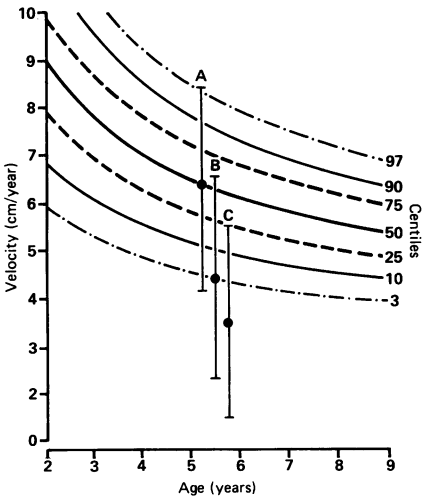
LETTERS TO THE EDITOR

Tests for growth hormone secretion

SIR,—The reproducibility of pharmacological and physiological tests for growth hormone deficiency is rightly questioned in the annotation by Brook and Hindmarsh.[1] The authors, however, do not consider the reproducibility of the measurement of height. We recently demonstrated the unavoidable imprecision of height measurement,[2] and emphasise here its serious implications for the interpretation of short term growth data. We are particularly concerned about the estimation of velocity, where the errors from two height measurements rather than one are involved.

In their 'plan for action', Brook and Hindmarsh advise: 'Measure the child and . . . measure the child again after four months and calculate the annual velocity'. To base a velocity on measurements four months apart greatly increases the error of measurement already associated with the estimation of velocity over 12 months. It has been shown that the SD for a single height measurement made by experienced observers lies in the region of 0·25 cm.[2-5] (Any claim of a lower SD may well imply correlated measurement errors, as will happen, for example, if the calibration trials are not blind.) Given a typical SD of 0·25 cm, the 95% confidence interval for an annual velocity, calculated from the formula 2 (SD)$\sqrt{2}$, is the observed increment ±0·71 cm/year. Where the measurements are only four months apart, instead of the standard 12, the confidence interval for an annual velocity triples in length. On this basis, the 95% confidence interval for a child between the ages of 5 and 6 years, estimated to be growing, for example, at the 50th centile for velocity, would lie between 4·2 and 8·4 cm/year, and more than span the whole centile range on the chart (A on the figure). A four month velocity cannot give any indication of current growth.



95% confidence interval for an annual velocity based on two measurements of height, four months apart for: (A) a child estimated to be on the 50th centile for velocity; (B) a child estimated to be on the 3rd centile for velocity; and (C) a child with upper confidence limit for velocity on the 25th centile. The observed velocity lies below the first centile.

Furthermore, we have shown,[6] and the authors have previously stated,[7] that there is little correlation between successive height velocities. Velocity cannot therefore in practice be used to predict future growth.

The appeal of velocity lies in the label it provides. The label 'slow grower' tends to generate action, which is often expected of the clinician, but whether the label is appropriately applied is seldom questioned. The Middlesex height velocity assessment chart—indeed any velocity chart—while attractive conceptually, may be deceptive clinically. We are sure that the authors, in their advice as to when to take 'immediate action', did not mean to imply that where a single four month velocity lies below the third centile, the paediatrician should seriously consider the 'option of . . . giving the child growth hormone'. A velocity, estimated to be on the third centile, could in reality be as high as the 60th (B on figure). To be 95% confident, after only four months, that a 5 year old was growing slowly—that is, at a rate below the 25th centile for velocity, the annual velocity would have to be less than 3·5 cm/year (C on figure). This cut off point lies well below the first centile, and not the 20th as illustrated on the Middlesex chart.

We would again recommend that those involved in the measurement of children establish their own error, in the way we have suggested, and verify for themselves the serious limitations of short term velocity in the assessment of growth.[2] There are no short cuts to replace the need for long term monitoring.

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1 Brook CGD, Hindmarsh PC. Tests for growth hormone secretion. *Arch Dis Child* 1991;**66**: 85–7.
2 Voss LD, Bailey BJR, Cumming K, Wilkin TJ, Betts PR. The reliability of height measurement. *Arch Dis Child* 1990;**65**:1340–44.
3 Tanner JM. Physical development. *Br Med Bull* 1986;**42**:131–8.
4 Preece MA. The anthropometric considerations in the evaluation of growth-prompting treatments. In: Ranke MB, Bierich JR, eds. *Paediatric endocrinology—past and future*. Munich: MD-Verlag, 1986.
5 Prader A, Largo RH, Molinari L, Issler C. Physical growth of Swiss children from birth to 20 years of age. *Helv Paediatr Acta* 1988;Suppl 52:3–33.
6 Voss LD, Walker J, Lunt H, Wilkin TJ, Betts PR. The Wessex Growth Study: first Report. *Acta Paediatr Scand (Suppl)* 1989;**349**: 65–72.
7 Brook CDG, Hindmarsh PG, Healy MJR. A better way to detect growth failure. *BMJ* 1986; **293**:1186.

Professor Brook and Dr Hindmarsh comment:
The comments from the Southampton group are noted. As the article was directed at tests of growth hormone secretion our interests lay in the brief given rather than a discussion of errors of height measurement, which, as the authors point out, have been documented by groups in Switzerland and the United Kingdom. As they show, short term measures require different charts for decision making. In practice, however, growth rates less than the third centile nearly always indicate a clinical problem so we stand by our plan.

It should be pointed out that growth velocity is better estimated by linear regression of all measurements obtained over a 12 month period and not based on the extremes of the measurement period which will lead to the sort of errors discussed. The advantage is that all data points are used, including multiple measures on the same day. Growth velocity can then be calculated with an estimate of error.

A disproportionate emphasis is still placed on endocrine tests in establishing the need for growth hormone treatment. Our annotation sought to put this in perspective. As the Southampton group have demonstrated, growth measures are a lot more reliable than any of the current tests available for estimating growth hormone secretory status, placing auxology foremost in the assessment of growth and its disorders in children, even with the inaccuracies to which they have rightly drawn attention.

Gut blood flow velocities in the newborn

SIR,—We read with interest the study by Coombs *et al* of the effects of parenteral indomethacin on splanchnic blood flow.[1] However we were surprised that no mention was made as to how the patency of the ductus arteriosus was established. In describing both the study and control groups the terms 'symptomatic' and 'clinical' lead to the assumption that echo Doppler cardiography was not performed. Surely in order to determine accurately the effect of a patent ductus arteriosus on splanchnic blood flow, with or without parenteral indomethacin, it is essential to assess accurately the direction of flow and the pressure gradient across the ductus for both systole and diastole. The statements that: (1) indomethacin has effects on splanchnic flow independent of its actions on the ductus and (2) the slow administration of parenteral indomethacin shows no apparent loss of efficacy on ductal closure, cannot be concluded from this study and are potentially misleading due to the lack of accurate haemodynamic documentation.

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1 Coombs RC, Morgan MEI, Durbin GM, Booth IW, McNeish AS. Gut blood flow velocities in the newborn: Effects of patent ductus arteriosus and parenteral indomethacin. *Arch Dis Child* 1990;65:1067–71.

Dr Coombs comments:
While echo Doppler cardiography may be the gold standard for diagnosing a patent ductus arteriosus, most UK neonatologists when deciding on the need for treatment rely, as we did, on the clinical findings of a characteristic murmur, bouncy pulses, a wide pulse pressure, an increase in oxygen requirements, and evidence of heart failure. These clinical findings were present in all the babies comprising the study group and were not seen in the control group. Supporting, but not influencing, the clinician's decision to treat was the finding in the babies studied of the absence of retrograde diastolic flow in the superior mesenteric artery, an indication of left to right shunt.

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