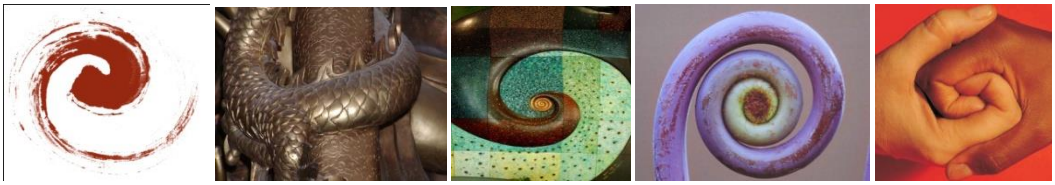
2013 March column
Geoffrey Cannon



Sao Paulo. 'In the beginning was the word' might now be rephrased, in much research science, as 'In the beginning, middle, and end, is the number'. (There is – I note with gloom – a book in the Old Testament named 'Numbers' (1). Yes, numbers are useful – see the headings above and below – but as servants, not as masters. Yes, we do need to know about quantity, as indicated in both stories here in this month's column, and also in the laws governing the proportions of spirals in nature and in art, like those shown above. But matters of quantity, however marvellous, such as the digital revolution that brings this column to you on the internet, are eventually mechanical.

We need also to understand or at least to accept quality, which is beyond the grasp of science of the types now dominant. Another great benefit of the internet is that this can readily be indicated by the use of beautiful or intriguing images, such as the spiral forms above, whose significance for new readers is explained below.

Note

1 Aptly. 'Numbers' can indeed be read with delight by a statistically-minded epidemiologist. It is deeply into enumeration, protocols, cohorts, confounding factors (such as leprosy), rejects (such as scabby beeves), and outliers (such as Bashanites and Midianites eliminated by smiting). Its doctrine of 'an eye for an eye' gives double-blinding a whole new dimension.

Food and nutrition, health and well-being
What I believe: 3 and 4

Here is my second column on 'what I believe'. As last month, the topics here are 'against the grain' of nutrition science as conventionally taught and practiced originally in Europe since the early 19th century CE. Yes, there is a justification for what may seem to be a cantankerous approach. Many current conventions do not fit

the facts of the 21st century – nor indeed of the late 20th century. We are in the midst of a new age (1).

The first topic I outlined last month concerns epistemology – the theory of knowledge. Here I believe that 'in the beginning is the idea'. In science it is not facts (quantity) but ideas (quality) that come first. Science is driven not by induction but by deduction. My second topic last month suggests that we should not think *nutrition* so much as *nourishment*. While being concerned with physical health, we should also engage with health and well-being in their mental, emotional and – fasten your seatbelts – spiritual aspects. More quality! In this mode I proposed last month that: 'Good meals can be celebrated in odes'.

This month my first theme is the now commonly accepted conceptual framework of nutrition as having biological, and also social, economic and environmental dimensions. This was a novel notion in 2005, when a large group of us came together and produced *The Giessen Declaration* on the *New Nutrition Science* (2). This month's second theme shows the new nutrition in action and proposes that: 'It is best to be small'. With both I tell some of the tales of the evolution of the ideas.

Notes

1 This new age. Students should absorb the masterwork of the Catalan master, Manuel Castells. Castells M. *The Information Age. Economy, Society and Culture.* Three volumes. Oxford: Blackwell, 2000, 2004. We can also look around us.

2 *The Giessen Declaration. Public Health Nutrition* 2005; **8**, 6A: 783-786.

Presentation

In what's below I use some slides. My presentations include photographs obviously taken at the time of the conference itself, up to an hour before I stand up. So participants know that I have not 'dusted off' a previous slide-set. My main purpose is to indicate that our work is in a context of time and place and is not 'objective' in being detached from circumstances.

Second, I show pictures of people who have influenced my way of thinking, and may quote from them, as you will see. The writer may be more significant than what is written. Also, much of what we write and say has already been said and written. Third, as evident in the slides following, while I respect the cascades of data projected by fellow presenters, my own shows are relatively fact-free. Following the general principle that science works by deduction, I try to show that facts (data, numbers, quantity, evidence) while essential, serve theories (principles, ideas, quality, judgement).

