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A healthy diet — A matter of balance

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The constantly evolving nature and extreme complexities of nutrition science have created an environment and perception of the science that is frequently muddled, misrepresented and often downright incorrect within general public discourse. The inexact nature of nutrition science (as opposed to physics, which has more known knowns) and the time-constrained and agenda-driven media will often poorly report on or misrepresent facts as we know them. This chapter reveals by way of nutrition anecdotes how complex the science of nutrition is and yet how simplistically the subject is treated by the media. So much so that it would seem there is a desire by the 'food' writers to churn out pieces that are contradictory and confusing to members of the public. Examples from the daily press and/or the Internet include: 'Diet of a lifetime', 'Freezing your fat off', 'Krill oil is nine times more bioavailable than fish' to name just a few of the many diet/nutrition/food topics that have appeared recently. In the end, there is a tendency for many readers to just give up and say: 'To hell with all this, the experts don't know what they are talking about so I will eat whatever I like.'

The desire to eat and eating patterns

As Oscar Wilde is reported to have said: 'I can resist anything except temptation.'[1] We have all experienced the tremendous desire to eat after passing a hot bread kitchen, or a place cooking

onions on a BBQ; or the opposite reaction when outside a fish and chip shop or hamburger joint that is using old frying oil with that acrid smell of the spent oil. Maybe reading a book on Vietnamese food can stimulate a strong desire to visit one's favourite pho restaurant, or for others it might be seeing an advertisement for fast food on TV that can excite one's taste buds? The cooking show, MasterChef Australia, was the most watched non-sporting event in Australia in 2010 since ratings began.[2] In this and similar shows, the focus is on pleasure, taste, and care for others rather than nutrition messages.

An example of how much we must love food is the number of eating places in our shopping malls, both large and small, and the drive-in places where for minimal fuss, wait and money, one can get a 'feed-fill' (get it into you and quickly) of fat, sugar and salt with relatively few other nutrients. No space to eat a banana now or munch on an apple. No need to have a balanced meal at what was normally the regular time when lunch or dinner used to be eaten, or to enjoy food in company, eating slowly and chewing one's food while discussing the matters of the day with family and friends. Many cultures maintain these social occasions, but it seems that in the western world, this type of food behaviour is increasingly uncommon.

What are we missing out on here? These social occasions include lots of discussion and the opportunity to eat, in a slow and measured way, a variety of foods providing a range of dishes including vegetables, and fruits to follow the meal. Is this what one might describe as a balanced life where food and social interaction are balanced and food is chewed and knives/forks/chopsticks are placed on the plate while chewing or talking? Contrast this with an observation I made recently of a family with one child, aged about 12, who arrived at a French wine bar (in Vietnam) at about 8.30 pm one night. Six large dishes were ordered together with drinks, and the man proceeded to consume more than two thirds of the food in a manner like a dog guards its dinner plate — head close

to the food and each forkful rapidly shoved into his mouth — such shovel mania is alive and well, all around us.

The media and matters related to food

It would seem that the media loves to print items about food as everyone is interested in the topic, so anything related to food is considered newsworthy, regardless of whether or not there is any veracity, balance or indeed accurate context within the whole body of knowledge on the topic. I recall how many times I have been contacted by a reporter wanting to know something about food or nutrition and at the same time being told that there is a huge urgency to my response (like this afternoon!). While work pressure is understandable for most, I have trouble with the notion that 'anything' will do. It has been said before that meditation is essential to transform knowledge into wisdom and this is a maxim that could serve nutrition writers well. Michelle Pillipov[3] from the University of Tasmania has written an interesting piece recently, arguing that it might be possible to learn — from shows such as MasterChef Australia — how to more effectively communicate food-related health risks via the media. That being said, there are serious food writers around the world[4] who take care and give the time required to do the research and publish respectable work that is balanced and placed in a context.

