Challenges facing NZ food technologists in the 21st century

Professor Ray J Winger

The JC Andrews Memorial Award is presented annually in recognition of the recipient's substantial contribution to science and technology in the food industry. The Award commemorates Massey University's first Chancellor, Dr John Clark Andrews, who proposed that a food technology degree course be established at Massey University. The 2007 J C Andrews award address, presented at the recent NZIFST Conference in Wellington, follows.

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Introduction

There has never been a more interesting time to be Professor of Food Technology at Massey University. I am fortunate to be able to reflect on the huge technological developments being created and to see how they relate to the food industry and consumers. In this paper I suggest that modern food technologists face a range of issues which collectively challenge the ethical boundaries of our profession. I consider whether we really understand this weighty responsibility and question if we are using (or failing to use) science as a foundation for our decision-making.

The relationship between food and health has never been higher on the agenda. While about 72% of all deaths in Africa are still from communicable diseases, often as a result of poor or inadequate food and water supplies, the developed countries have improved safety and nutrition in the food supply, to the point that 77% of all deaths are now related to non-communicable diseases. These are mainly diseases of the circulatory system and cancers (Anon, 2003), upon which diet has considerable influence. The 21st century food industry is confronted with completely different challenges from anything that has gone before.

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There is a dramatic range of new science frontiers. Geneticists have defined the human genome and are close to defining both the proteome and the metabolome: we can already measure and manipulate the genetic makeup of biological organisms, such as crops and pests. We are also developing and introducing new food ingredients and processing aids at an unprecedented pace. As we develop our understanding of genes and food and their relationship to health, Nutrigenomics, or personalised health, is becoming a reality. Allied with this, we are seeing potent bioactives being identified in, and isolated and concentrated from, food raw materials, then being offered in huge doses, whose effects we know next to nothing about. Meanwhile, nanotechnology offers a fascinating new set of structures and technologies for foods, packaging and sensors, several of which are already in use without most of us even noticing. New measuring tools are being developed and scientists are uncovering new and unforeseen problems, such as acrylamide in foods, and emerging pathogens.

Consumer awareness of the links between diet and health is also growing. Whereas ten years ago food safety and basic nutrition were the givens, consumers now expect safety and nutrition, and look additionally for some health benefit. This is fed by a desire to improve the quality and length of healthy life as the population progressively ages (See table 1).

our bodies get bigger. There is now a major mismatch between fundamental scientific knowledge and its application in industry. New products with nutrition and health claims emerge into the marketplace, yet the science underpinning these claims is at best dubious and insufficiently robust.

Challenges of this nature are not new. The process of discovery and application, which accelerated greatly in the last century, has been a feature of the human race. But the drivers of discovery have changed and the food industry must itself evolve to meet the new demands. In the 20th century, much technological change came from scientific discovery and its application by the industry. Today, scientific discovery is be-

Life Expectancy at birth and healthy life expectancy at birth (Table 1).

location	2001		2002		2003		2004		2005		2006	
	life	health	life	health	life	health	life	health	Life	health	life	health
world	66.4	54.7	66.5	56.9	66.7	57.3	66.9	57.8	67.1	58.3	67.3	58.7
OECD	77.4	66.0	77.5	66.9	77.7	67.2	78.0	67.7	78.3	68.0	78.5	68.4
EU	76.2	70.33	78.8	70.8	79.1	71.5	79.2	71.9	79.4	72.2	79.6	72.4
Australia	79.3	71.6	79.6	72.6	79.8	73.2	79.9	73.5	80.1	73.9	80.4	74.2
NZ	78.7	70.3	78.8	70.8	79.1	71.5	79.2	71.9	79.4	72.2	79.6	72.4

(Euromonitor, 2007)

An enormous amount of misinformation reaches both consumers and food specialists, exacerbated by the Internet, where a good deal of information lacks scientific credibility and/or authority. Consumers now expect to self-diagnose health problems and they often seek magic bullet solutions which may include food or drugs which probably don't work.