Public health and nutrition

Our four-dimensional world

Five spiral philosophers. From the left to right: Lao Tsu, Leonardo of Pisa (Fibonacci), Giambattista Vico; and also Tony McMichael and Colin Tudge

One can glimpse a great expansion in the horizons of the science of nutrition. The limited area that we had grown accustomed to is expanding. We are getting closer and closer, like a great magic wheel, to the ideas that the Greeks held about dietetics – as the dominion of life itself, both in the biological and social sense. It seems as if we are redefining nutrition as the beginning and end of life itself

JOSÉ MARIA BENGOA, BARCELONA, 28 SEPTEMBER 2006

José Maria Bengoa (1913-2010) has been seen as the father of public health nutrition. He would I think disavow any such tribute, for reasons indicated in his valedictory statement above, made at the First World Public Health Nutrition Congress in Barcelona in 2006. Properly understood, the whole of nutrition science should be concerned with the health of populations, and more besides. Why else practice it as a profession as distinct from a trade?

Also, in the classic tradition to which he refers, dietetics is the philosophy of the good life well led, of which nutrition in its specialised narrow modern sense is just one aspect. Wisdom comes from understanding where we have come from, and realising that many people who came before us were wiser than most of us are now. TS Eliot said in his pageant 'The Rock': 'Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?' Hold these thoughts please, in reading what follows.

The spiral philosophy

You may be curious about the people whose pictures introduce this story, and also perhaps about the spiral images that introduce this column. They are linked. We are breaking out of a strange age in which the nature of life itself, and the actual experience of living, has been neglected. It has been assumed that properly conducted biological science dissects living things into their constituent parts, as if they are dead – chemicals, objects, or machines. What about life itself, which is the difference? It has also been assumed that improvement in our condition requires constant velocity in straight ahead lines, as if we are arrows to be shot into the future. What about the present and the past, in which we live? Odd, eh?

Help is at hand. Here is the Chinese sage Lao Tsu (6th century BCE, above left). His philosophy is evoked by the golden serpentine shape (top next to left), photographed in a temple by the West Lake of Hangzhou, in China. The Tao says 'things rise and fall…/ They grow and flourish and then return to the source/ Returning to the source is stillness, which is the way of nature' (1). Next, here is Leonardo of Pisa, usually known as Fibonacci (1170-1250 CE, above next to left), who identified the 'golden ratio' of 1: 1.618 seen in all spiral shapes (such as that shown top centre) (2). This proportion is everywhere in nature as, for example, the diameter of the successive spirals in a shell, and as shown in a fern (top next to right).

And next here is Giambattista Vico (1668-1744), whose *Scienza Nuova* (*New Science*) rejects the reductionist take on reality, in favour of the systematic cyclical philosophy nicely expressed by his fan James Joyce as 'Egg burst, egg blend, egg burial, and hatch-as-hatch-can'. This has the spiral as its foundation concept, and respects nature, including human nature. We make little progress by moving in a straight line further and further away from where we started. Solid progress is cyclical, always returning whence we came but with more knowledge and insight, and therefore 'further out' and enlightened, (The reverse process, of the vortex, is that of returning but diminished – 'going down the drain', as is said of depressed people). This is our human experience. Giambattista Vico said that introducing geometry into life as actually lived 'is like trying to go mad with the rules of reason, attempting to proceed by a straight line among the twists and turns of life, as though human affairs were not ruled by caprice, temerity, opportunity, and chance'.

The systems approach

So that's a bit about the systems approach to life, art and science. It is also an ecological approach. It was with this in mind that Mark Wahlqvist, then president of the International Union of Nutritional Sciences (2001-2005), in 2002 invited Claus Leitzmann and me to set up an IUNS task force on 'eco-nutrition'.

By the turn of this century many sentient nutrition professionals sensed that nutrition defined only as a biological science was stuck. Thus, recommendations made in the US or Europe to consume increasing amounts of fruits, have tacitly assumed that if production of temperate crops such as apples, pears and plums dwindled, or if the 'home' populations greatly increased, boats and planes would constantly import abundant cheap or affordable fruits, such as bananas, mangos and pineapples, from all over the tropical world. The first time the limitation of resources was mentioned in an expert report on nutrition and health, as far as I know, was the case of fish. This note of concern was not expressed 150, 50 or 25 years ago. It was a mere dozen years ago that common knowledge that the world's fish stocks are liable to dwindle irretrievably, was beginning to concern food and nutrition policy-makers. Likewise, other phenomena not amenable to randomised controlled trials, such as the impacts of economic globalisation, climate change, food and nutrition insecurity, and inequity between and within countries; and then the linked fuel, food and finance crises (3).

