service to our colleagues, to accept the increased work load with which we are presented, and to carry out additional specialized work.

In the applications which Professor Williams outlined for us, there are some in which centralization can only be limited. The accurate enumeration of living bacteria in urine is very much dependent on the time between collection and test. The introduction of such methods as the dip inoculation spoon provides an answer in some fields. It would also seem that the identification of pathogens in hospital practise requires the close cooperation between microbiologist and clinician to obtain the best results. These factors also apply to the determination of antibiotic sensitivities and of serum antibiotic levels. Where the patient is severely ill, treatment will have to be started before the results are available and these will be of value as much in guiding the treatment of future cases as in management of the current case. It follows that apparatus for use in these fields will require a much smaller output than equipment where very large-scale centralization is possible.

On the other hand, serum antibody determinations lend themselves to considerable centralization, and at my laboratory at Manchester we provide a routine VD serology service for a population of about 5 million people and test between 400 and 500 specimens a day with three or more tests. My approach to the problem was to provide for smooth work flow which involved minimum handling of specimens and documents.

About seven years ago we mechanized our reporting and record system by the use of a punched card installation which consists of a power-driven punch, a sorter, and a tabulator on which our records and reports are printed. It provides us with an integrated system of compact and indexed records. Six feet of shelf space contain about 120,000 reports and a cumulative patient file for positive results. It also allows us to select special population groups for surveys and to analyse our results. About five and a half years ago we eliminated our main bottleneck on the bench, which was pipetting and diluting serum by the use of a prototype pipetting machine which is a forerunner of the one mentioned by Dr Taylor. In a

single operation we pipette undiluted serum for our flocculation test and prepare and distribute diluted serum for our two complement-fixation tests. Its use has reduced the labour content of testing 400 specimens, after serum separation, from five hours to one and a quarter hours, which is comparable with the time taken to fill the same number of AutoAnalyzer cups without carrying out the tests or transcribing the results. This machine was replaced after it had been used for about 300,000 specimens. We have now pipetted about 250,000 sera on the commercial machine, which has proved mechanically less reliable in spite of modification.

About three and a half years ago, we moved into a new laboratory which we had planned to suit our work flow and our present test capacity is something over 1,000 specimens a day of which we are only using half. Our spare capacity can be utilized for carrying out surveys and other projects. We find that we can not only do complement-fixation tests but also, for example, mycoplasma metabolic inhibition tests using this machine. We also carry out the virus complement-fixation test for the area. The great virtue of this machine is its flexibility and in the course of the day it might be carrying out six entirely different pipetting procedures. We are, however, looking forward to a third generation machine which we have on the drawing board, which will be fully automatic but retain its flexibility and also can easily be sterilized. With this machine we hope to be able to carry out virus neutralization tests and perhaps set up antibody assays. While mentioning virus work, we have two other prototypes which might be of interest. One is an automatic filling machine for tissue culture tubes; we have chosen its rate of operation so that it should be safe to use with infected tubes as well as for use in cell preparation. In considering time saving by automatic processes one should not forget the 'setting-up' time. Even though the setting-up time is only two or three minutes, unless more than two or three hundred tubes are to be filled, it is quicker to pipette by hand rather than use the machine, but where one has, say 20 racks to wash and change, the advantages of the machine are enormous. The second machine illustrates time saving without automation and is for rotating tubes as an alternative to using a roller drawn machine. The racks are clipped straight on to a large wheel which rotates as a whole and can carry up to 50 racks or 1,500 tubes, equivalent of rather more than seven drums. Here we have a considerable gain in time as it eliminates transfer from rack to drum and back again and is especially valuable where this is repeated.

Compared with chemical pathology, we may say that microbiology is still almost a cottage industry but we may utilize the chemical pathologists' experience in guiding our own development. It seems that many of the discrete analysis systems now available will have applications in microbiology, especially where the incubation period can be varied at will. Sterilization also becomes a possibility. We may also find fruitful their concept of 'work simplification' where the main tool is the observation and the stop watch augmented by the introduction of comparatively simple equipment. Microbiologists may use such equipment for inoculation plating and preparing dilutions.