us all over five years from start to finish to get the centre built. When we decided to build the annexe to the house to make our own group-practice centre all the partners spent a couple of evenings together discussing what they wanted. We then drew out the plans ourselves and applied for a group-practice loan, which was readily granted. From plan to completion took only nine months."

As with any new project other minor snags have inevitably arisen —such as, at Hythe, those resulting from the design of the buildings, or, at Huntly, what services are included in the rent—but the doctors thought that these could readily be sorted out by the house committees. " So why not a salaried service ? " I asked one doctor at Hythe. He was against this, even if the salary was a large one. A salary, he thought, would not necessarily be related to work load, and at present it was possible to keep the list to a reasonable size. Moreover, once general practitioners lost their independence authority was in a position to dictate—even though he admitted that where the nature of the work to be done was concerned this had not happened in the hospital service. But he emphasized that under the existing arrangements there were no restrictions of any kind.

Judgment of Paris

Hence we came back to the question at the beginning of this article, " Group practice, health centre, or both ? " With the limited number of health centres built any conclusions must be both tentative and personal. There are already enough health centres in existence, however, to disprove the contention that they must necessarily fetter the doctor's freedom to practise medicine in his own way. Moreover, many doctors are obviously happy working in modern premises in close contact with colleagues, supported by consultant, ancillary, and diagnostic aids. Some have also commented favourably on the way health centres may break down the present tripartite system of the Health Service. Many doctors, also, lacking capital, could never under the present system have provided such conditions for themselves. But, apart from close contact with consultants, almost all these things can be provided in a group-practice centre, even if the cost at present is extremely high.

Here I must state some personal conclusions, for what they are worth, emphasizing that they refer neither to Huntly nor to Hythe. Of the places I have visited where I would most like to work one was a health centre attached to a small hospital, the other a modern group practice with a hospital near by—and I could find little to choose between them. As elsewhere, much of their success seemed to owe a great deal to an " old-boy " net connecting family doctor to medical officer of health and consultant, and often arrangements that were unrecorded in any committee minutes had made all the difference between a practice that ran smoothly and one that did not. For doctors in a health centre this vital relationship might seem to be all too tenuous, depending as it does on rapport between persons who may move, retire, or die. Whereas in a doctor's own practice a change in relationships might be serious but not disastrous, some might think that the reverse would be true in health-centre practice. This conclusion could be called unfair when to-day many medical officers of health, by attachment of ancillary workers and other enlightened schemes, are showing their willingness to co-operate fully with general practitioners. On the other hand, one question that I heard asked remains unanswered, " Why if one county can attach 180 ancillaries to general practices cannot all do the same ? ", and one still meets family doctors who say that they have spent years trying unsuccessfully to persuade local medical authorities to assign them a district nurse or a midwife. Again, other doctors have told of matters agreed on in the planning of health centres that remained unprovided, without explanation, in the final building.

Unlike Scotland, where the statutory responsibility for providing health centres rests on the Department of Home and Health, in England and Wales this rests on the local authority. Many have criticized, rightly or wrongly, the National Health Service for introducing a third person—the State—in the doctor–patient relationship. In England and Wales the health centre introduces yet another person—the local authority—and for this reason, other things being equal, I think that most doctors will still choose to remain independent contractors and to practise at group-practice centres.

I wish to thank the doctors at Huntly and Hythe for their kindness and help in the preparation of this article.

REFERENCES

[1] Eckstein, H., *The English Health Service*, 1959. Harvard University Press, Cambridge, Mass.
[2] *Report of the Future Provision of Medical and Allied Services*, 1920. H.M. Stationery Office, London.
[3] Barnett, N. S., *Brit. med. J.*, 1965, 2, 109.

Computers in Medicine

[FROM A SPECIAL CORRESPONDENT]

A discussion on the use of computers in medicine took place at the general meeting of members held at the Royal College of Physicians on 25 November.

Mr. D. ELLIS-JONES (Electronic Data Processing Division, Honeywell Controls Ltd.) said that his prescription for computers in medicine was to increase both the size and frequency of the dose. It was not necessary to learn all about computers, merely to come to terms with them ; they did not really compute, they compared. Mr. Ellis-Jones illustrated the forms of input media, such as punched and magnetic cards and tape. These would offer tremendous compression of data—for example, 28,000 characters would be printed on one small card. The memory part of the machine had its value in the phenomenal acceleration possible in data manipulation. Such data could be stored serially or in random order, for instantaneous retrieval. The output of the computer could be geared to any device suitable for displaying the information required.