After a year, Claus and I had done nothing. We realised why. The concept of 'eco-nutrition' is self-defeating. It implies yet another branch of nutrition science. Whereas ecological principles, and the systems approach that sees current humans as in a matrix of the past and future, one part of the whole living and physical world, should guide nutrition as a whole. What was being offered to us was one new shelf in an old shop. We wanted a new whole shop.

After a series of brainstorms, we came up with the name 'The New Nutrition Science' (4). We also sought a logo, a 'brand image', and for another year doodled scores of geometric shapes. Then we engaged Chris Jones of *Design4Science*, former design and art director of *New Scientist* and then of the three epic World Cancer Research Fund reports. After a while she reported that the calligrapher Ying Huang Bi, working in Beijing, had made his masterpiece for our project: the spiral above (top, left). All our attempts had been worse than useless. Straight lines would have sabotaged our purposes. The final spiral above (top, right), created seven years later for the *World Nutrition Rio2012* conference, of two hands of different origin clasped in union, further celebrates spiral philosophy.

The Giessen workshop

Our next steps were to convene a workshop meeting in April 2005, whose products would become a special issue of *Public Health Nutrition* that September. This we did, and some of the papers can be accessed at the beginning of this story. Claus and his administrator Elvira Kratz masterminded the meeting, held at the Schloss Rauischaushausen, a Gothic Revival pile owned by the University of Giessen. The venue was apt, because it was at that university, which now bears his name, that in the 1840s Justus von Liebig in effect invented nutrition as a biochemical science.

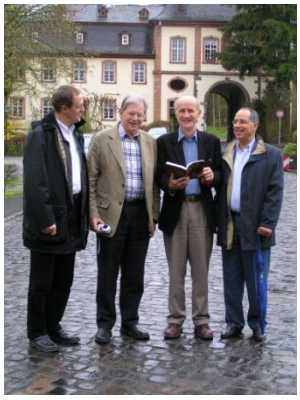
The Giessen Declaration on nutrition as multi-dimensional was agreed at a workshop held in Giessen, Germany, in April 2005. Be aware of the spirals!

Here we are, above. Mark Wahlqvist was there (front row, second from left). Claus and I (front row, centre) flank the project's benefactor, the Baroness Mariuccia Zerilli-Marimò. Ricardo Uauy, IUNS president 2005-2009, engaged with us but could not come to Giessen; but Ibrahim Elmadfa (2009-2113, centre row, centre) was there, and Barrie Margetts, who in 2006 became founding president of the Association (front row, left). Others included Joan Sabaté, Prakash Shetty, Tim Lang (middle row, third and sixth from left, and at right), and Esté Vorster (front row, second from right). The workshop chair was Christopher Beauman (top row, middle).

The most influential and inspiring participants at Giessen on the environmental dimension are shown in the picture strip that introduces this story (next to right, and at right). These are Tony McMichael of the Australian National University, and the author Colin Tudge, who is shown below (left) enjoying a point made by laptop controller Tim Lang to Mark Wahlqvist in one of our break-out sessions, watched over by Claus. Tony is in the other picture below (second to right), with Barrie Margetts, Mark again, and Ibrahim.

The Declaration

After the meeting was completed and the Declaration agreed, we all moved to the Liebig Museum in the city centre, within which the offices and laboratories of the great biochemist are preserved. In the small lecture theatre in which he taught the first generations of his students, who then went on to shape nutrition science in Europe, the USA, and all over the world, we all in turn stood at his lectern and read out a clause of the Declaration, and all signed it.

The Giessen workshop included plenaries with pre-prepared papers, and break-out small groups (above) and overnight revisions of the Declaration

Here is some of what we agreed. The *Declaration* begins by stating: 'Now is the time for the science of nutrition, with its application in food and nutrition policy, to be given a broader definition, additional dimensions and relevant principles, to meet the challenges and opportunities faced by humankind in the twenty-first century'. It continues: 'Those now concerned with the future of the world at all levels from local to global, generally agree that their over-riding shared priority is to protect human, living and physical resources all together, in order to enable the long-term sustenance of life on earth and the happiness of humankind. Nutrition science is one vital means to this end … This implies expansion and enlargement of the science, and its identification as a broad, integrative discipline, enabled to identify and address the circumstances, challenges and opportunities of the twenty-first century… The biological dimension should therefore be one of the three dimensions of nutrition science. The other two dimensions are social and environmental' (7).