Everyone loves food and has strong opinions on what's good for you or not

As a nutritionist I am amazed at just how much discussion there is among family and friends about which foods are good or bad for you. The opinions vary from both ends of nutrition's wacky spectrum to views that are 'balanced' (just as we are told our diets should be — whatever a balanced diet means!). We hear discussions in the media of new nutrition research which either overturns everything we all understood to be true ('chlorogenic acid in green tea burns fat' and so on!), or nutrition-related stories

about how people are 'killing themselves with a fork'. In contrast, we do not hear any discussion in the popular press on whether high-rise structures, planes or bridges are increasingly more or less safe (maybe because engineering is an exact and trusted science?).

Because there is so little formal understanding of the science of nutrition in the community or even in the medical profession, this situation favours the following of fad diets, the purchase of dietary (nutrient) supplements and other ingredients (for example, wheat grass), for which there is next to no evidence of any measurable benefit. While we are all aware of the fairly rapid relief one can obtain from taking a painkiller to alleviate a headache, there are very few circumstances of a consumer actually feeling better/stronger/healthier within a reasonable time scale (hours/days or longer) after swallowing a dietary/nutrient supplement. Such purchases are based on believing the advertising of the mass marketers, and it is difficult to know what benefits there are for the population from using these additional nutrients. If, for example, the products that have been recommended for weight control were effective, one might have expected to see lower rates of obesity and overweight people in the population, but this does not appear to be the case! So, the question is: 'Can the science better inform the public on the facts/non-facts related to nutrition?'

Nutrition science research is complex and ongoing

Like most branches of science, nutrition is evolving at a tremendous pace and textbooks become out of date as fast as in other biological disciplines.

Several examples suffice to make it clear that trying to portray the latest nutrition science research studies in the popular press is not possible in a few sentences, nor is it appropriate to engage with the public when the scientific enquiry is ongoing. The arguments are complex and each study is usually only adding a small piece to the large jigsaw of nutrition research.

Example 1: Polyunsaturated fatty acids[5]

Since the 1960s nutritionists and others have recommended that our diets should contain less saturated fat and more polyunsaturated fat (a sort of butter versus margarine story). The polyunsaturated fat recommended is that most commonly found in all vegetable oils and is known as linoleic acid. The basis of the recommendation for consuming polyunsaturated fat is related to lowering blood cholesterol levels and thereby reducing heart attacks. However, just in the past two years, evidence has emerged that might change the 'message' that flowed from some of the heart disease trial results; it turns out that in the trials that reported a reduction in heart deaths, the oils used contained not just linoleic acid (an omega 6 fatty acid), but also fatty acids from fish (known as long chain omega 3 fatty acids). In other words, the greatest benefits were not from diets rich in vegetable oils, but from mixtures of vegetable oil and fish oil. While this is of great interest scientifically, it may be too soon for the media to latch onto this new information unless they want to confuse the readers ('Fat, the good, the bad and the confusing'). These recent observations have the potential to overturn 50 years of focus on one type of polyunsaturated fat. Needless to say, this matter is under intense discussion, argument and consideration by nutrition scientists.

Example 2: Gut microbiome[6]

Or, as others have written, 'mind altering microorganisms'.[7] It has only been in the past 10 years or so that scientists have focused their attention on the huge number of microbes that live in the large bowel[8] and understood that they do far more than produce wind/gas from foods such as beans and onions. It now emerges that the range of possibilities include being influential in how fat or thin people are, to having an impact on brain and behaviour! Who would have thought that the types of microbes in the gut could influence these events? The composition of the food we eat and the amount of stress we are under are both known to influence the microbiota composi-

tion. How is this possible? It appears that microbes are capable of making small molecules (chemicals) which can be taken up into the blood and send messages to alter the function of specific tissues in the body; in some extreme circumstances, these gut microbes can end up in the blood and tissues, which can set off harmful inflammatory processes. Additional studies are showing that the microbiota might be especially important in the field of gut pain, with evidence that some probiotic bacteria[9] can alleviate pain induced by stress and inflammatory bowel disease. Research findings in this area are emerging almost daily so any media reports are but a snapshot on a rapidly moving target.

