some of the principal leg muscles, and so more energy expenditure. That view suffered a nasty blow when it was shown that the metabolic cost of running for lizards was about the same as for mammals of equal mass, running at the same speed. The new story (reviewed in Bramble's chapter in the book) depends on Carrier's demonstration that lizards do not and apparently cannot breathe when running, because these two activities require different patterns of activity in the muscles of the body wall. To become capable of sustained running, mammals had to evolve a gait that was compatible with breathing. That story now seems much more convincing than the old one, but it may be superceded (the old one seemed very convincing, in its time). It has changed our view of the evolution of mammalian gait, but it does not seem to me that the new story makes any difference to our general understanding of how integrated systems evolve. Many of the other persuasive scenarios in the book do not even have the merit of being novel.

Few of the morphologists at the conference succeeded in using the particular cases that they studied to throw general light on the evolution of complex systems. In this respect, Lauder and Liem did better than most. They stress that what is possible in evolution depends on the point from which you start. For example, the anabantoid fishes have evolved two mechanisms for breathing air that enable them to survive in foul, stagnant water. One group of them has evolved a mechanism that will work only when the fish is largely submerged but another has a mechanism that will still work if they leave the water. Only the second group could evolve the habits that have made *Anabas*, the climbing perch, famous.

Functional morphological studies often suggest that optimal performance depends on integration between characters, but seldom actually demonstrate it. Emerson and Arnold describe a study in which sprint speeds of new born garter snakes were measured, and also their numbers of vertebrae. Snakes with more than the average number of vertebrae in their tails crawl fastest if they also have more than the average number in the rest of the body, and snakes with fewer than average in the tail do best with fewer than average in the body. However, this might look less like interaction between characters if the characters had been defined differently, if instead of tail vertebra number and body vertebra number the authors had considered total vertebra number and fractional allocation to the tail.

Schluter makes a related point in his discussion of the evolution of finches. He points out that he might choose to describe beaks by giving their length and depth, or alternatively by giving measures of overall size and of proportions. Should evolution from a short, shallow beak to a long, deep one be regarded as two changes (in length and in depth) or as one (a change in size, while shape remains constant)? The question has disturbing implications for morphologists who use parsimony as a criterion for constructing evolutionary trees.

I return to garter snakes, which feature also in Bennett's paper. He describes an investigation in which young garter snakes were released into the wild after their maximum sprint and sustained speeds had been measured, and their survival was followed for several years. This is a rare example of an attempt to relate performance to fitness. Its potential value is greatly enhanced by the findings that the locomotor traits that were studied are highly variable, hereditable and repeatable from year to year. There was also little correlation between the traits.

Despite highlights like these, I found the book generally unsatisfactory. Many of the points made in the papers will be incomprehensible to readers who do not already have a good knowledge of vertebrate morphology. Few case studies are presented in detail and there are only 53 illustrations in a book of 451 pages. The group reports are bland consensus views though there are frequent references to two parties (internalists and externalists, or structuralists and functionalists) who seem to have squabbled at the meeting. I do not feel that my understanding of the evolution of complex systems has been very much increased.

R. McNEILL ALEXANDER
Department of Pure and Applied Biology, University of Leeds

Handbook of Normal Physical Measurements. By JUDITH G. HALL. URSULA G. FROSTER-ISKENIUS and JUDITH E. ALLANSON. Oxford Medical Publications. 504 pages. Price £25.00 ISBN 0 19 261696 X.

The stated purpose of this handbook is to 'provide a practical collection of reference data on a variety of physical measurements for use in the evaluation of children and adults with dysmorphic features and/or structural anomalies'. By and large it succeeds admirably in this aim. There is an introduction and 17 chapters describing measurement techniques, height, length and weight, different body areas (including dermatoglyphics and trichoglyphics), developmental screening techniques and data and postmortem organ weights. There are useful chapters on prenatal ultrasound measurements, how to approach the differential diagnosis of a child with dysmorphic features and a chapter of growth curves for specific conditions such as Down and Turner syndromes.

In each chapter there is a brief but clear introduction to the relevant embryology, measurement landmarks, instruments and techniques plus relevant references. A glossary defines many of the specialist terms used. The data collected are wide-ranging and generally comprehensive.