Retailers have enormous power and effectively control the gateway to the consumer, but have done little to embrace the technical considerations of processed foods in their drive for market share and profit. Essentially, retail and supply are at odds with each other and the casualty can be food safety or quality. This lack of appreciation of the cost of safety and quality assurance is most pronounced as the retail sector pressurises manufacturers' margins, while continuously demanding more sophisticated products, such as minimally processed foods. Without a rigorous understanding of food technology, retailers are in danger of undermining the substantial achievements in food safety and quality that have been the hallmark of the food industry in the 20th century.

R&D expenditure is usually the first casualty of a tightening budget

In manufacturing, R&D expenditure is usually the first casualty of a tightening budget, leaving technical services fully stretched with responsibility for both maintaining day-to-day activities and trouble-shooting. Opportunities for staff to up-skill and stay abreast of modern scientific developments are being reduced all the time. Meanwhile novel technologies, new ingredients and new product formats are being widely promoted as consumers demand less processed foods, fewer additives and reduced levels of protective packaging. The combined outcome is a reduction in the normal safety margins that exist in food processing – and the real potential for a progressive increase in food-borne diseases.

While we are gaining scientific knowledge about ingredients, especially bioactives and related so-called functional ingredients, the gaps in knowledge about how they interact in ing embraced or rejected for the first time mainly by consumers, who are then demanding that the industry incorporate (or exclude) this science before it has been assessed or properly applied.

The development of food technology at Massey University

Let us now reflect on the JC Andrews Award and its associated history. I hold the Logan Campbell Chair in Food Technology at Massey University, which is linked to Dr Andrews and his pivotal influence on food technology in New Zealand.

In 1923, Sir Walter Clarke Buchanan donated £10,000 to Victoria University College, Wellington, to found a Chair in Agriculture, and in May the following year Professor G.S. Peren was appointed to the first Chair in Agriculture in the whole of New Zealand. Towards the end of that same year, Sir John Logan Campbell endowed the Logan Campbell Chair of Agriculture which was set up at Auckland University College. <I am trying to source a pic of the original site for here, so please leave a space> In June 1925 Professor W. Riddet was appointed. For the next 2 years both Schools of Agriculture struggled to survive in an urban environment and then in February 1926, committees from the two Universities met and unanimously recommended they pool their funds, amalgamate the two Schools and establish one well-equipped institution in the Palmerston North /Marton area. The recommendation was adopted by the respective Councils within the month, and a joint deputation laid the proposal before the Prime Minister (Rt. Hon. J.G. Coates) who gave his approval and promised financial assistance. Following a thorough survey, the property of J. Batchelar, esq., was purchased by the government in December that same year.

Professors Geoffrey Peren and William Riddet meet to plan an agricultural college, 1925/6

The College had been established in September 1926 by the NZ Agricultural College Act, and the Council met for the first time in February, 1927. In July, an amending Act was passed, and Massey Agricultural College was established, named after a former Prime Minister, William Ferguson Massey. The first lectures followed in March 1928 and later that month, the College was formally opened.

Next year the foundation stone of the main building was laid and the University was officially opened on 30th April 1931. Professor Peren became the Walter Clarke Buchanan Professor of Agriculture and Principal of the College, while Professor Riddet became Logan Campbell Professor of Agriculture, and Director of the Dairy Research Institute, which had been established on campus in 1927. This amazingly rapid programme of concept to action goes to show how slow we have become these days!

Let's now skip thirty years to the establishment of Food Technology at Massey. First year science courses were introduced to Massey Agricultural College in 1958. The Faculty of Technology was established in 1961 and the Faculty of Veterinary Science a year later. In 1963 Massey University was awarded degree-conferring powers, effective from 1 January 1964 and this formally changed the organisation from an Agricultural College to a University. The Faculty of Science was founded in 1965.

The first Professor of Food Technology, J.K. Scott, was appointed in 1961 and in 1964 the Logan Campbell Chair was assigned to the Professor of Food Technology. Professor Scott was also Dean of the Faculty of Technology. He became Professor of Industrial Management and Engineering and relinquished his Food Technology Chair to Professor E.L. Richards in 1971. The Logan Campbell Chair passed briefly from Professor Richards on his retirement in 1988 to Professor P.A. Munro (who was Head of Department of Food Technology and Professor of Food Engineering) before my appointment in 1990.