Example 3: Vitamin D roles are evolving

This nutrient has the power to contribute to nutrition confusion, because while it is called a vitamin it is actually made in the skin from cholesterol, provided the skin is exposed to sufficient sunlight for long enough each day. It actually might be better described as a hormone as it functions at the level of the gut (intestine) to promote absorption of calcium from food, which in turn is a fundamental component of bones. Deficiency of vitamin D typically occurs in regions of the world where the population is exposed to little sunlight (mostly the northern hemisphere) or where the inhabitants are prone to covering much of the skin for a variety of reasons (religious, and/or concern about skin cancer). The disease that results from vitamin D deficiency is rickets, and is identified by badly bowed legs. Cases of vitamin D deficiency in migrant children have been seen in recent years at the Royal Children's Hospital in Melbourne. There has been a huge resurgence of interest in this micronutrient recently, with suggestions that a lack of vitamin D could be associated with (but not yet proven to be caused by) a range of conditions unrelated to bone, including heart disease and mental health. Such research findings have the potential to be picked up by the media and result in headlines, such as 'Vitamin D, miracle drug: is it science or just talk?'.[10]

It is often not appreciated just how much the food supply has changed

It is unlikely that generations X, Y and Z can understand just how much food has changed since the 1950s, although for those old enough to remember the suburban shopping strips it is clear how individual food shops (butchers, grocer, greengrocer, milk bar and fish shops) selling hundreds of different food items (as can be still be seen in the suburb of Yarraville, in Melbourne, today) have been replaced by 'super' markets selling thousands of food items, many of these being in the category of highly processed foods. Some estimates suggest that up to 10,000 new food items are introduced into supermarkets yearly, with many failing to last the distance.

In general terms, as nations become more affluent they move from the era of deficiencies of protein, energy and micronutrients, to an era of abundance of food, including the processed foods. The new dietary patterns are associated with various non-communicable diseases such as obesity, heart disease, diabetes, cancer and mental disorders. The battle is with the excess of foods with completely different nutrient compositions to unprocessed foods; often these new processed foods are rich in energy, typically contain high levels of fat, sugar and salt, are appealing to the taste buds for many, and are inexpensive. Such dramatic changes in the food supply can have very significant consequences for the individual and the health care system.

In 2010, Carlos Monteiro,[11] a professor of Public Health, classified foods into three categories, as follows: the *first group* of foods are minimally processed (whole foods submitted to processes that do not substantially alter the properties of the food and that the foods remain recognisable: for example, fresh meat, milk, grains, pulses, nuts, fruits, vegetables). The *second group* of foods consists of substances extracted from whole foods, including oils, fats, flour, starches and sugars. Most of these are not consumed by themselves but are ingredients used in domestic

preparation or cooking of foods. The Food and Agricultural Organization of the United Nations (FAO) data show that global supplies per capita of sugar and sweeteners increased by 30% from 1961 to 2003, while that of vegetable oils more than doubled; use of the second group of foods has been transformed to become the raw material base for the *third group*, which Monteiro refers to as ultra-processed foods; these foods in addition include salt, flavours, colours, and preservatives. Examples of Group 3 foods are breads, cookies, ice creams, breakfast cereals, chips, sweets, snack foods, meat products including hot dogs, and chicken nuggets (extruded foods). Group 3 foods have no real resemblance to Group 1 foods though they may be shaped, labelled and marketed so as to seem wholesome and fresh. Many of these Group 3 foods are designed to be consumed as ready-to-eat, consumed on their own or in combination with other Group 3 foods. Typically branded, distributed globally, heavily advertised and marketed, they are very profitable. In the United States, adolescents doubled their consumption of soft drinks in the 30 years from 1965 to 1996, whereas milk consumption nearly halved. Typically, Group 3 foods are energy dense and can be intrinsically nutritionally unbalanced, being low in nutrients, containing little fibre, with excess simple carbohydrate, saturated fat, sodium and trans fatty acids.