Inclusion of the environmental dimension was agreed after long discussions. Thus: 'Many planetary environmental indicators are now deteriorating. These include global climate change and the persistent depletion of stratospheric ozone; the depletion and degradation of topsoil; the accelerated loss of species and of fresh water and sources of energy; and increased use and of persistence of many chemical pollutants. Recent and current modes of food production have made major contributions to such adverse changes. If these environmental changes are not arrested, the conditions of the natural world will deteriorate for future generations...For the first time in human experience, the overall size and the economic activity of humankind exceeds the capacity of the planet to supply, replenish and absorb'.

A new conceptual framework requires a new definition. And so: 'Nutrition science is defined as the study of food systems, foods and drinks, and their nutrients and other constituents; and of their interactions within and between all relevant biological, social and environmental systems'.

Box 1

The need for principles

One of the tasks of the group gathered at Giessen was to set out principles to govern and guide the teaching and practice of nutrition. This was done and is also part of the *Giessen Declaration*.

Guiding thoughts included the following. If we want to have a fair idea of where we are going, as we all should, we surely need to know where we are, and also where we have come from. Nutrition, in common with all other disciplines, should be informed by knowledge of history. If, as we all may, we want to develop recommendations on what is good to eat, we need to know about the mechanics of the body, and also its adaptability.

All sciences that involve biology make full sense only in the light of evolution. If we want to take into account the impact of our work on the world, as is our duty, we must be aware that its resources have limits. We better had live in balance with the living and physical world. If we want to make a difference for the better, as we surely all do, we are bound to think about what is right and what is wrong.

Most nutrition professionals may well agree. Curiously though, principles seem to be absent from any formal document issued by any professional body concerned with nutrition. Documents on nutrition and its teaching and practice often include attempts at definition and usually include some purposes, but stop short of specifying any general governing or guiding principles, which surely are a pre-requisite for any organised professional activity.

In tranquil times, professional principles may be implied rather than stated. In tumultuous times, such as now, they need to be specified. Thus as mentioned in the main text here, when modern nutrition science was initially shaped in the early 19th century, it was assumed that the natural and physical resources of our planet were limitless.

As with fruits and fish, when committees of experts have estimated human protein requirements, they have paid practically no attention to the capacity of the planet to provide specified adequate or desirable quantities of protein, or to the social, economic and political implications of recommending greater consumption of animal protein. They seem to have assumed that there was no issue – or else that issues they might be aware of as citizens were not their problem as scientists.

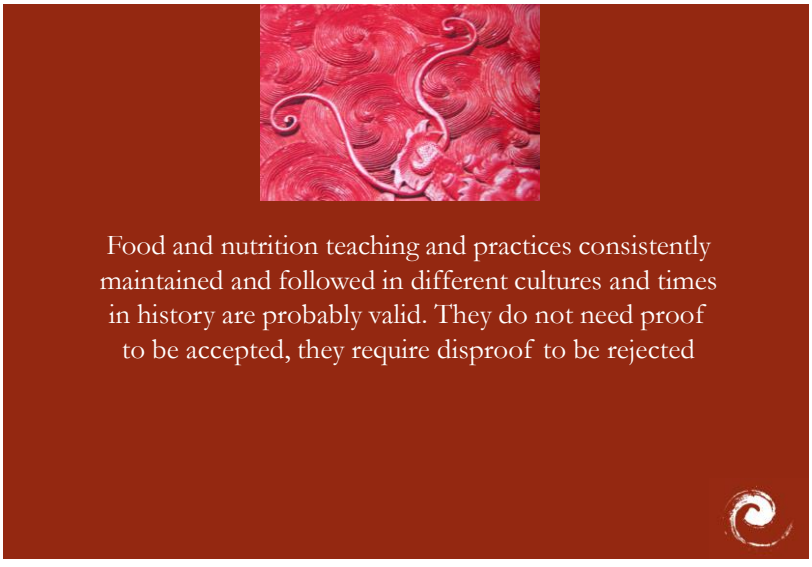
Accordingly, the *Giessen Declaration* states: 'All sciences and all organised human activities are and should be guided by general principles. These should enable information and evidence to be translated into relevant, useful, sustainable and beneficial policies and programmes. The overall principles that should guide nutrition science are ethical in nature. Its principles should also be guided by the philosophies of co-responsibility and sustainability, by the lifecourse and human rights approaches, and by understanding of evolution, history and ecology'.

