From my point of view, the most important contribution of the NCHS reference was that it enabled the traditional index of weight-for-age to be separated into two biologically different components: weight-for-height and height-for-weight. I proposed the terms 'wasting' and 'stunting' for extremes of deficits in these two components, because they describe what one actually sees, in a more graphic way than more speculative names such as 'acute' and 'chronic' malnutrition. Certainly these two names imply a value judgement or norm, since they are defined as deviations of more than 2SDs below the reference mean.

Nevertheless, in spite of uncertainty about the validity of the reference, I believe that a high prevalence of stunted children in a population is an indicator of a disadvantaged environment, though precisely what the disadvantage is, whether nutritional, repeated infection or whatever, we do not know. An economist has described stunting as a beneficent adaptation, because a stunted child needs less food. That may be so, but the 'adaptation' comes at a huge cost. The stunted child is impaired in mental as well as in physical development, as shown by the studies of Grantham-McGregor *et al*. In a recent series of papers in the *Lancet*[4] some workers have found that stunting is reversible when the child is transferred to a better environment, others not. A fascinating paradox is described by Satyanarayana *et al*. In India[5] poor children at 5 years of age had a very large height deficit compared with their well-to-do peers; between 5 and 18 they grew as much in stature as children in California, but they never made up the deficit with which they started.

Thanks to the NCHS we know a good deal about the natural history of stunting. I am not well up on the literature; I know of little work on the biochemical or metabolic defect that is holding back growth. Perhaps there may be a hint in the finding of Millward's group that rats on a low-protein diet had decreased synthesis of the proteoglycans of cartilage[6], but that is only a beginning.

Why do I go on about this? I ask myself does the 'new nutrition science' provide any stimulus to tackle the old but very important problem of stunting – a problem that involves nutritionists at all levels: the biochemist, the epidemiologist, the administrator? I can't see that it does.

John Waterlow
London, UK

doi: 10.1017/S1368980007721997

References

1 Cannon G. Infant and child growth and health: standards, principles, practice. *Public Health Nutrition* 2007; **10**: 106–8.
2 Waterlow J, Buzina A, Keller W, Lane J, Nichaman M, Tanner J. The presentation and use of height and weight data for comparing nutritional status of groups of children under the age of 10 years. *Bulletin of the World Health Organization* 1977; **55**: 489–98.
3 de Onis M, Garza C, Victora C, Bhan M, Norum K. The WHO Multicentre Growth Reference Study: rationale, planning and implementation. *Food and Nutrition Bulletin* 2004; **25**(1S): 3–84.
4 Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. International Child Development Steering Group. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369**: 60–70.
5 Satyanaranya K, Prasanna Krishna T, Narasiga Rao B. Effect of early childhood malnutrition and child labour on growth and adult nutritional status of rural Indian boys around Hyderabad. *Human Nutrition: Clinical Nutrition* 1986; **40C**: 131–9.
6 Yahya ZA, Tirapequi JO, Bates PC, Millward DJ. Influence of dietary protein, energy and corticosteroids on protein turnover, proteoglycan sulphation and growth of long bones and skeletal muscle in the rat. *Clinical Science* 1984; **87**: 607–18.

Geoffrey Cannon replies

Sir,

It is a pleasure and a privilege to debate these important matters with a great nutrition scientist whose contribution in particular to world child health is fundamental. Others should join in.

John Waterlow points out that the intention of the consultation he chaired[1] in identifying the US NCHS growth curves as 'references', was not to be normative. Respectfully, this is by the way. What matters is what then happened: not intentions, but effects. What I said – as he does – is that the NCHS numbers inevitably became values as soon as his paper was endorsed and the growth curves issued by the relevant UN agencies. Plus, once the word 'value' is added, as in 'reference value', the term becomes normative – and, if the concept that 'reference' is neutral is preserved, a contradiction in terms.

The growth charts for infants and children derived from the NCHS studies of formula-fed babies[2] became accepted as the norm – and still are, and will be, until they are everywhere discarded in favour of the new standards based on breastfed babies[3]. We now know that the numbers based on formula-fed children in the USA were an 'overshoot': the NCHS-derived charts identify a proportion of babies as 'failing to thrive' when they are actually growing at the natural rate, and as healthy when in fact they are overweight. As a result, paediatric health professionals all over the world, from chief government officers to volunteers equipped with a growth chart, a pencil, scales, a ruler and a dozen boxes of tins of infant formula and dried milk donated by the manufacturers, were – and still are – in the business of pushing growth. The human race has been and still is being reshaped, no doubt about that.

https://doi.org/10.1017/S1368980007722553 Published online by Cambridge University Press

Yes, below a certain range of weight and size, infants and young children are in danger. Yes, children deprived of nourishment by intestinal parasites are liable to remain disabled[4]. Yes, below a certain range of intake of food, adults become unproductive[5]. Yes, public health nutritionists charged to formulate policy proposals should estimate what these ranges are, with necessary caveats. Yes, prevalent feeding practices from birth to early childhood, in communities without proper security, sanitation and often shelter, contribute to countless deaths and result in disabled children and adults. Yes, young children who are famished, and very likely to be infected and infested, need immediate nourishment.