Dr J.C. Andrews was a member of Council in 1960 when food technology was established at Massey University and was the first Chancellor of Massey University in 1963. He had been pivotal in the lobbying for the establishment of food technology at Massey and was a staunch supporter of the new programme. In 1964 he was invited by Professor Scott to be the very first member of NZIFST. Dr Andrews was instrumental in the development and expansion of the Faculty of Technology and the introduction of the Chair in Biotechnology in 1964.

My personal reflections and early career

Some early experiences had a profound impact on decisions that I made and attitudes I have today. I stumbled into food technology through a chance encounter with a medical doctor in Christchurch, when feeling disillusioned with my first year towards an engineering degree at Canterbury. Once in food technology, I found that I thoroughly enjoyed the course work, which I managed to sandwich between my hockey and other sports activities, and I relished the enthusiasm, knowledge and practical experiences of the lecturing staff and a wonderful group of classmates.

But two people in particular had a formative impact on my

4th year B Tech class photo, 1971

career path and related decision-making: Professors Dick and Mary Earle. It was Dick Earle who inspired my interest in research, through some fascinating lectures on unit operations and particularly, freezing of foods. I can still remember, as an undergraduate, walking past Dick in the Riddet Building and thinking that I was going to be like him one day. If he was an inspiration, Mary was my mentor and driver. It was her challenges; her persistent questioning of what I was doing and why; that kindled the desire to pursue a career in research rather than industry. They both advised me to do a PhD, and to ensure it was in the American (not English) system and they helped me identify and capture the opportunity with Owen Fennema and Bruce Marsh at the University of Wisconsin-Madison.

My time at Wisconsin was terrific: I learnt a lot about food chemistry and meat science and had unparalleled experience with two world-leading research supervisors. When I first arrived in Madison I was met by Professor Marsh, a New Zealander who had been Deputy Director of MIRINZ before moving to the Muscle Biology Lab in Wisconsin. While driving from the airport he was busy assuring me that the crime rate in Auckland, per head of population, was higher than in the USA, when we came across half a dozen police cars surrounding a vehicle, and policemen with shotguns frisking a man spreadeagled against a wall. He also told me that Madison had a record snow fall the previous year and I should expect the same while I was there. Two good myths.

Food Technology staff, circa 1970

This same Bruce Marsh gave valuable advice that resulted in my returning to NZ to work. Two years into my study, before I even had my MSc, I was offered a job in a major US food company, which would wait til I finished my PhD. Bruce told me to think carefully about this, as my experience in Wisconsin would totally change my appreciation of NZ and unless I went back home and worked there, I would always have in the back of my mind "what if?" He was absolutely right.

Professor Owen Fennema was one of the most pleasant, hard-working and challenging scientists that I have ever met. He provided a marvellous life experience and research training. I had arrived in Madison in August, the peak of summer: 40ºC and above during the day and perhaps as cool as 35ºC at night. It was debilitating and I was running around in my only suit… well, walking anyway, carefully selecting routes with air-conditioned pubs at strategic locations along the way. We worked on frozen foods, so the lab had several refrigerated water baths and no air conditioning, rendering it even hotter than the surroundings. So I worked during summer from dusk to dawn, when it was cooler. At one of my first meetings with Owen, he gave me a final draft copy of his first food chemistry book and asked me to proofread it. This experience, along with the engineering methods for freezing and refrigerated storage espoused by Dick Earle, combined to drive my professional interest in frozen food systems and the complexities of the water state in foods. Owen also encouraged me to become involved in IFT and I became very active. I established the Graduate Student Paper Competition for IFT which ran for the first time in 1977 and continues today.

The PhD defence

The formative event that influenced my attitudes and professional performance, however, was my PhD defence. All my student colleagues expected me to pass with ease and plans were laid to meet at the pub for lunch. I had duly provided my supervisor with a list of possible examiners to attend the oral examination; they were the leading meat science, protein and food chemists in the University. All 8 turned up, promptly at 9am.