Further, 'The purpose of nutrition science is to contribute to a world in which present and future generations fulfil their human potential, live in the best of health, and develop, sustain and enjoy an increasingly diverse human, living and physical environment. Nutrition science should be the basis for food and nutrition policies designed to identify, create, conserve and protect rational, sustainable and equitable communal, national and global food systems, in order to sustain the health, well-being and integrity of humankind and also that of the living and physical worlds'.

Message received and understood

The New Nutrition Science is an idea whose time had come. Two prompt responses came from John Waterlow of whom more below, and from Marion Nestle of New York University. John Waterlow, while emphasising the importance of physiology and biochemistry, wrote: '*The Giessen Declaration* has reminded us that environmental science should be included in nutrition's field of interest'. Marion Nestle wrote: 'Expanding the definition of nutrition science to encompass social, economic, political and environmental dimensions is a really good idea...this Project should be required reading for everyone who investigates or applies nutrition science'.

Since then, as readers will know, identification of nutrition as a social, economic and environmental as well as a biological discipline has become commonplace. This conceptual framework shaped the World Cancer Research Fund report on the policy implications of cancer prevention, published in 2009 (9). The new nutrition thinking has put the 'social determinants of health' in a new light, either as only part of the whole story, or else a code term for the comprehensive framework (3). Meanwhile, new 2015-2025 global development plans are replete with references to social, economic and environmental determinants. Wise heads may reflect on a *New Nutrition Science* principle, which suggests that the populations now waiting to be 'developed' already know what they need. This is shown on the slide here:



References and notes

1 Lao Tsu. *Tao Te Ching.* Feng G-F, English J (tr). London: Wildwood House, 1973.

2 Raised in north Africa, Fibonacci brought the Hindu-Arabic numbering system to Europe, enabled accounting on paper, and so was the founding father of the Italian banking system that originated capitalism and financed the Renaissance. Yes, numbers are useful as long as they do not master us.

3 A fifth dimension for nutrition is political. The assumption that the world's living, physical – and human – resources are limitless has strong implications for students of imperialism and capitalism. But we will not 'go there' now…

4 Like 'New Labour', this may be a mistake. During our public launch at the 2005 IUNS congress in Durban, some colleagues disliked being identified as old nutrition scientists. Besides, we were proposing a rebirth of ancient values. 'The old nutrition science' did not, however, ring our bells.

5 The New Nutrition Science. Leitzmann C, Cannon G (eds). *Public Health Nutrition* 2005; **8**, 6A: 667-804.

6 *The Giessen Declaration. Public Health Nutrition* 2005; **8**, 6A: 783-786.

7 After Giessen, further workshops were held in Spain (Barcelona), China (Hangzhou), Chile (Santiago), Australia (Hobart) and Sweden (Stockholm). Their main purpose was to develop the new nutrition principles. At the Hobart meeting Boyd Swinburn and colleagues rightly insisted that economics should not be subsumed under 'social', and so the economic dimension was proposed and approved.

8 World Cancer Research Fund/ American Institute for Cancer Research. Policy and Action for Cancer Prevention. Food, Nutrition and Physical Activity: a Global Perspective. Washington: AICR, 2009.

Human height and weight

It is best to be small

Reasons to be small. Left to right: Pandurang Sukhatme and John Waterlow, and also François-Marie Arouet (Voltaire), Yuri Gagarin, Sachin Tendulkar

If everyone were to achieve the height now common in industrialised countries, the height explosion would be almost as disastrous as the population explosion, carrying with it the need not only for more food, but for more clothing, more space, more natural resources of all kinds

JOHN WATERLOW, 1998

Very occasionally we have the opportunity to present a 'killer slide'. In proposing 'It is best to be small' in a debate with David Pelletier of Cornell University at the second World Congress of Public Health Nutrition held in Porto in 2010, this above was my killer (1). Usually such missiles are launched at the end of the show. Here it introduces this item in my column, and what more do I need to say? But I will!

John Waterlow (1916-2010, above, and above left in the row of pictures) was the most distinguished and influential British nutrition scientist of his generation, and the leading authority on protein and energy requirements (2). On visits to London starting in 2007, I visited him and Joan Stephen several times, having been charmed by learning that he read my 'Out of the Box' columns in *Public Health Nutrition*. This, I was warned, was merely because he enjoyed my tittle-tattle, about conferences that near and in his tenth decade he no longer attended.