Michael Pollan,[12] who has written a number of books on nutrition, wrote a rather provocative piece entitled 'Unhappy Meals' in the *New York Times Magazine* in 2007.[13] He concluded with a section on 'Beyond Nutritionism'. In this he had a set of rules that included:

- Eat food ... easier said than done ... don't eat anything your great grandmother wouldn't recognise as food.
- Avoid foods bearing health claims — they are apt to be highly processed and the claims are of limited value.

- Avoid food products with ingredients that are not familiar, unpronounceable, more than five in number or contain high-fructose corn syrup, all markers of extensive processing.
- Get out of the supermarket whenever possible. Farmers' markets are likely to have food harvested more recently than that from supermarket.
- Pay more but eat less … the past century has been dominated by increasing quantity, reducing the price but not necessarily the nutritional quality of processed foods. Eating less sits well with data on longevity.

The link between food and health

We are all bombarded with diet messages, signposts on food packages, warnings and so on, including diverse and conflicting opinions about healthy diets, diet plans and endless diet books, so is it any wonder that some of us become worried about what food we should or should not eat (the worried well)? For those with sufficient affluence to be able to choose different foods and supplements, the worry remains over whether the choices were correct or not. To others, whose budget is constrained, the choice is how to purchase the greatest amount of food that fills the mouths in the household and particularly *without* any food going off (say goodbye to perishable fruits and vegetables). It is no surprise therefore that the choices for those on a low budget are often ultra-processed, energy-dense, nutrient-poor foods.

There are sound reasons for warnings about particular dietary patterns, such as avoiding foods rich in salt, fat and sugar, as often these foods are energy dense (lots of calories) and low in nutrients. The link between food and health flows from a range of epidemiological studies within and between countries, together with other types of studies where the health of people have been followed for years, or even intervention studies where diets have

been changed in one group of people in comparison with a control group. A number of important conclusions can be drawn from these studies, such as: 'Dietary patterns that are rich in salt are associated with high blood pressure which increases risk of heart disease'.[14] Food Standards Australia and New Zealand, the principal authority related to standards permitted regarding claims about food and health, has recently announced a series of high level health claims which are permitted on foods. Examples of such claims include: 'An increased intake of fruit and vegetables reduces the risk of heart disease', 'Calcium reduces the risk of bone disease (osteoporosis)', and 'Sodium or salt increases blood pressure'. More recently, rather than focusing on nutrients to avoid, we are being urged to eat a balanced diet, which in effect means eating a wide variety of different foods each day, and often this includes choosing foods of different colours — this applies to fruits and vegetables (rather than different colours on food packaging from grocery stores, milk bars and the like). Dietary pattern analysis has emerged as an alternative and complimentary approach to examine the relationships between dietary patterns and the risk of chronic diseases.[15]

Recently there have been very strong calls for the prevention of the harmful effects of tobacco, alcohol and ultra-processed food and drinks through public health measures . The authors of this call suggested that together, tobacco and alcohol caused nearly 12% of global disability-adjusted life years. They reported that more than 18 million deaths every year are caused by high blood pressure, high body mass index, high fasting blood sugar levels and high blood cholesterol levels and that much of these could be attributed to the consumption of ultra-processed foods and drinks.

Is there a widespread deficiency of nutrients?

Not for everyone it would seem! The topic of a healthy diet is apparently very simple as most people say they eat such a diet; however, the question is 'a healthy diet for whom?'

