

ever it met a fibrous septum. It was thereupon clamped on the band, which was ligated and cut. The dissection went on slowly round the tumour, which was lifted up as it became free. Some of the bands encountered were tiny, some were of moderate size, but none were really large. When the tumour was finally removed the cavity left in the liver was like a tea-cup, oozing slightly from its whole surface, but not bleeding from any particular point. The total blood loss cannot have been more than three or four ounces (85–115 ml.).

It was clear that such a cavity could not be closed. A long forceps was therefore passed down between the diaphragm and the liver till its point could be seen bulging the abdominal wall at the costal margin. An incision was made over the point and a strip of corrugated rubber was drawn back and laid in the cavity. The diaphragm was repaired, the lung re-expanded, and the thoracotomy incision closed.

Dr. de Navasquez reported as follows on the specimen: "The specimen shows a spherical tumour 8 cm. in diameter which is an argentaffin tumour or 'carcinoid' of similar morphology to the tumour in the rectum. The excision appears to be complete, as the tumour is surrounded by normal liver."

The patient was slightly jaundiced for a few days after the operation, but his condition was never alarming. Drainage was maintained for about a week. He is now back at his work as a fruit farmer, playing games, and feeling well. He has gained 30 lb. (13.6 kg.) in weight. He has lost his fiancée, who was more upset by the series of operations than he was, and threw him over. Perhaps he has gained more by his ordeal than he realizes.

### Conclusion

I cannot claim to be familiar with the literature of partial hepatectomy, nor have I consulted more than the standard textbooks of operative surgery. It would, in any case, be out of place to burden a clinical report of a single case with references to the experience of others.

The surgeon to-day is confronted with the almost impossible task of keeping in touch with a literature that increases in volume every year. He can read most of that which concerns the small branch in which he is particularly interested. For the rest he must be content to let others do the hard work at the coal face, and get the knowledge from them, picked, assorted, graded, and delivered in clean sacks. The knowledge thus acquired gains in perspective from being unclogged by excessive detail, and it is laid down in the association centres of a mind clarified by idleness. What I have learned of surgery since taking my Fellowship has been gleaned from registrars, house-surgeons, dressers, and sisters; from meetings of the Association of Surgeons, the Royal Society of Medicine, and the Medical Society of London; from journeyings round Europe with the Surgical Travellers; and from the Colchester Surgical Group and those who visit them. At a recent Colchester meeting we were discussing the surgery of the liver, and I learned for the first time that the method that proved so useful to me in this case was not known to the majority. For that reason, because the information may prove useful to others faced with a similar predicament, I venture to put out this unscientific communication.

The use of radioactive phosphorus to study the movements of wild rodents over a long period has had promising results. Workers at the University of Wisconsin have found it possible, with the help of a Geiger counter, to trace the movements of a field-mouse, which had previously been injected with a harmless amount of radioactive phosphorus, by its radioactive excretions. These tests have shown that a field-mouse travelled at least 700 feet in a period of eight days, and ranged over an area of 120 feet long and 100 feet across. The method has also been used in tracing the movement of insects and birds.

## PLASMA PROTEIN CONCENTRATION OF NORMAL ADULTS LIVING IN SINGAPORE

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Wills and Bell (1951) and Holmes *et al.* (1951) found that coloured people living in the Tropics had higher plasma protein concentrations than white people living in the same climate. The present investigation was designed to show whether a racial difference in plasma protein concentration did exist under good social conditions and to show whether the plasma protein concentration of healthy people was the same in the Tropics as in a temperate climate.

### Materials and Methods

The subjects were students, blood-donor volunteers, or members of the armed Forces, between 20 and 40 years old. All were apparently in good health, and in a state of adequate nutrition. There were 80 men, of whom 24 (30%) were Asian (Chinese, Eurasian, or Indian) and 56 (70%) European. There were 59 women, of whom 17 (29%) were Asian and 42 (71%) European.

Venous blood samples were collected with minimal stasis, and the oxalate mixture of Heller and Paul (1934) was used as an anticoagulant. The subjects were recumbent for a few minutes before and during the collection of the blood. The samples were kept in stoppered bottles and stored at about 4° C. until required. Estimations were made within a few hours of collection, except in a few instances in which there was a delay of 24 hours. Plasma was obtained by centrifuging the blood in stoppered tubes. Before transferring the blood to these tubes it was thoroughly mixed in the storage bottles.

Estimations of the specific gravity of the plasma were made by the method of Phillips *et al.* (1950) and the results converted to equivalent total protein concentration by the application of a suitable formula. It was necessary to determine which of the formulae suggested by previous investigators (Moore and Van Slyke, 1930; Kagan, 1938; Phillips *et al.*, 1945; etc.) was the most suitable in the present instance. Simultaneous estimations of the specific gravity and of the total nitrogen content were therefore made on 25 samples of plasma obtained from men and women. These were sometimes pooled if individual quantities were insufficient for analysis. The total nitrogen was estimated by the macro-Kjeldahl method and converted to the equivalent amount of total protein by multiplying by 6.25 (Hawk *et al.*, 1947). Duplicate and blank determinations were made in each instance. In making these estimations 1 ml. of plasma was treated with 20 ml. of concentrated sulphuric acid. A mixture of copper sulphate (0.1 to 0.2 g.) and potassium sulphate (5 to 10 g.) was added. Digestion was continued for four to five hours after the mixture became clear.

In a separate investigation it was found that the same results were obtained on prolonging the oxidation for 10 hours. The method was found accurate when applied to a standard solution of ammonium sulphate of known nitrogen content. Recovery experiments were also made, using preserved ox plasma to which known amounts of nitrogen from a standard ammonium sulphate solution were added. There was always a recovery of at least 87%.