After correspondence in *PHN* (3), I realised that he was conscientiously conflicted on the issue of weight and height. On the one hand, as the originator of the concepts of 'wasting' and 'stunting' (4), he knew that weight and height below specified levels are clear signs of deficiencies and diseases. On the other hand, he always considered the social and environmental dimensions of nutrition. He never said that the biological case in favour of being big was clear-cut. He made a point of respecting the thesis of Pandurang Sukhatme (1911-1997, above second to left). This is that in parts of the world like rural India, the metabolic processes of people who are short because of frugal circumstances, become more efficient, so that they can be well nourished on amounts of food that otherwise would be inadequate (5,6). He also abhorred the notion that physically large populations are for that reason superior to small populations (7).

After supper at Costa's Grill opposite his home in Hillgate Street in Notting Hill, on the last time I met him, he made a point of giving me a book jointly edited by him, based on a two-day symposium on 'Feeding a World Population of More than Eight Million People' (8).The statement on the slide above is a passage in his first chapter in the book. It felt like a torch was passed to me. Yes, he enjoyed my gossips also.

First experience of heresy

The issue of human height and weight, and in particular stature, is an example of the multi-dimensional and systematic new nutrition science in action. For me it is a long story which began a quarter of a century ago in the late 1980s. During a conference held in London at the Royal Society of Medicine, I attended a symposium on pediatric nutrition. What intrigued me was not what was said, but what was not said – what was implied. So when the chair of the session asked for questions, I stuck up my hand and said that yes, as an earnest seeker after truth, I had a question. All the speakers based their presentations on the assumption that children should be born big, grow fast, mature early, and become tall adults. Why, I asked, was this?

You need to picture the scene. The main lecture theatre at the RSM is raked, and I was sitting at the back. Maybe 150 people sitting in front of me craned round and it felt like that all of them were looking at me with similar expressions of scorn or contempt, conveying the same thought: 'who let him in here?' The session chair ignored me, and asked for another question. During the coffee break I was blanked. Did this mean that from then on, professors would hire heavies to guard entrances to conference halls who on sight would tell me 'No admission. You are an idiot'?

Hugh Trowell reassured me. Perhaps best known now as co-author with Denis Burkitt of *Western Diseases*, he was of missionary stock, and after retirement in 1959 after 30 years as a physician in Kenya and Uganda, became vicar of Stratford-cum-Castle in Wiltshire (9). All his professional life he was concerned with the ethical and

social implications of medical practice. Denis, one of my mentors, told me that Hugh had strong views on modern methods of infant and child feeding. These accelerate growth, weight and height, as a result of which children, evolved to reach puberty around the ages of 15-17, become sexually mature aged 11-13. The results, Hugh pointed out to me when we first met, include disrupted schooling, chaotic behaviour, unwanted pregnancies, misery and poverty. His paper on the topic had been submitted to several publications, and after peer reviews, had been rejected. (9-11). While somewhat scandalised I was also delighted. Any heavies hired by the paediatric nutrition establishment would bar conference doors to Hugh, too!

Bad vibrations

Five or so years later I learned more. In 1992 Michael Latham invited me to give three lectures on 'The impact of nutrition science on world food and agriculture' to the Cornell University faculty. The 'go for growth' dogma had around the 1860s led to the foundation of US land-grant colleges including Cornell, whose duty was to promote meat, dairy and milk technology and production.

Encouraged by Malden Nesheim, then the provost, and Cutberto Garza, then head of the nutrition division, Cornell then had a reputation for being open-minded. So I took my contrarian position. For my start I pointed out that The Cornell pioneers were shorter and lighter – on average around 3 inches (7.5 cm) and 50 pounds (22.5 kg) less than the average faculty member facing me – and not much bigger and heavier than food-secure Asian rural populations. Also, the average age of sexual maturity in the mid-19th century was 14-15 years, contrasted with what is now 11-12 years (12). I plunged on. 'This astounding development in human scale and function was not a result of acts of nature, but of nutritional scientists. Like plants and animals, we have been intensively grown'.

After applause and lively discussion I sensed that the positive waves were not coming from those present who were members of the nutrition departments. Michael sent me away with papers stating that such reasoning smacked of the dangerous, damaging and damn-fool 'small but healthy' notion of PV Sukhatme (5,6) and would, if taken seriously, condemn the children of Africa and Asia to wasted as well as stunted lives. He had written: 'Speaking of smallness as a desirable attribute is similar to making a virtue of the scarred lungs of a person who has survived a severe attack of pulmonary tuberculosis' (13). His offer for publication of a revised manuscript in his Cornell International Nutrition Monograph series was countered by an internal review by Reynaldo Martorell, already a leading authority on classic malnutrition, then at Cornell. This ended: 'I would not recommend publication… since this would, in my opinion, reflect badly on the scientific reputation of past and future issues'.