Humans have existed for generations on diets that have varied enormously, from extremely meat-rich (Eskimos whose diets are mainly seals) to extremely rich in vegetables (many parts of Africa and Asia where rice and sweet potatoes are staple foods). Mostly, people are able to live under these nutritional extremes, including having sufficient food and nutrients to maintain viable pregnancies, provided they do not exist in regions where the soil and therefore the food is deficient in iodine,[17] or their food supply is contaminated by the toxic methyl mercury,[18] or they are suffering from true malnutrition, as in famines and war.[19]

In some areas of the world, there is widespread deficiency of protein and micronutrients[20] such as vitamin A, iron and zinc, leading to considerable suffering and death — it has been estimated that more than 1.5 million children die globally each year because of such nutrition-related deficiencies, with most of these occurring in South Asia and Sub-Saharan Africa, principally the result of poverty (insufficient food). These nutrient deficiencies result in increased susceptibility to infections and increased deaths in young children. A number of different strategies have been adopted to remedy these deficiencies, including nutrient supplementation, food fortification,[21] creating new varieties of staples such as rice with boosted levels of micronutrients and attempts to diversify diets. Given the primary cause is poverty, these nutrient deficiencies will continue to result in deaths globally for the foreseeable future, although considerable efforts are being made by foundations such as the Bill and Melinda Gates Foundation.[22]

An example of a really effective nutrition intervention program is that directed at overcoming iodine deficiency. This micronutrient is present in soil (and in the sea) and therefore if the soil is deficient as it is in many parts of the world (such as in Asia and Africa and closer to home in Papua New Guinea), the crops and animals, and humans eating both of these can become iodine deficient. Iodine deficiency, of all micronutrients, has had the great-

est impact on limiting human intelligence and performance, with some evidence that the iodine status in some western countries may still be marginal.[23] The deficiency can have devastating consequences on mental health and mental capacity, particularly if the deficiency affects pregnant women and therefore the children during their early years of brain development. Basil Hetzel, a famous Australian public health nutritionist and former director of the CSIRO Division of Human Nutrition in Adelaide, has been recognised worldwide as a driver to prevent iodine deficiency disorders (IDD, which include goitre, cretinism, stunted growth, and general lethargy) through the auspices of the International Council for the Control of Iodine Deficiency Disorders. More than 800 million people are thought to suffer from IDD around the world. So, for these folks, their diet can become healthy by the simple and inexpensive addition of iodine to the entire salt supply in the country (known as Universal Salt Iodization) – a policy promoted by the International Council for the Control of Iodine Deficiency Disorders. For example, in 1995 China mandated that the all salt in the food supply be iodised, which has led to dramatic reductions in the extent of the problem there.

The discoveries of the micronutrients have been summarised in an excellent series by Carpenter, published in 2003.[24] The stories typically began with a disease and attempts to identify whether it was of an infectious nature or not, and if not, what components of the diet were able to correct the symptoms. In hindsight, it would have been a very frustrating time for researchers; however, by the 1940s most vitamins had been identified and chemically synthesised and their roles in biochemistry and physiology established. Discoveries of the essential nature of trace elements such as selenium and chromium were still being made well into the middle of the 20th century or later. In other words, the full complement of essential factors/nutrients for humans is information only fairly recently obtained if viewed in the time scale of the past couple of centuries.

Historically, there are some famous and well-cited examples of deficiencies of micronutrients in early explorers, including vitamin C deficiency in sailors cured by fresh limes and ginger. For other explorers, vitamin A toxicity occurred in some polar expeditions as a result of the intrepid travellers consuming the livers of their dogs, which were loaded with vitamin A following the dogs being fed on seals (blubber and meat). Mawson's famous journey[25] in 1911–1914 was beset with this problem, including for Mawson himself, who was the sole survivor of three who set out to explore to the east of Cape Denison.

Why is it that we have been invaded by dietary supplements?

The evidence is everywhere in the supermarkets, the cheap chemists, the mega supplement stores and ads on TV. A visitor from Mars might wonder just what we are consuming every day, asking questions such as 'Are all these folks eating sawdust or some other nutrient-poor food such that they need to purchase their requirements of nutrients from ingredient manufacturers?' Reasonable question indeed, but the evidence for the benefit for widespread supplementation is certainly hard to find among one's friends and colleagues. I do not know anyone who has claimed to feel any better by taking these pills. So what is going on here and why are some 'affluent earthlings' practising this cult? Of course, there are certain exceptions where there is clear evidence for a need for certain nutrients that are present in most foods at levels below recommended intakes, such as the need for folic acid and iodine in pregnant women, and the increased need to consume omega 3 fatty acids from fish and perhaps vitamin D (see above).