In this book, as in so much of medicine, we are concerned with data defining normality in a quantitative sense – what are the normal limits of biological and morphological variables. This is an important basis of knowledge from which to ask questions about qualitative aspects of normality – is an individual physiologically correct or rightly functioning? The authors are strict in sticking to physical data (other than in the chapter on IQ testing and developmental screening). Thus there are data on chest circumference and thoracic index but not, for example, on normal peak flow rates [Godfrey *et al.*, *British Journal of Diseases of the Chest* **64**, 15 (1970)] nor on electrocardiographic or blood pressure data.

As one might expect with a geneticist and obstetrician/gynaecologist but no paediatrician among the authors, in many chapters the morphological descriptions are better than the practical measurement instructions. In chapter 4 there is inadequate description of the technique of exerting gentle pressure under the mastoid processes to overcome any postural drop. Both this and the suggestion that a tape measure be used if a stadiometer or infant measuring table is unavailable will lead to significant errors and the latter overlooks the widening range of more accurate but still cheap and portable devices (e.g. the 'Minimetre') which are becoming available for height and length measurements. The posture problem is inadvertently highlighted by the medical artist who shows the infant in fig. 4.1 (b) and child in fig. 4.5 (b) in a hopeless position for obtaining an accurate measurement by any technique. It would be worth emphasising in the introduction that the accuracy of all measurements depends both on the apparatus used and the care with which the measurer takes the reading.

Occasionally the Canadian/European bias of the authors shows itself. The height prediction section (p. 51) concentrates exclusively on the Bayley and Pinneau tables and no mention is made of the Tanner and Whitehouse predictive equations. This omission is reflected in the section in the radiographic chapter on bone age estimation (p. 378) where the Tanner and Whitehouse system is not mentioned. It is based on rather old data and the American (Greulich and Pyle) data may, arguably, be more relevant to current British children! Nevertheless an advantage is that one cannot 'cheat' with the Tanner and Whitehouse method to get an approximate but inaccurate score by viewing the hand and wrist radiograph as a whole – as busy radiologists are inclined to do with the Greulich and Pyle atlas. Tanner and Whitehouse skinfold data are also omitted and the technique for skinfold measurements is inadequately described.

No comments are made, in the section (one paragraph!) on height velocity, of the need to interpret velocity in the context of pubertal staging. Failure to do so will result in seriously misleading conclusions about the normality or otherwise of the child's growth. More descriptive emphasis should be given to such factors as the timing of the growth spurt and deceleration before menarche. More needs to be emphasized about the dynamism of growth, the importance and interpretation of velocity data in assessing normality and how frequently measurements should be made.

Retraction of the foreskin in infants to measure penile length is definitely contraindicated – c.f. the advice on page 374.

The 'Special measurements for special conditions' chapter usefully gathers together disparate information but there is no mention of the data of Lyon *et al.* [*Archives of Disease in Childhood* **60**, 932–5 (1985)] on Turner syndrome despite the inclusion of older data.

Most of the figures and line drawings are clear (there are no clinical photographs) but occasionally too much information is crammed into too small an area of the page (e.g. figs 11.2, 12.7, 13.5). For a book of this complexity the proofreading is generally accurate but the legend for fig. 10.12 is misplaced on what should be fig. 10.10 (p. 326) which presumably relates to the Goodman and Gorlin reference on page 325. In fig. 13.8 (p. 381) the data for females of 11 years and over is wrongly labelled and there is an extra number (35·9?) in the 11 year column which throws the alignment out.

The references are generally up to date but in a book published at the end of 1989 it is surprising to see references to the 3rd edition (1982) of the late David Smith's 'bible' *Recognisable Patterns of Human Malformation* when the 4th edition appeared in 1988. The index is adequate though, for example, if you look up 'hand' you are directed to the 'Limbs' chapter only and not to the section on dermatoglyphics or the radiographic section where hand bone length profiles are discussed.

In the introduction the book is described as 'a small pocket book...easily carried by the physician to the ward or "the field"'. One of the few data sets omitted are the centiles for pockets in North America and Europe but a 504-page book that measures 20·3 cm by 13·7 cm by 2·8 cm certainly does not fit in mine and weighing in at 620 g (even in its wipeable 'flexicover') would induce deformity even if it did! Nevertheless, the chunky format is easy to handle and the layout and typography (with the exceptions noted above) are clear making the book easy to read and surprisingly compulsive to dip into! At £25 I think it is good value for money. All paediatricians, physicians interested in dysmorphology and clinical geneticists should have access to a copy. Mine will stay near at hand and will be much consulted.

C. J. H. KELNAR
Royal Hospital for Sick Children, Edinburgh and Senior Lecturer in Child Health, University of Edinburgh