As you may well know, the conversion of live muscle to meat involves the development of rigor mortis, a collection of physiological changes including the conversion of glycogen through glucose to lactic acid, by the process of glycolysis. The established methodology for following this process involved the decline in muscle pH until – at rigor mortis – the muscle was dead and all changes ceased. To measure pH effectively, glycolysis had to be stopped, or pH would continue to decline while the sample was being analysed and thus give a false result. The standard method was to homogenise meat in a dilute solution of sodium iodoacetate which denatured the proteins, and duly stopped glycolysis. The then doyen of meat science was Professor James Bendall, who had written some seminal articles on muscle biochemistry. He asserted that the addition of iodoacetate to muscle causes a small alkalisation of the sample and this needed to be corrected to give the exact pH (Bendall, 1973). I included this statement as part of my literature review.

I began my defence by briefly outlining what research I had done and what it meant. The first question came from an outstanding dairy protein chemist with little knowledge of meat science. He asked me to write down the reaction between iodoacetate and a sulfhydryl group – no problem:

$$RSH + ICH_2COO^- \rightarrow RSCH_2COO^- + I^- + H^+$$

Puzzled, he asked how therefore the addition of iodoacetate could cause an alkalisation of the reaction mixture. I looked at the equation and replied that "Bendall had said it, so it must be right". In all, I defended Bendall for a full 30 minutes, but not one of those examiners let me get away with it. The right answer was obvious and I refused to accept it, because the saintly Bendall could not be wrong. The examiners continued to pick up other statements attributed to Bendall and also gave me a rigorous challenge of my research and the conclusions I had reached. It was an awesome six hours grilling, one of the longest thesis defences at Wisconsin. I missed the lunch at the pub but joined the troops in the evening with my degree duly granted. The lessons I learnt? Always challenge the givens and be a sceptic. Always ask for the scientific evidence.

<subhead> Revenge – and a lesson learned

Soon after returning to New Zealand to work at the Meat Industry Research Institute in Hamilton, I was asked to review an article by none other than James Bendall, entitled "The relationship between muscle pH and important biochemical parameters during the post-mortem changes in mammalian muscle". With vitriol-loaded pen, my review was longer than his article and included a detailed commentary on the chemical reaction between iodoacetate and muscle proteins. The editor of the journal gave my report back to Bendall in little pieces, lest he offend him. Revenge was very satisfying and to my amazement Bendall rewrote his article significantly and even undertook a series of experiments to prove (and in some cases disprove) the points I had made. In fact, he found, through careful scientific experimentation, that there was actually no pH shift in the iodoacetate poisoning of muscle (Bendall, 1979). He undertook the science to justify and sometimes refute statements he had taken for granted. This is a reflection of an outstanding scientist, prepared to go back and check assumptions and not afraid to repeat experiments and acknowledge a mistake. No wonder he remains one of my heroes.

The modern food industry – are we really science-based?

Thirty years on from my PhD, I see that we are constantly bombarded with information that has never been tested scientifically, with no basis in fact and science principles. The tenets may make sense, but where is the evidence? I am increasingly and deeply concerned about dramatic changes perpetrated by the food industry, on the basis of unproved and sometimes dodgy science. While we have serious ethical issues facing us as food technologists, we are relatively nonchalant about accepting poorly founded comments proliferated at all levels in the food value chain.

Obesity: whose problem?

A good example is obesity. Problems with overweight consumers started to attract significant attention in the 1980s. The World Health Organisation, in a report entitled “Diet, Nutrition, and the Prevention of Chronic Diseases” (Anon, 1990) published a figure showing how “modern” man’s diet is made up very differently from before.

But this was not based on science: it was conjecture and assumptions. We don’t know for sure what our ancestors ate, let alone completed proximate analyses. Yet we chose to extrapolate this and related information, into action.