While some nutrition scientists scorn the use of supplements, it is clear that very few Australians (or people from other western countries) eat the recommended amounts of fruits and vegetables daily, which could lead one to conclude that for these

folks supplements might provide the essential micronutrients missing as a result of inadequate fruit and vegetable intakes. A question to ask here is, who among us knows they do not eat sufficient fruits and vegetables, and can those most lacking in fruits and vegetables afford to purchase the supplements?

Of some interest in this context is the work conducted by Dr Bernard Gesch, from the United Kingdom,[26] in which he trialled the use of supplements containing a wide range of micronutrients with groups of violent prisoners. His work was based on his working knowledge of the very poor dietary habits of many offenders prior to being incarcerated. The remarkable program he initiated revealed that there was a highly significant reduction in violence, as reported by the warders in those prisoners on treatment compared with those on placebo supplements. This research has been repeated with similar results elsewhere, with a trial being considered in Australia in the near future.

What are the major nutritional crises facing the world?

1. Obesity

Nowadays, kids have sufficient loose change to buy 'fast food' on the way home from (or even to school), such that it is easily possible for them to consume half their daily energy requirements in one snack meal.[27] My neighbour turns to me and says: 'Do you actually mean that we know how much food a person should eat each day?'. 'Yes,' I say, 'we do know this, but the biological systems that used to control a person's food intake appear to have been overridden, don't they? Just look around you at the number of young people who are so obviously overweight. How do you imagine that happened? One episode of binge eating on a weekend?' Of course not, but over the period of a year a person has only to overeat a small amount and this can lead to weight increase (an imbalance of as little as 20 excess kcal/day could contribute to an extra 1 kg/year), to the point that once the individual acknowledges they might have a weight problem (belt

too tight, shirts do not button up) it might almost be too late to return to the previous weight without an immense individual effort involving willpower, exercise and diet budgeting.

What controls eating these days? While it is apparent from the media and public health authorities that control over obesity is simply a matter of 'self-control', the situation of overconsumption of food is far more complex than just self-control as we now live in a world dominated by food availability. It is a pity there are no certain feedback mechanisms to stop overeating, such that every time one's body weight exceeded a certain point, the mechanism kicked in (vomiting, or even worse, anal leakage). Such mechanisms would certainly be effective in controlling the obesity epidemic!

Our system of supermarkets, shopping malls and strip shopping centres is one way of viewing the relationship between self and food. Our supermarket system distorts the possibilities for consuming a balanced diet by having a bidding system for the best locations within the store. So it is no surprise that foods rich in energy and nutrient poor are most prominently displayed at the checkout areas. In contrast, in some countries, these goods are displayed at the back of supermarkets in less well-lit areas. Our supermarkets are systems of such food and energy abundance that it should be no surprise that much of the population is overweight or obese. However, there is a complex interaction between food availability and advertising, with some arguing that changes in environmental cues, such as low cost food availability everywhere in our lives, increased serving sizes of food and drinks, smart TV marketing of food to both young and old people and so on, result in obesity. The population is responding to the forces of the environment rather than everyone simply lacking in willpower and self-control, what with the increased accessibility of foods and the decline in the relative price of food; this has led to more people being able to afford eating away from home.

