Table 1. MUCOPROTEINS IN SERUM AND AQUEOUS HUMOUR

	Serum		Aqueous humour			
	No. of rats	Muco-proteins Galactose-mannose (mgm./per cent)	No. of samples pooled	Muco-proteins Galactose-mannose (mgm./per cent)	No. of pools	Total sugar Galactose-mannose (mgm./per cent)
Diœstrus	40	190 ±3	6	99·6±8	4	178·4±22
Pro-œstrus	15	200·5±5	4	69·0±8	2	140 ±2
Œstrus	24	214 ±6	9	51·8±3	4	147·7±7
Met-œstrus	18	200·3±6	4	67·3±9	3	160±3
Males	30	188 ±10	5	67·7±5	3	174·1±0·5

Quantitative results are presented in Table 1. From these results, we conclude that a cyclic variation in the content and quality of the mucoproteins of the serum and aqueous humour exists in the sexual cycle of the female rat. In the male rat, the values are similar to those found in the female rat in diœstrus. It may be supposed that the œstrogens are responsible for the variations seen.

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[1] Asboe-Hansen, G., *Amer. J. Med.*, **26**, 470 (1959).
[2] Shetlar, M. R., Foster, J. V., and Everett, M. R., *Proc. Soc. Exp. Biol.*, **67**, 125 (1948).
[3] Blumenkratz, N., *Clin. Chem.*, **3**, 696 (1957).
[4] Blumenkrantz, N., and Moreno, A. R., *Laboratorio* (in the press).

Effect of Altitude on the Body/Venous Hæmatocrit Ratio

THE concentration of red cells is not the same in all parts of the circulatory system[1], the cell plasma ratio being lower in the capillaries and small vessels than in the larger arteries and veins. The over-all cell percentage (body hæmatocrit) is determined from the direct measurement of both red cell volume and plasma volume, and from this the body/venous hæmatocrit ratio (*BH/VH* ratio) is calculated. In normal adults resident at sea-level the *BH/VH* ratio averages 0·91 (ref. 2).

Little is known of the constancy of the *BH/VH* ratio in varying physiological and pathological conditions. The ratio increases during pregnancy[3], and in patients with splenomegaly[4], and may decrease in congestive heart failure with fluid retention[5].

In subjects resident at an altitude of 5,740 ft. above sea-level there is contraction of the plasma volume[6], and an increase in red cell volume[7], compared with values at sea-level. It is not known, however, whether the *BH/VH* ratio remains at 0·91. To investigate this an investigation was undertaken, where red cell volume was measured with red cells labelled with chromium-51 and plasma volume with radio-iodinated human serum albumin. Venous hæmatocrit was measured in a microhæmatocrit centrifuge, spinning at 12,000*g*. Observations were made on 36 young White adult males, 18 resident at sea-level (Durban) and 18 resident at an altitude of 5,740 ft. (Johannesburg). The results are shown in Table 1. The difference in the mean *BH/VH* ratio in the two groups is highly significant ($t = 5{\cdot}17$; $P = < 0{\cdot}01$).

The raised body hæmatocrit in subjects resident at a high altitude probably represents a compensatory

Table 1. BLOOD VOLUME IN SUBJECTS RESIDENT AT SEA-LEVEL AND AT 5,740 FT.

No. of subjects	Altitude	Red cell volume (^{51}Cr) (ml./kgm.)	Plasma volume (RISA) (ml./kgm.)	Venous haemato-crit (per cent)	Body haemato-crit (per cent)	Body venous haemato-crit ratio
18	Sea-level	30·53± 0·694	43·96± 0·799	45·83± 0·512	40·99± 0·358	0·902± 0·00965
18	5,740 ft.	35·72± 0·817	41·40± 0·584	48·11± 0·551	46·25± 0·549	0·962± 0·00830

mechanism enabling more red cells per unit volume to pass through the lungs in unit time. This compensation in capillaries is evidently not completely reflected in the larger vessels, and the *BH/VH* ratio is thus nearer unity in subjects resident at this altitude.

There is evidence from experiments on animals that the response to altitude is not uniform throughout the body vascular system. Thus in rats exposed to simulated altitudes of 20,000–22,000 ft. for periods of 1–4 weeks there is a greater increase in the capacity of the non-capillary vessels (arteries, veins, arterioles and venules) than in the capillary bed[8].

This observation has practical application in the routine clinical estimation of volume of blood. In practice, either the red cell volume or plasma volume are measured directly, and the other compartment then calculated from the body hæmatocrit, which is the product of the venous hæmatocrit and the *BH/VH* ratio. In subjects resident at altitudes above sea-level it is inaccurate to assume a *BH/VH* ratio of 0·91, and it is necessary to determine this value for subjects resident at any particular altitude.

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[1] Gibson, J. G., Seligman, A. M., Peacock, W. C., Aub, J. C., Fine, J., and Evans, R. D., *J. Clin. Invest.*, **25**, 848 (1946).
[2] Chaplin, jun., H., Mollison, P. L., and Vetter, H., *J. Clin. Invest.*, **32**, 1309 (1953).
[3] Caton, W. L., Roby, C. C., Reid, D. E., Casewell, R., Maletskos, C. J., Fluharty, R. G., and Gibson, J. G., *Amer. J. Obst. and Gynec.*, **61**, 1207 (1951).
[4] Rothschild, M. A., Bauman, A., Yalow, R. S., and Berson, S. A., *J. App. Physiol.*, **6**, 701 (1954).
[5] Schreiber, S. S., Bauman, A., Yalow, R. S., and Berson, S. A., *J. Clin. Invest.*, **33**, 578 (1954).
[6] Ellis, B. C., *S. Afr. J. Med. Sci.*, **18**, 45 (1953).
[7] Levin, N. W., Metz, J., Hart, D., Boardman, R. G., Farber, S. A., and Gazides, C. (unpublished work).
[8] Anthony, A., and Kreider, J., *Amer. J. Physiol.*, **200**, 523 (1961).

Plasma Clearance of *p*-Aminohippuric Acid by the Kidneys of Fœtal, Neonatal and Adult Sheep

AN investigation into the development of secretory activity in the renal tubules has been undertaken using *p*-aminohippuric acid.

Observations were made on fœtuses ranging from 89 days to 148 days (term), on lambs up to 2 weeks and on Welsh Mountain ewes. Pregnant ewes received a procaine spinal anæsthetic supplemented when necessary during the course of the experiment