There was a call from nutritionists for the food industry to reduce calories in foods and – in particular – remove fat, which has the highest calorie density. As a result, low fat foods and fat replacers were developed in the 1980s and early 1990s in one of the biggest R&D efforts ever. The food industry moved in response to demand, but not for reasons based on science. The changes may have seemed logical and rational to address a ‘growing’ problem but there was no supporting science to show cause and effect. As the science caught up, it became clear that it was a mistake to remove fat completely from our food and so the industry got blamed for substituting it with carbohydrate. Fat had been found to be required at between 15 and 35% of our calories, but by the early 1990s there were also ‘good’ and ‘bad’ fats. At first it was ‘saturated fats bad, unsaturated fats good’. But today, the ‘good’ fats are omega-6 and omega-3 (in the

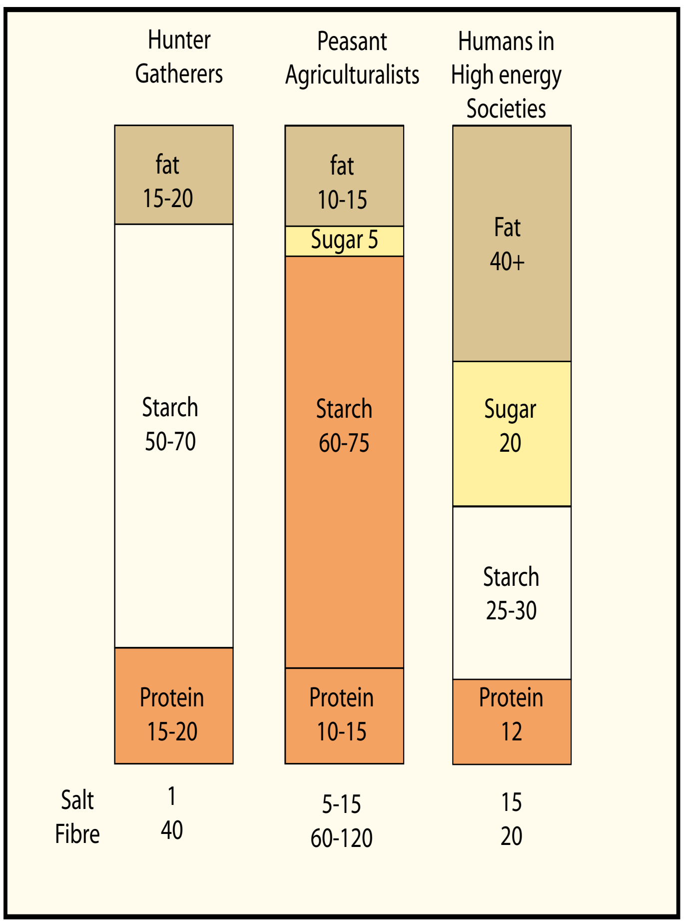


Figure 3, from Boyden, 1987

right ratio), and fish oils are the preferred forms of omega-3 for humans. Trans fats are now the villains. In all, we spent nearly two decades making new and supposedly healthier foods by removing fat, without real scientific evidence. Despite a plethora of low calorie and low fat products in the supermarkets, obesity continues to increase.

It's diet, not food

In a more recent WHO report (Anon, 2003) an Expert Consultancy Panel identified that changes in diet, eating behaviours, environmental factors, physical activity and fitness levels plus genetic factors were contributing to the causal factors underlying noncommunicable diseases, even in the poorest countries. They consistently emphasised that the concerns around obesity were related to diets, not individual food products. I fully agree with this.

The panel stressed that average per capita supply of macronutrients, derived from food commodities on a national basis, did not correspond to actual per capita consumption. If we accept that the majority of consumers in every country are not obese, then clearly a focus on per capita consumption data (and the calculated calorie intake) is somewhat meaningless in this debate. Obesity is evident in developing countries, primarily confined to middle aged women living in households, often where others are malnourished. But the science establishing cause and effect has still to be done.

the majority of consumers in every country are not obese

There has been a substantial increase in fats in our modern diets, predominantly vegetable fats. It is assumed this has created an imbalance in our metabolism which has resulted in obesity. Is there a cause and effect?

One dimension has been provided in the 2003 WHO report as shown in Table 2. This is valuable in assisting food technologists' understanding of the areas of greatest concern and in affecting the confidence that experts have in the current state of the science. However, direct cause and effect information is scarce. It is interesting, given the current situation in New Zealand, that the same report states that "despite the obvious importance of the roles that parents and home [and school] environments play on children's eating and physical activity, there is very little hard evidence available to support this view."

