hæmaturia; frank hæmaturia is not rare and at autopsy the kidneys are usually found to be heavily scarred. Subcutaneous infarcts may develop causing tender plaques resembling panniculitis. Cerebral vascular occlusion is not rare and retinal scarring is quite commonly found.

The liver undergoes progressive enlargement and damage as age increases and has often become frankly cirrhotic when adult life is reached. This process seems to be due to the deposition of a fibrinoid reticulum within the sinusoids which is steadily incorporated into the perisinusoidal membrane. Gross thickening of the latter thus develops throughout the liver and impairs the transit of gases and electrolytes between the liver cell and the blood in the sinusoid. In addition, acute blockage of sinusoids occurs here and there, causing local liver cell necrosis which is ultimately marked by a dense fibrous plaque (Walters 1958).

In rare instances girls suffering from sickle-cell anæmia reach adult life and marry. They are then exposed to special hazards which arise in pregnancy. The tendency to develop thrombotic crises is greatly augmented, while placental infarction often causes abortion, still-birth or prematurity of the fœtus. Breast infarction may simulate acute infection or neoplasm. The myometrium may be so damaged that fibrocollagenous replacement may seriously impair its power to expel the fœtus and may lead to rupture during labour (Curzen 1964).

The sickle-cell trait, in which the subject carries hæmoglobins S and A in his erythrocytes but is not anæmic, was once thought to be harmless but is now being increasingly recognized as the cause of unexpected symptoms, such as hæmaturia. I have had personal experience of two such instances. A healthy Nigerian athlete, during a flight by Comet aircraft to London became very cold and suddenly developed acute pain in his spleen; on arrival the spleen was enlarged and very tender and this persisted for several days in hospital; undoubtedly a splenic infarct had developed. A Nigerian student, who was under treatment with Luminal for epilepsy subsequently found to be due to a meningioma, hibernated in his room for several days in the intense cold of January 1963. On admission to hospital he was hypothermic and showed gangrene of both feet. He died ten days later of pulmonary embolism and at autopsy the feet showed capillary occlusion with thrombosis extending into the veins. A West African woman (a patient of Dr A C E Cole's) developed a splenic infarct while flying in a jet aircraft. She was shown to be a double heterozygote for hæmoglobins S and C. I have also been told of the death of a healthy, 30-year-old Negro ward orderly who underwent an operation for the removal of a ganglion at the wrist. This operation was carried out with the use of a tourniquet: within a few minutes of its removal the patient developed cardiac arrest and subsequently died. The cause of this disaster is speculative, but it may well be that a flood of sickled erythrocytes dislodged from the ischæmic limb by the returning blood flow plugged the pulmonary capillary bed.

Surgeons would be wise to carry out a sickling test on all patients of the Negro races prior to operation, and, in the case of those whose blood sickled, to avoid operating under hypothermia or with the use of a tourniquet. Anoxia should be avoided at all costs.

In the treatment of sickle-cell crises anticoagulants are ineffective and carbonic anhydrase inhibitors such as Diamox do little good. Plasma expanders such as the small molecular dextran, Rheomacrodex, are said to help by reducing vascular spasm (Watson-Williams 1963). Treatment suggested (Apthorp *et al.* 1963) is as follows:

(1) During the thrombotic crises: slow intravenous injection of 1–2 ml of 50% magnesium sulphate every four hours.

(2) For one week thereafter: 12 ml of 70% magnesium glutamate in 60 ml water daily by mouth: this provides 720 mg magnesium.

(3) Permanently: sodium bicarbonate by mouth sufficient to keep the urine alkaline to litmus.

(1) and (2) are designed to lower blood coagulability by substituting Mg++ for Ca++ and (3) is designed to increase the alkali reserve of tissue fluids and to diminish the tendency for acidosis to develop under anoxic conditions.