Another change in this time has been an increase in serving size (drink sizes rising from 180 mL to up to 600 mL for carbonated beverages). As noted by Cohen:

> While the food environment has changed dramatically, this does not necessarily explain why people might be consuming more foods. What is required is to identify the mechanisms of how changes in the environment might be connected to changes in consumption. Evidence for such mechanisms has been identified in the fields of neurophysiology, behavioural economics, social psychology and commercial marketing. It has been suggested that the response of the brain to drugs and to food is similar, although the magnitude of the effect is lower with food. The reactions are automatic (largely uncontrolled) and, put simplistically, the ready availability of food and constant advertising is artificially stimulating people to feel hungry and overconsume.[28]

Other research has revealed that people can consume different amounts of food in a manner beyond their awareness and control (the facial expressions of people in ads, or music played in food environments can lead to more expenditure on appetisers and coffee!).

The effect of improvements in marketing and advertising on consumer behaviour has long been recognised as a contributing factor to overconsumption, but this has reached new heights with devices that can track the retina and record where people look and how long they focus on a particular object.[29] With this information, marketers can constantly improve on designs and products that will automatically grab people's attention. Finally, it is very difficult to resist in an obesogenic environment as obesity is a condition that occurs in an insidious way and is almost undetectable on a day-to-day, week-to-week basis. To what extent this more complex message is reflected in public health messages and nutrition education is indeed uncertain!

Contrast this situation of supermarket dominance in our country with countries in transition from poverty to affluence, where the ingredients of each meal are valued for their sensory (taste) attributes and where there has been a long established system of using different foods to create meals that delight the palates of locals (and western folks), as well as sustaining the local population. On a recent trip to Vietnam, I could not get over the contrasting body size of the locals compared with visiting westerners, who were often significantly overweight/obese and a great source of amazement to the local people; they knew the cause of this and probably could not ever imagine having enough wealth to become so overweight! For countries in transition, the major challenge is to prevent their food supply being overwhelmed by the ultra-processed foods. As Oscar Wilde said:[30] 'In this world there are only two tragedies. One is not getting what one wants [poorer countries who are subsisting on lower calorie food supply] and the other is getting it [richer countries who are being overwhelmed by obesity]. The last is much worse.'

2. World hunger

The above discussion on obesity and lifestyle diseases and excess cheap food pales into insignificance when one considers reports from the FAO on hunger.[31] Due to the global financial crises and high food prices, 868 million people are undernourished — one-eighth of all humanity. Are we dealing with issues of food insecurity at university in courses on medicine, nutrition or agriculture? What happens in food insecurity is that household spending shifts to cheaper, calorie dense (grains) and away from more expensive protein- and nutrient-rich foods (dairy, meats, fruits and vegetables). As noted by FAO, while countries are endeavoring to deal with the GFC they must not forget their commitments to one billion people suffering from hunger.

The new nutrition science[32] acknowledges that nutrition is a biological discipline, in areas as diverse as pathology, mathematics,

plant breeding, molecular biology and behavioural psychology, but that the time has come for nutritionists to realise that its biological dimension should be at one with its social, economic and environmental dimensions. Nutrition research can never be simple, but the success of the past amid many failures should encourage young scientists to tackle the challenges that face us, notably obesity and mental illness.

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Endnotes

1 Oscar Wilde, *Lady Windermere's fan, a play about a good woman*.

2 M Phillipov, 'Communicating health risks via the media: What can we learn from MasterChef Australia?, *Australasian Medical Journal*, vol. 5, no. 11, 2012, pp. 593–597.

3 Ibid.

4 For example, Marion Nestle, Paulette Goddard Professor in the Department of Nutrition, Food Studies, and Public Health at New York University; and Michael Pollan, American author, journalist, activist, and professor of journalism at the UC Berkeley Graduate School of Journalism.

5 Polyunsaturated fatty acids are unsaturated fatty acids that help supply energy for the muscles, heart and other organs, aid in the formation of cell membranes, and supply energy for the storage of fat.

6 A microbiome refers to the totality of microbes, their genetic elements (genomes), and environmental interactions in a particular environment, and in this case in the large bowel.

7 JF Cryan and TG Dinan, 'Mind-altering microorganisms: the impact of the gut microbiota on brain and behaviour', *Nature Reviews Neuroscience,* vol. 13, no. 10, 2012, pp. 701–712.