Once again I got that sinking feeling, and I stayed away from the topic of human size for the next 15 years. Then in 2007 the textbook *Human Body Size and The Laws of Scaling* was published (14). Its author Thomas Samaras has an intriguing professional qualification as a structural engineer. His main line of exhaustively referenced argument is that – well, it is best to be small. So I got interested again, in two of my 'Out of the Box' columns written for *Public Health Nutrition* in 2007 and 2009 and then later in this column in 2010 and 2011. In March 2011 *World Nutrition* published a commentary by Thomas Samaras (15) with an accompanying editorial.

The case for being tall

Is Queen Elizabeth stunted? (left, with the Obamas). But Princess Diana was good stock for breeding some height into the UK royal family (right)

Here is how I see the issue now. Basically there are three arguments in favour of humans being tall and so relatively heavy (but not overweight in the sense of having a high body mass index).

Superiority

Big tall people are in most parts of the world now seen as superior to small short people simply because of being higher and able to 'look down' on them. In the picture (above left) note that Barack and Michelle Obama are carefully not looking at Queen Elizabeth, who is around a foot (25 centimetres) shorter than they are. It's said that Prince Philip, perhaps aware that his son Charles's then fiancé Diana was nutso, nonetheless recommended her as good stock for breeding height into the royal family, which she did (above right).

The prejudice in favour of height is self-fulfilling. Tall people tend to get better jobs. Tall men tend to have more success with women. So for sure, this is a benefit. But this does not mean that there is anything intrinsically worse about being short. The strip of pictures introducing this story includes (centre to right), the French philosopher François-Marie Arouet (Voltaire), the Soviet astronaut Yuri Gagarin, and the Indian cricketer Sachin Tendulkar, all of whom were or are around 1.57.5 metres or 5 foot 2 in height, as is the Chinese WHO director-general Margaret Chan – and

Queen Elizabeth, whose ancestor Queen Victoria was shorter. Societies set up to celebrate being short, publish lists of hundreds of distinguished or powerful short people, including statesmen (such as Mahatma Gandhi) philosophers (Jean-Paul Sartre), economists (Milton Friedman), dictators (Josef Stalin), engineers (Isambard Brunel), film stars (Charlie Chaplin), generals (Vo Nguyen Giap), presidents (Benito Juarez), athletes (Olga Korbut). So many exceptions do not prove any rule that it is best to be tall.

Disease, longevity

Practically all epidemiologists say that tall people are less likely to suffer prematurely from heart disease, and that they also live longer. Thomas Samaras contests this. Evidence in favour of tallness comes from studies mostly of white men in the global North, and has to suffer from residual confounding simply because of the prejudice spread from the global North in favour of tallness. On the other hand being tall, independently of body mass, certainly or probably increases the risk of some common cancers.

Deficiency, infection

Paediatric nutritionists, including authorities on global South health such as Reynaldo Martorell and Michael Latham, oppose any suggestion that small can mean healthy. Indeed, the evidence that low birth-weight, slow growth, shortness (labelled as 'stunting') and thinness (labelled as 'wasting') are all associated with infant and young child deficiency, infection and death, is rock-solid. Below certain levels, 'stunting' and 'wasting' are reliable warnings or 'markers' of presence of or vulnerability to deficiency and disease. But it does not follow that being small or light is itself the cause. The causes are those which underly why the children are short or thin, such as inadequate diet, or helminthic infection. This is not an academic point, because treatments with especially energy-dense foods and products whose purpose is to make children grow faster and become heavier, memorably characterised by Benjamin Caballero as 'piling on the calories', are known to cause diabetes and obesity.

The case for being small

John Waterlow wrote the final words on the last page of the 1985 UN report on energy and protein requirements (5) for which he had special responsibility as expert consultation chair. These were 'No longer can we bypass the question "requirements for what".' Quite. Thus, the first Soviet astronaut had to be small, because there was no room at that time for a big man in the space capsule. In some occupations and activities big tall people have a natural advantage; in others small thin people have the advantage. And circumstances can change, as illustrated above by the slide here

showing invaders of Baghdad at different times of history. As detailed on the slide, a lot is known about the Mongol hordes that swept across Asia; and we also know about the size and weight of US soldiers and their equipment, as well as the relative fuel requirements of the humans, and of horses and tanks.