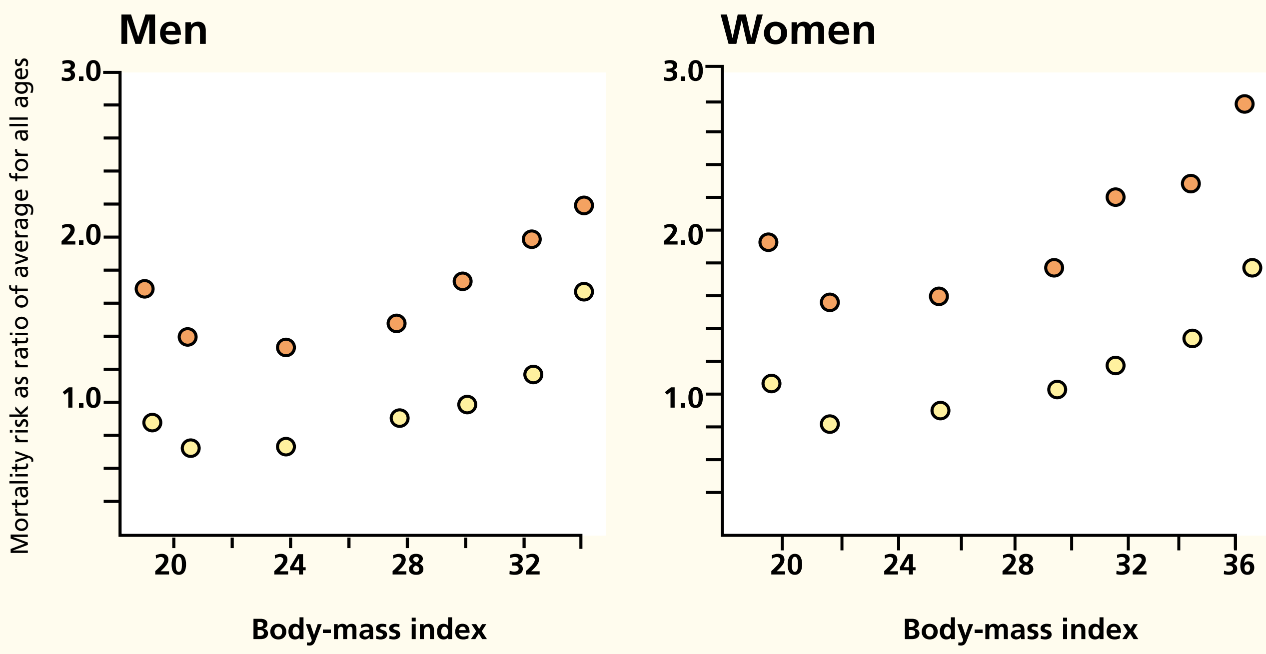
Health and metabolism

Let's look at the 1990 WHO report again. A diagram in that report shows a U-shaped curve for BMI against mortality. The report then proceeds to assume a BMI of 20-25 is 'normal' and appropriate for adults in developed countries. But what has this

Table 2. Summary of strength of evidence on factors that might promote or protect against weight gain and obesity[a]

Evidence	Decreased risk	No relationship	Increased risk
Convincing	Regular physical activity High dietary intake of NSP (dietary fibre)[b]		Sedentary lifestyle High intake of energy-dense micronutrient-poor foods[c]
Probable	Home and school environments that support healthy food choices for children[d] Breastfeeding		Heavy marketing of energy-dense foods and fast-food outlets[d] High intake of sugars-sweetened soft drinks and fruit juices Adverse socioeconomic conditions (in developing countries, especially women)[d]
Possible	Low glycaemic index foods	Protein content of the diet	Large portion sizes High proportion of food prepared outside the home (developed countries) "Rigid restraint / periodic distribution" eating patterns
Insufficient	Increased eating frequency		Alcohol

[a]Strength of evidence: the totality of the evidence was taken into account. The World Cancer Research Fund Schema was taken as the starting point but was modified in the following manner. Randomized controlled trials were given prominence as the highest ranking study design (randomized controlled trials were not a major source of cancer evidence); associated evidence and expert opinion was also taken into account in relation to environmental determinants (direct trials were usually not available).
[b]Spoecific amounts will depend on the analytical methodologies used to measure fibre.
[c]Energy-dense and micronutrient-poor foods tend to be processed foods that are high in fat and / or sugars. Low energy-dense (or energy-dilute) foods, such as fruit, legumes, vegetables and whole grain cereals, are high in dietary fibre and water.
[d]Associated evidence and expert opinion included.