8 10^{13} (10,000,000,000,000).

9 Probiotics are live microorganisms that may confer a health benefit on the host.

10 T Parker-Pope, 'Vitamin D, miracle drug: is it science, or just talk?', *New York Times*, 2 February, 2010.

11 CA Monteiro et al., 'A new classification of foods based on the extent and purpose of their processing', *Cadernos de Saúde Pública*, vol. 26, no. 11, 2010, pp. 2039–2049.

12 M Pollan, op. cit.

13 M Pollan, 'Unhappy meals', *The New York Times Magazine*, 28 January, 2007.

14 NHMRC Dietary Guidelines 2013.

15 FN Jacka et al., 'The association between habitual diet quality and the common mental disorders in community-dwelling adults: the Hordaland health study', *Psychosomatic Medicine*, vol. 73, no. 6, 2011, pp. 483–490.

16 R Moodie et al., 'Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries', *The Lancet,* vol. 381, no. 9867, 2013, pp. 670–679.

17 Iodine deficiency affects about two billion people and is the leading preventable cause of intellectual disabilities.

18 Methyl mercury is a bioaccumulative environmental toxicant.

19 Malnutrition can be defined as the condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (too high an intake), or in the wrong proportions. Malnutrition most commonly refers to inadequate intake of food.

20 Micronutrients are nutrients required by humans and other organisms throughout life in small quantities to orchestrate a range of physiological functions (Canadian UNICEF Committee, Global Child Survival and Health, 2006, p. 67).

21 The Flour Fortification Initiative is a network of partners encouraging countries to add essential vitamins and minerals to wheat and maize flour and rice. Retrieved from http://www.ffinetwork.org

22 Bill and Melinda Gates Foundation, retrieved from http://www.gatesfoundation. org/What-We-Do/Global-Development/Nutrition

23 M Andersson et al., *Iodine deficience in Europe: a continuing public health problem,* World Health Organization, Geneva, 2007.

24 KJ Carpenter, 'A short history of nutritional science: Part 2 (1885–1912)', *The Journal of Nutrition*, vol. 133, no. 4, 2003, pp. 975–984; and KJ Carpenter, 'A short history of nutritional science: Part 3 (1912–1944)', *The Journal of Nutrition*, vol. 133, no. 10, 2003, pp. 3023–3032.

25 L Bickel, *Mawson's will: the greatest polar survival story ever written*, Steerforth Press, Hanover, New Hampshire, 2000.

26 CB Gesch et al., 'Influence of supplementary vitamins, minerals and essential fatty acids on the antisocial behaviour of young adult prisoners: Randomised, placebo-controlled trial, *The British Journal of Psychiatry,* vol. 181, 2002, pp. 22–28.

27 Energy requirement is the amount of food energy needed to balance energy expenditure in order to maintain body size, body composition and a level of necessary and desirable physical activity consistent with long-term good health. This includes the energy needed for the optimal growth and develop-

ment of children, for the deposition of tissues during pregnancy, and for the secretion of milk during lactation consistent with the good health of mother and child. *Human energy requirements: Report of a Joint FAO/WHO/UNU Expert Consultation*, Rome, 2001.

28 DA Cohen, 'Obesity and the built environment: changes in environmental cues cause energy imbalances', *International Journal of Obesity,* vol. 32, 2008, pp. 137–142.

29 R Peters and M Wedel, 'Attention capture and transfer in advertising: brand, pictorial and text-size effects', *Journal of Marketing*, vol. 68, 2004, pp. 36–50.

30 Oscar Wilde, op cit.

31 FAO, *2012 Hunger Report*, retrieved from http://www.fao.org/publications/sofi/en/

32 The New Nutrition Science project is a join initiative of the International Union of Nutritional Sciences and the World Health Policy Forum, initiated in 2001. The aim of the project is to redefine nutrition in a more holistic way while preserving all that is basic and vital in 'classic' nutrition science.