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Automation in Medicine
[*Abridged*]

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There are many fields in medicine in which the electronic engineer is providing instruments to revolutionize our methods. Patient-monitoring and the application of digital computers are two of the most important.

Patient-monitoring: In association with the Bio-engineering Laboratory of the MRC we have been developing a monitoring system to measure

the temperature, blood pressure (systolic and diastolic), pulse rate, and respiratory rate, of a number of patients simultaneously. The technical difficulties of designing the transducers to make these measurements have been solved; the two main problems have been the presentation of the data, in an acceptable form, to doctors and nurses and the design of a suitable harness, to house the electrodes, &c., which would not disturb the patient. The measurements on each patient are shown on a group of indicators which are fitted with variable alarms for both upper and lower limits. The individual values for each patient are recorded automatically, say every five to thirty minutes on a conventional temperature chart. There is a separate chart for each patient which is presented to the recorder in turn and can be removed for inspection at any time. The temperature is measured in the axilla and the ECG electrodes are also located in a simple harness. The final design of this is not yet available. These methods can be adapted for either intensive care units or general medical and surgical wards.

Digital computers: With the help of Elliot Medical Automation and the King Edward VII Hospital Fund for London, an experimental centre equipped with an Elliot 803 computer has been installed in University College Hospital. It is proposed to investigate the application of computer techniques to medical problems.

It appears that the most difficult and controversial subject is the handling of medical records. We have started by placing the 15 items of information on all 'in-patients' contained in our disease index, into a magnetic tape store. This process is now complete for 1962 and 1963. Multifactorial analysis of these data has now started.

The problems are not only those of the computer engineer but lie in selecting, verifying and categorizing the medical data before they can be stored in this way. The quality of the data needs careful checking and it is possible that as these methods become more important, then the standards of note keeping and the accuracy of observation will improve. In order to study most medical conditions, however, a suitable method of including out-patients in the disease index must be devised.

A method of reading automatically the results of the auto-analysers in the biochemical laboratory and feeding these directly into the computer is under development. These data can then be manipulated to give statistical information about all or groups of tests and also cross-reference can be made to the disease index store to study groups of patients or specific diseases.

Numerous other projects are being studied, ranging from radiation treatment planning to assistance in the allocation of nursing duties. Courses for medical personnel on computer techniques take place every fourteen days. These and the other facilities of the centre are available to other hospitals and medical institutions.

The increasing need to maintain and improve the standard of medical care makes it essential that the collective data and ultimately the experience of the hospital are available to those who need them. The computer can rapidly manipulate the information it contains and hence give answers to problems which were impossibly tedious by older methods.

The Early Diagnosis of Deep Venous Thrombosis [*Abridged*]

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Twenty-five years ago Pilcher (1939) drew attention to the fact that examination of patients with deep venous thrombosis of the legs frequently showed, as well as the usual physical signs, a raised leg temperature on the affected side; this often preceded the development of other local signs.

A survey of a group of adult surgical patients was recently carried out to reassess the value of this physical sign. The patients were examined daily or on alternate days as follows: all patients with unbandaged legs were placed so that their legs were outstretched on the bed in front of them and uncovered to above the knee; they were thus exposed for about ten minutes, care being taken to avoid crossing the legs or constricting the thigh by clothing; this allowed normal legs to cool to an equal temperature but maintained a temperature difference in legs where an abnormality was present. The temperature of the skin around the ankles was compared by the hand of the observer. Only a qualitative and clinically detectable difference was sought, no attempt was made to measure the difference or the absolute temperature of the legs. The presence or absence of pedal pulses was then checked and leg pathology, including the usual signs of venous thrombosis, noted. Solitary occasions when one leg was warmer ('hot leg') were ignored in order to eliminate observer error; a positive result was recorded when a hot leg was found on two or more consecutive occasions.

Results (*Table I*)

Table 1 shows that a relatively large number of patients had a cause for their hot leg: this group contained a high percentage of patients with