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Mathematical models for determining intestinal permeability using polyethylene glycol

SIR.—Sundqvist *et al*¹ have described three methods for comparing the relative absorption of polyethylene glycol (PEG) through the intestinal wall: (1) by comparing the median values of the molecular weights, (2) by curve fitting to a normal distribution and comparing the mean and standard deviations, and (3) by curve fitting to modified Butterworth filter functions^{2,3} and comparing the seven parameters obtained. The latter method described, if workable, would present a novel procedure for quantifying difficulties in the passage of either high or low molecular weight molecules in diseased patients. Unfortunately, there appears some doubt on the applicability of the methods mainly because of apparent discrepancies with their curve fitting procedures. The first difficulty is that the methods as reported¹ had only been tested for one 'healthy' and one chronic Crohn's disease patient. Secondly, the standard deviation of the distribution illustrated in their Fig. 2 (~80) is incompatible with the values quoted in their Table 1 (26–27). In addition, the means of the distributions quoted in Table 1 for a chronic patient represents less than only a 7% increase than that for a healthy patient. The actual imprecision of the means may be greater than this difference, particularly for patients with less severe forms of the disease. In fact other data for untreated coeliac disease suggest a diminished absorption of all the molecular weight species of PEG 400⁴ with, in addition, increased restriction to the passage of the higher molecular weight components (mol wt 462–550).⁵ Finally, their use of a modified Marquadt's algorithm to extract seven parameters (two of them exponents) from the nine rather noisy data points of Fig. 3 appears rather optimistic. Our own attempts to extract the parameter values given in Table 2 from the data of Fig. 3 using an advanced Gauss-Newton algorithm (NAG E04GEF⁵) not surprisingly failed because of the lack of a clearly defined minimum. Because of the absence of adequate tests for the proposed methods and also apparent uncertainties in the numerical analysis the preliminary conclusions of Sundqvist *et al*¹ on the

applicability of their method should be taken with some caution.

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References

- 1 Sundqvist T, Magnusson KE, Sjö Dahl R, Sternström I, Tagesson C. Passage of molecules through the wall of the gastrointestinal tract. II. Application of low molecular-weight polyethylene glycol and a deterministic mathematical model for determining intestinal permeability in man. *Gut* 1980; **21**: 208–14.
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Books

The liver: biology and pathobiology Edited by I M Arias, H Popper, D Schachter and D A Shafritz. (Pp. 897; illustrated; \$117.80.) New York: Raven Press, 1982.

There are many books about the liver, but few are so scientifically stimulating, so up-to-date, and so well written and illustrated, as the present volume. The book attempts to bring basic sciences directly in relation to liver biology and disease processes in man. Thus the volume commences with the hepatocyte. The various organelles and their function and metabolism generally are fully discussed and illustrated with excellent electromicrographs. This section is followed by one on bile secretion. The Kupffer cells have been the Cinderella of the liver, but their growing importance is stressed by three excellent chapters on their