Small people often make better soldiers. In history, it was light cavalry who were the conquerors. These days, wars tread very heavily on the earth

What this and many other examples show, is that in general, whether it is better to be tall and heavy, or short and light depends on circumstances and also on what criterion is judged to be most important. Box 2 gives some examples:

Box 2

Tallness and shortness: Advantages and disadvantages

Advantages of being tall

Performance

Taller people have greater strength and reach, run and swim faster, and jump higher and further. They keep warmer in colder weather, due to a lower surface area to body mass ratio.

Health, lifespan

Taller people in high-income countries tend to have less cardiovascular disease and to live longer. Taller people tend to have lower resting heart rates. Their larger blood vessels may protect them from cardiovascular disease. Tall people with higher socioeconomic status are more likely to have a healthy weight, to follow healthy ways of life, and to have better medical care.

Social
Taller people have social advantages. They are given more respect. In most countries now they are more likely to succeed in life. Women prefer taller men.

Economic
Taller people generally earn more money than shorter people. Executives tend to be taller than their subordinates.

Disadvantages of being tall

Health
Taller people are more likely to develop some common cancers.

Environmental
Taller populations require more resources. Food, water and energy needs are greater. More consumption means increased pollution and environmental damage.

Economic
Taller people consume more and so cost more. Their additional resource needs and environmental damage also increase economic costs.

Advantages of being short

Performance
Shorter people are stronger in relation to their weight. They also have faster reaction times and can accelerate and rotate faster than taller people. They are more agile and have more endurance.

Health, lifespan
In many settings shorter people live longer. Most centenarians are short. Shorter populations from lower-income countries generally have much lower coronary heart disease and stroke.

Environment
Smaller people need less food, water and other resources. They generate less waste and create less pollution and ecological damage.

Economic
Because shorter people require less of virtually everything, they cost less.

Disadvantages of being short

Performance
Shorter people cannot lift as heavy objects as taller ones. They have a shorter reach. They are slower swimmers and runners, except for long-distance running.

Health, lifespan
Shorter people tend to have higher heart rates.

Social
In many countries and settings there is prejudice against short people.

As with the new nutrition, and its four dimensions and spiral philosophy outlined in this month's first story, much depends on what is considered most relevant and important. As indicated above, the biological aspect is mixed and somewhat contentious. The point about 'stunting' and 'wasting' being markers rather than causes of deficiencies and infections of children is important for the reasons briefly indicated. The social aspect clearly favours tallness. That is on the one hand. On the other hand, economic and environmental arguments for shortness and smallness, in our era now, are surely conclusive. This is why I am sure that it is best to be small.

An achievable policy could be to plan for an average world population size 7.5 centimetres (3 inches) shorter and 25 kilograms (55 pounds) lighter than what is now average in the global North, which is to say, roughly the average size of the founders of Cornell University. The impact on food and fuel requirements would alone be impressive. John Waterlow has the last word (8):

We will have to accept that future generations will be smaller, leaner, and perhaps slower. I doubt if that matters….The declaration in the UN Convention on Human Rights that all people have a *right* to fulfill their genetic potential does not seem realistic if the race is to survive

John Waterlow,, 1998

Notes and references

1 The style at Porto was also to have a 'pre-vote' before the presentations. The number in favour of the motion before I spoke for it was zero. Afterwards I still lost (bah!), but only by one vote.

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6 Sukatme P, Margen S. Autoregulatory homoestatic nature of energy balance. *American Journal of Clinical Nutrition* 1982; **35**: 355-365.

7 This notion was a reason for the defeat of the US and its allies in Vietnam.

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10 Trowell H. Pathological growth and maturation in infants and children associated with modern methods of feeding. 1974. Unpublished.

11 Denis told me that the reason he was taken seriously as from the 1970s on the topic of dietary fibre, was because he was FRS as a result of identifying in East African children the lymphoma named after him. Otherwise, he said, his peers in the profession would have dismissed him as another retired colonial physician, with a bee in his bonnet about 'roughage', which 'made you go' but had no other significance except as a gut irritant.

12 Frisch R. Population, food intake and fertility. *Science* 1978; **199**: 22-30.

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14 Samaras T, editor. *Human Body Size and The Laws of Scaling: Physiological, Performance, Growth, Longevity and Ecological Ramifications.* New York: Nova, 2007.

15 Samaras T. Reasons to be small. [Commentary] *World Nutrition*, March 2011, **2,** 3: 108-135. Obtainable at www.wphna.org.

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