Letters to the Editor

It has also been reported that with the use of capillary viscometers blood is slightly thixotropic, but we doubt whether this could be demonstrated in a rotational viscometer provided the blood was well mixed beforehand.

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Professor Stuart and Dr Kenny reply as follows:

It has been reported on several occasions that viscosity measurements on human blood are dependent on both time and rate of shear.¹⁻⁵ Using a Contraves Low-Shear 30 viscometer, we have exposed normal blood to increasing shear rate over the range 0-1.0 mPas. The resulting viscosity tracing (or rheogram) showed a progressive decrease in viscosity as shear rate increased. When the process was reversed, so that the same specimen was exposed to progressively decreasing shear, the reverse tracing did not follow the original curve but showed a lower viscosity at all shear rates, indicating an alteration in the characteristics of the blood. This phenomenon, probably a consequence of red cell disaggregation, is consistent and reproducible and demonstrates that viscosity is time and shear-rate dependent under these experimental conditions of low shear.

The variable shear-stress instrument used by Davenport and Roath works on a different principle and will require to be evaluated in its own right. We estimate, however, that the shear-rate range produced by the shear stresses stated is much higher than our own so that rouleaux would be dispersed. Few rheologists would support the suggestion that a viscometer should first be operated at high shear in order to 'mix' blood before readings at low shear are made. As the authors seem to have demonstrated, this technique will disperse rouleaux for several minutes. Yet the effect of plasma proteins in causing rouleaux formation at low shear is probably one of the most important determinants of hyperviscosity in patients with vascular disease.

Rheologists are, of course, aware that temperature is a critical determinant of viscosity and must be rigorously controlled. Adequate mixing, but not shearing, of blood before testing is also essential, and

even when a well-mixed specimen has been placed in the viscometer cup, the instrument should begin rotation within 60 seconds to avoid false-low readings at low shear rates as a consequence of red cell settling (Inglis, Carson, and Stuart, unpublished).

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References

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- ² Dintenfass L. Thixotropy of blood and proneness to thrombus formation. *Circ Res* 1962;11:233-9.
- ³ Dintenfass L. Study in thixotropy of concentrated pigment suspensions. Part II. Thixotropic recovery and non-equilibria states. *Rheol Acta* 1962;2: 187-202.
- ⁴ Huang CR, Fabisiak W. Thixotropic parameters of whole human blood. In: Copley AL, Okamoto S, eds. *Hemorheology and Thrombosis. Proceedings of the United States-Japan Cooperative Seminar, Kobe, Japan*. New York: Pergamon Press, 1976;1-8.
- ⁵ Dintenfass L. *Rheology of Blood in Diagnostic and Preventive Medicine*. London: Butterworths, 1976.

Book reviews

Clinics in Haematology. Vol 9. No. 2. 'The Porphyrrias.' Ed A Goldberg and MR Moore. (Pp 226; illustrated; £9.) WB Saunders. 1980.

The porphyrias are a fascinating group of disorders, which impose themselves on all clinical specialties. This monograph is particularly timely because during the past few years the enzyme defect has been demonstrated in at least three of these diseases, our understanding of the pathogenesis of the clinical syndromes has been significantly increased, and there have been useful methodological developments.

In the first chapter Dr Moore takes us gently but thoroughly through the biosynthesis of porphyrins. The acute and cutaneous porphyrias are fully discussed in the subsequent two chapters. Variegate porphyria is reviewed by Dr Kramer, and recent studies on the neurotoxicity of amino-laevulinic acid are described. The unique experience of Professor Ippen's group with congenital porphyria include new clinical observations. An interesting chapter by Dr With on porphyrias in animals and an important contribution on the clinical chemistry of the porphyrias by Professor Elder are followed by a section on drugs and hepatic porphyrias and a discussion of abnormalities of porphyrin metabolism in diseases other than the porphyrias.

This is an excellent monograph; the contributors reflect Who's Who of the porphyrias, and even George III would be pleased! Perhaps the use of consistent nomenclature throughout the various chapters would have been helpful but nevertheless it is a highly recommended book.

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Medical Information Systems. Ralph R Grams. (Pp 464; 114 Figs + 40 charts; \$49.50.) The Humana Press Inc. 1979.

Readers of this book will have much to interest them concerning the definition and analysis of the problems that face a clinical pathology department introducing a computer into its management. Nevertheless since the system described in this