Clinical Applications

Dr. P. CLIFFE (Westminster Hospital) was concerned with applying computers to clinical and experimental medicine. He was stimulated by the fact that qualitative observations were giving way to an increasing degree of clinical measurement. This itself was creating new problems of definition and analysis. In applying conditional probability to diagnosis, characters such as signs and symptoms must be independent and mutually exclusive. One must choose, for example, between recording cyanosis or clubbing but not both. This technique was only suitable for diagnoses for which the machine was set up. On the other hand, by applying numerical taxonomy, characters could be grouped together into clusters which revealed associations previously unrecognized and separated diseases which were not really associated. Thirdly, the statistical method of multivariate analysis not only grouped characters according to disease but worked out which characters would further aid their separation. Dr. Cliffe quoted instances in which these approaches had already been fruitful, but warned that " if you feed garbage in, you will get garbage out."

Dr. R. F. L. LOGAN (Manchester University) said that the factual data of hospital usage were not yet freely at our disposal, and that we had not seized the opportunity of building a bank of clinical experience on which all could draw. It had taken, he said, eight students three weeks to follow up 145 cases of gastrectomy. Particularly now that each patient was cared for by teams of doctors and survived one crisis to reach another, 5% being readmitted each year with a growing volume of clinical data, the old records system had broken down. The computer was coming to the rescue only just in time.

Uses in the Laboratory

Turning to the biochemical laboratory, Dr. A. J. BUCKLE (Guy's Hospital) discussed " unsolicited, valuable, laboratory information " which could ideally be gained from measuring 30 parameters simultaneously on one 10 ml. sample of blood. This, of course, required suitable methods of measurement of proved significance. He estimated that this approach could double the number of abnormal values found, and lead to significant improvement in diagnosis and treatment. A small study had shown that a mechanized approach could reduce the patient's stay in hospital by up to two days. Dr. Buckle showed pictures of two systems currently in use in the U.S.A. and Sweden which nearly reached his idea of 100–300 specimens an hour, with the results in a form suitable for data processing.

Professor J. R. SQUIRE (University of Birmingham) tackled the problem of cost of these new systems. He found that by renting fairly simple equipment for £700 a year he had saved 10% of the technicians' expensive time. The secretaries were able to punch out and print requests at the same time as producing a daily work sheet. The machine grouped the cards functionally and also produced the report. The main problem was to get quality control of the routine methods by ridding the biochemical methods of inaccuracies. He thought that a gradual approach to this expensive discipline was the sensible one.

Encouragement from the Ministry of Health

Sir GEORGE GODBER (Chief Medical Officer, Ministry of Health) said that computers were the technology of the younger man. The interest of the younger generation was essential, not to learn to write programmes but to learn to rationalize and standardize data for computer use.

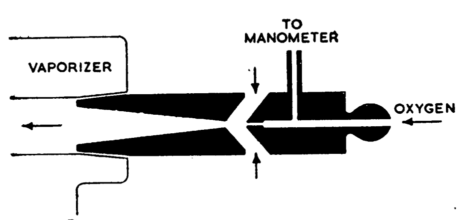
Already seven regional hospital boards had acquired or had ordered computers, and the others would soon follow. By 1967 there should be 100% analysis of hospital activity. Soon regular statistics should be available to any hospital doctor who needed a regular feed-back of information. Then it should be possible to go on to special studies for individual consultants. Small machines should be on hand for special tasks, such as calculating radiation dosage, allocating nurses to the wards, and working out diets. Storage and retrieval of the literature should make it easier to keep up to date and avoid the repetition of research. So far only hospital problems had been considered, but there was a vast volume of records and information outside hospital.

In answer to previous criticisms that many doctors might regard the provision of clinical data for computer analysis as a breach of professional confidence, Sir George emphasized that such information was anonymous and that the profession must programme its work to do the most for the most. This also meant standardization, which implied record sheets of the questionary type, so that the data could be put straight into the computer without further handling.