I have travelled in the backlands of Brazil and seen what deprivation, food insecurity, gross inequity and misery does to communities and their children. What I also have seen in India and Sri Lanka, in line with what another consultation chaired by John Waterlow hinted[6], is small skinny kids – who if netted, weighed and measured by a visiting expert, might well be marked down as two standard deviants, stunted, wasted or both, another ticked box then subjected to heroic extrapolation – who are more lively, talkative and energetic, and seem more sharp, sociable and enterprising, than big podgy kids.

It is one thing to state that countless babies and young children are born dangerously light and small. It is another thing to apply a statistical model and define all below the line as 'wasted' or 'stunted' irrespective of their state of health and well-being.

His students and readers know that John Waterlow's nature is challenging in the Socratic sense: he invites others to think, and to advance understanding. I sense he will agree that it is a completely different thing to assume that public health is best served by proclamations that promote the dumping of surplus energy-dense processed products on dispossessed populations in the name of aid (or Millennium Development Goals), with all the invalidation, dependency, helplessness and further transformation of poverty into misery[7] this implies.

Specifically, has the supply of countless millions of tonnes of formula feeds and dried milk to Asia and Africa in the last half-century improved overall public health and well-being? Or contributed to the good governance and independence of any country? Or enabled communities to become more self-sufficient? If any reader thinks so, let's see an evidence-based case.

John Waterlow wonders if the new nutrition, which defines the science as three-dimensional – biological, and also social and environmental[8] – casts any light on these issues. Yes, it does. In its social dimension it asks questions like those above. Its overall guiding principles are ethical, evolutionary and ecological. One specific principle in the biological dimension, with many others still subject to revision after discussion in three workshops, is: 'The single nutritional factor that most protects human health lifelong is sustained exclusive breastfeeding. The practice of breastfeeding is also emotionally vital, socially valuable, and environmentally sound'. Or, in other words: 'In biology, nothing makes sense except in the light of evolution'[9]. This was overlooked in the 1970s, as was the significance of human milk being uniquely low in protein.

Geoffrey Cannon
Rio de Janeiro, Brazil
Email: GeoffreyCannon@aol.com

doi: 10.1017/S1368980007722553

References

1 Waterlow J, Buzina R, Keller W, Lane J, Nichaman M, Tanner J. The presentation and use of height and weight data for comparing nutritional status of groups of children under the age of 10 years. *Bulletin of the World Health Organization* 1977; **55**: 489–98.
2 WHO. *A Growth Chart for International Use in Maternal and Child Health Care. Guidelines for Primary Health Care Personnel*. Geneva: WHO, 1978.
3 de Onis M, Garza C, Victora C, Bhan M, Norum K. The WHO Multicentre Growth Reference Study: rationale, planning and implementation. *Food and Nutrition Bulletin* 2004; **25**(1S): 3–84.
4 Mata L. *The Children of Santa Maria Cauque. A Prospective Filed Study of Health and Growth*. Boston, MA: MIT Press, 1978.
5 Fogel R. The persistence of misery in Europe and America before 1900 [Chapter 1]. *The Escape from Hunger and Premature Death, 1700–2100. Europe, America and the Third World*. Cambridge: University Press, 2004.
6 WHO. *Energy and Protein Requirements*. Report of a Joint FAO/WHO/UNU Expert Consultation. Technical Report Series No. 724. Geneva: WHO, 1985.
7 Rahnema R. *Quand la Misère Chasse le Pauvretè*. Paris: Fayard/Actes Sud, 2003.
8 The Giessen Declaration. Public Health Nutrition 2005; **8**(6A): 783–6. Also available at www.iuns.org.
9 Dobzhansky T. Nothing makes sense except in the light of evolution. *American Biological Teacher* 1973; **35**: 125–9.

https://doi.org/10.1017/S1368980007722553 Published online by Cambridge University Press