*Reproduced from reference 49, by kind permission of the publisher, Recalculated from data in reference 51, with unpublished data from the American Cancer Society.

got to do with health? The true science required is to develop a relationship between your personal BMI (or some better measure of body composition) and how long you will live. It is an experiment that can never be performed since we die after only one treatment. So science, in this instance, cannot tell an individual what their target BMI should be.

The 1990 WHO document included a statement: "the cumulative effect of a sustained 2% discrepancy between energy intake and energy expenditure can lead in an adult to a 5kg weight change over a period of a year". This was probably a calculation and a theoretical conclusion. Similar calculations were made in the 2003 report.

However, statements of that ilk have been taken to mean that people put down fat because the calories ingested are greater than the calories expended. I am not aware of any peer-reviewed, internationally published scientific experiment that justifies that statement. We accept it because it makes logical sense – but is it correct? Our bodies are complex metabolic pools of intertwined biochemical, regulated pathways, not simple machines.

It is known that fat in our diet is absorbed almost unchanged into our lymph systems and passes directly to the muscles, and that fat is the major source of energy in the muscles. Carbohydrate and protein, on the other hand, are digested and absorbed as small molecules, then converted in our liver to other products. We also know that if our muscles can't handle glucose because of a biochemical imbalance, then it will be removed as fat and stored in adipose tissues. The physiological factors that could cause obesity might include:

- an imbalance in our metabolism
- some limiting, or excessive, or imbalance in micronutrients in our diet
- adding or removing too much fat, or the wrong fat, or imbalances in fatty acids
- an unidentified virus or mutated microorganism
- hormonal cascades being disrupted or challenged
- some unidentified antinutritional factor(s)
- some change to our lifestyle introduced over the last 50 years

This list is not exhaustive. Concomitant with an increase in obesity is an increase in Type II diabetes. Is diabetes caused by obesity, or is obesity caused by the early, undetected stages of diabetes? What if we are busy trying to reduce the caloric content of our diet, because that makes logical sense, but the true cause of obesity is something else? Are we exacerbating obesity or ameliorating the problem by the product development path we are following today? Are those individuals who are obese, or becoming obese, trapped by some addictive impulse(s) similar to those who choose to smoke? Show me the science that justifies what we are doing, and I mean, science that clearly shows unequivocal cause and effect, not empirical studies and statistical correlations. I don't think you can. I think we have not defined the problem that we are trying to solve.

Obesity: Damned if you do, damned if you don't

Today, the food industry is being pilloried for its role in obesity. In fact, it is being blamed for the problem. On what scientific evidence? The obesity issue is about diet and lifestyle. We cannot control an individual's diet by controlling individual food products, but all the food options necessary for making a healthy diet are available in the supermarkets. We read that the causes of obesity include 'bad' foods, but the allegations lack scientific credibility. Diets include a wide variety of foods and these must be tailored to an individual: what they can tolerate, what they will eat, what is available, what they like and can afford.

While opinion-formers are influenced by phenomenal advances in gene technology and understanding of the human genome, the real science is in its infancy. We cannot make credible extrapolations to human health and the foods we must feed to people. I refuse to believe that the human genome has changed in the last 20 years: certainly it is not the reason for the obesity developments, but it may be a factor. We should be looking for the underlying causes of obesity.

We should be looking for the underlying causes of obesity

The infectious disease landscape has also changed dramatically in the last 50 years, with antibiotics and the emergence of new and evolving pathogens. Vaccination and the advances in medical science have created a totally different environment from that of pre-obese times. Prions have show a unique pattern of infection and an incredibly long lag period prior to the indication of the disease, and they may not be alone. These aspects combine to pose an interesting set of questions for human health.