NEW APPLIANCES

Economical Anaesthesia Overseas: Air-entrainment Device for Use with Draw-over Vaporizers in Children

Dr. J. V. FARMAN, Department of Anaesthetics, Welsh National School of Medicine, Cardiff, writes: Draw-over vaporizers, such as the Oxford vaporizer and the E.M.O. (Epstein and Macintosh, 1956), have proved ideally suited to conditions where supplies of compressed gases are difficult to obtain and where safety and robustness are the principal considerations. They can be used on children above the ages of 3 or 4, but for younger children the resistance and deadspace of the valves are too great. While it is customary to use open drop ether for these patients, there are certain operations, such as repair of cleft lip, for which tracheal intubation is essential. An entrainer (see Diagram) has therefore been developed which blows a stream of gases through the apparatus to vaporize the ether. The resultant mixture is led to a circuit suitable for babies such as Ayre's T-piece. The patient is therefore relieved of the need to draw air through the vaporizer.



The device consists of an injector, driven by compressed air or oxygen, which entrains a flow of air. It delivers a total gas flow of 10 litres a minute against the resistance of an E.M.O. and delivery tubing. Dr. H. G. Epstein, of the Nuffield Department of Anaesthetics, Oxford, has kindly calibrated an E.M.O. vaporizer at various gas flows. He found that with a constant flow of less than 9 litres a minute the ether concentration was rather lower than indicated (in contrast to the intermittent flows for which the vaporizer was designed). The accompanying Table shows that the concentration of ether delivered is still somewhat less than that indicated on the vaporizer dial, but the difference is not great. Since 10 litres a minute is more than double the minute volume of a 4-year-old child this flow will be more than enough to avoid rebreathing when using the usual paediatric breathing circuits.

Concentration (Vol. %) of Ether Delivered by the E.M.O. Vaporizer at 26° C. (Figures Supplied by Dr. H. G. Epstein)

	2%	3%	4%	6%	10%	15%
Constant gas flows:						
7 litres a minute	1·2	1·7	2·3	3·2	6·1	11·9
9 ,, ,,	1·5	2·7	3·5	5·4	9·9	13·8
11 ,, ,,	1·8	3·0	4·2	6·1	9·0	13·7
Intermittent gas flows: 20 breaths a minute, total vol. 9 l./min.	–	–	3·9	5·9	9·9	13·8

Any source of compressed gas (cylinder, pipeline, or compressor) can be used, but a cylinder of oxygen will normally be employed. An ordinary mercury or aneroid manometer is used to measure the driving gas pressure. The flow of gas from the cylinder is adjusted until the manometer reads 100 mm. Hg. At this pressure the entrainer delivers 10 litres a minute. This way of estimating the flow depends on the fact that the rate of flow of a gas through a fixed resistance varies with the driving pressure.

If the flow of gases from the entrainer is occluded the maximum pressure achieved inside it is 15 cm. H_2O. This means that if for any reason gas is prevented from escaping from the breathing circuit the pressure in the apparatus cannot rise higher than 15 cm. H_2O. This pressure is unlikely to cause damage to a patient's air passages.

Artificial ventilation can be carried out by squeezing the reservoir bag of the circuit or by simply occluding the exhaust end of a T-piece. Bag squeezing will cause a reverse flow through the vaporizer and entrainer so that not only will the volume of fresh gases delivered to the patient be reduced but the gases will make more than one passage through the vaporizing chamber, so increasing the ether concentration. For these reasons a non-return valve should be placed between the vaporizer and the breathing circuit. The Oxford inflating bellows can be used for this purpose.

The use of oxygen as the driving gas ensures that the inspired mixture contains an adequate concentration of oxygen. It should be borne in mind that this will render the ether-oxygen mixture detonatable, and full precautions should be taken against explosions. The entrainer has a male taper which fits the air inlet of the vaporizer. When working it makes a low hiss which becomes louder if the outlet is obstructed.

The device has been in use in Cardiff for the past two years and has proved efficient and reliable. Only occasional adjustment of the cylinder valve is needed during anaesthesia. Induction may be carried out by the open drop method or with the entrainer, vaporizer, and a child's breathing circuit with a face-mask. In the case of neonates surface analgesia of the larynx may be used instead. Tracheal intubation is then performed and the apparatus connected and turned on. A vaporizer setting of 5–10% ether is needed for maintenance, but for induction or to deepen anaesthesia this can be increased to 15%.

My thanks are due to Mr. E. K. Hillard, senior technician in this department, and his assistant, Mr. Roy Saunders, for constructing the entrainer, and to Professor W. W. Mushin and Dr. H. G. Epstein for their valuable help and advice.

Further inquiries about the apparatus should be directed to the Longworth Scientific Instrument Co., Radley Road, Abingdon, Berks, the makers of the E.M.O. vaporizer.

REFERENCE

Epstein, H. G., and Macintosh, Sir Robert (1956). *Anaesthesia*, 11, 83.