## Results

The most suitable formula for converting specific gravity measurements to total protein concentration in the present investigation was that proposed by Phillips *et al.* (1945), if no correction was made for the presence of oxalate. This formula was :

$$P = 360 (s - 1.007)$$

where P was the total protein in grammes per 100 ml. and s was the observed specific gravity of the plasma specimen. The mean plasma protein concentration of the 25 samples estimated from total nitrogen content was 7.68 g. per 100 ml., and that derived from specific gravity measurements was 7.67 g. per 100 ml.

Applying the above formula to specific gravity measurements, the mean plasma protein concentration of 80 men was 7.8 g. per 100 ml., and of 59 women 7.6 g. per 100 ml. The difference between the mean plasma protein concentration of Asians and that of Europeans was not statistically significant either for men or for women. The difference between the mean figure for men and that for women was also not significant. Details are given in the Table.

### Plasma Protein Concentration of Healthy Men and Women Living in Singapore

| Group                  | No. | Plasma Protein (g./100 ml.) | S.D.  | S.E. of Mean | "t"    | P  |
|------------------------|-----|-----------------------------|-------|--------------|--------|----|
| <i>Males</i>           |     |                             |       |              |        |    |
| Asian ..               | 24  | 7.69                        | 1.682 | 0.3433       | } 0.62 | 50 |
| European ..            | 56  | 7.89                        | 1.136 | 0.1517       |        |    |
| <i>Females</i>         |     |                             |       |              |        |    |
| Asian ..               | 17  | 7.78                        | 2.025 | 0.4911       | } 0.58 | 50 |
| European ..            | 42  | 7.53                        | 1.246 | 0.1922       |        |    |
| <i>Combined Groups</i> |     |                             |       |              |        |    |
| All males ..           | 80  | 7.84                        | 0.987 | 0.1103       | } 1.4  | 10 |
| .. females             | 59  | 7.59                        | 1.106 | 0.1439       |        |    |
| .. samples             | 164 | 7.7                         | 1.31  | 0.1023       |        |    |

The grand mean of all estimations made by the specific gravity method for plasma protein concentration of 80 men, of 59 women, and of 25 samples used in the course of the comparison with total nitrogen estimations was 7.7 g. per 100 ml.

## Discussion

Marrack and Hoch (1949), on reviewing the available literature, concluded that the mean total protein concentration of normal adults approximated to that found by Gutman *et al.* (1941)—namely, 7.2 g. per 100 ml. These estimations, however, were made on serum and not plasma. Even so the present findings suggest that living in a warm climate may be associated with a relatively high plasma protein concentration which is not caused by dehydration or increased formation of antibodies. An investigation of haemoglobin levels (Wadsworth, 1953) and of packed red cell volume (Wadsworth, 1952) did not suggest that healthy people living in Singapore suffered from haemoconcentration due to excessive loss of moisture from the body. Wills and Bell (1951) suggested that the comparatively high plasma protein concentration of the coloured subjects of their investigation might have been due to a high antibody content of the blood; but Singapore is free from chronic endemic infections which might give rise to such antibody formation, and no increase of the plasma protein concentration can be expected from such a cause.

Although an ammonium salt was used in the present investigation in the anticoagulant mixture, the amount was too small to affect the results of the total nitrogen estimations.

The experiments of Bazett (1949) suggested that the amount of protein in the plasma varied in such a way as to counteract the movement of fluid from the blood into the tissue spaces. A high concentration of plasma proteins in the blood of people living in the Tropics may therefore

be the result of a compensatory change to prevent an excessive loss of fluid from the blood into the tissue spaces.

It is necessary to state that the present investigation was not concerned with the universal application of a particular formula for the conversion of plasma specific gravity to total protein concentration. The formula adopted was found accurate when applied to specific gravity measurements made in the circumstances of the present investigation, but it does not follow that it would yield accurate results when applied to such measurements made elsewhere. The discrepancy between results of investigations of total plasma protein concentration made by different authors indicates that more rigid standardization of technique should be used if the influence of climate and other factors on this value is to be accurately assessed. In the absence of such standardization each series of determinations must be checked against some method of known accuracy.

## Summary

The plasma protein concentration of 80 men and 59 women was measured by the copper sulphate specific gravity method, and found to be 7.8 g. and 7.6 g. per 100 ml. respectively.

The accuracy of the method was tested against estimations of total nitrogen made by the macro-Kjeldahl method. Close agreement was found between the two series of estimations.

The difference between the mean plasma protein concentration of Asians and that of Europeans was not statistically significant.

The findings suggest that living in a warm climate might be associated with a relatively high plasma protein concentration which is not a result of dehydration or of increased antibody formation.

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Last financial year (1952-3) the British Council's grant from United Kingdom public funds was cut by 8% to just over £2.5 million. In the annual report giving these figures, the council devotes a chapter to its work in science and medicine. The British Council makes no attempt to interpret science to the general public overseas, but addresses itself solely to professional associations and universities. It does this by providing facilities for personal contacts between scientists, by distributing and publicizing scientific material, and through its own publications. In the medical field last year the council sponsored 12 overseas lecture tours or advisory visits by eminent British medical workers; it helped arrange the programme of nearly 500 foreign students, research workers, and medical visitors; it arranged for the showing of British medical films abroad; and it published the *British Medical Book List*—a guide to new medical publications for overseas booksellers—and the *British Medical Bulletin*. In addition the council has carried out a survey of medical, scientific, and engineering graduates who either visited or left Britain for the purpose of advanced study and research. Of these 40% were medical.