So I conclude that obesity is a lifestyle issue, with impact from all aspects of the human body; it is complex and cannot have a single solution. We need more whole body scientific research that takes into account psychology, social issues, genetic factors, biochemical and physiological matters, diet, exercise – and more. This is not a trivial matter and, unequivocally, it cannot be 'fixed' at a population level. After all, the majority of people are not obese.

Nutrients: Where goeth the modern food industry?

We as food technologists need to question what we are trying to do in meeting our ethical industrial responsibilities; to stop making a series of knee-jerk reactions to the problems associated with obesity and instead look at a more scientific approach. But there are other science issues. From an industry technical point of view, much modern science is new and exciting but potentially confusing. For example, GM foods and many of the supplements, micronutrients and their roles in foods, including potent bioactives present a growing issue.

It has been suggested that there has been a reduction in concentrations of micronutrients in foods over the century as we have bred crops and animals for maximum production efficiency, rather than composition. We also do less manual work these days and from metabolic feedback research this generally means we consume fewer calories. So is there a need to redress the nutrient density in our raw food supply? If so, it must certainly have a science basis and justification. For example, while much research has focused on the biological impact of βcarotene, scientific intervention studies have not shown the causative relationship between βcarotene and cancer prevention in humans. A bioactive polyacetylene, falcarinol, found only in carrots may be the primary anti-cancer agent (Kobaek-Larsen et al., 2005). In particular we don't know the role that yet-to-be-discovered micronutrients will play in our health.

Bioactives pose a significant ethical issue for the food industry.

Bioactives pose a significant ethical issue for the food industry. For example, phytoestrogens in pastures are a significant factor in spontaneous abortion in ruminant animals, yet we promote soy products containing them for women to reduce the difficulties associated with menopause. We also add phytosterols to margarines to reduce cholesterol absorption. A Swedish review in 1998 suggested an assessment of the phyto-estrogenic and endocrine effects on growing children was called for, especially with respect to subsequent fertility in boys (Thomas, 2006). Examples like this challenge the ethics of incorporating potent bioactives into foods.

We are heading for a period of proliferation of health claims, functional foods and a flurry of medical foods, but are we also heading for a serious set of problems that we havent yet adequately debated?

What is really important for the food industry?

While not trying to be a doom merchant, I am using these as examples of significant issues that require our attention as food technologists. We need to debate the ethical challenges we will face, because many of these modern practices are based on scientific research insufficient for anybody to be able to make sound judgements. We can identify major holes in research works being done, but we are not asking the questions loud enough. The food industry is relatively silent on these matters and yet we, the food industry, are going to be the ones to develop and sell the products, and carry the can for the mistakes.

Currently we are concerned with issues around food safety, natural foodborne toxins and antinutritional factors, including allergens. We have seen the emergence of new challenges in food borne diseases, including obesity, Type II diabetes, etc, above. We are on the cusp of creating another set of challenges in medical foods and foods for health by promoting individual food products with supposed health benefits, when we should really be targeting our entire diet. Public health professionals try to create a nutritional template for each and every product we manufacture, instead of directing the bigger picture related to the diet. Consumers are falsely accepting the unsupported and non-scientific misinformation proliferated on the Internet. They can't differentiate fact from fiction, yet the demands of their product choices pressurises retailers and, through them, processed-food producers in an unprecedented, and often, misdirected way. When all is said and done, consumers still want acceptable and affordable food that tastes good. This is nothing new and is unlikely to change into the future.

It is a food technologist's responsibility to pursue a professional and ethical approach to the introduction of new technologies and food products. We cannot merely wash our hands of the need to question and argue the science.

These are definitely exciting and challenging times for the food industry. The vertical integration of all facets of the food value chain means that the applied technical skills needed, the scientific understanding of food and its biological impact are far more important than ever before. Lifelong learning is now an essential and crucial part of our career path if we are to keep abreast of the rapid advances in science. Food technologists have had the pivotal role in innovation in the processed food sector and we cannot default on our obligations to the consumer by falling behind in our understanding of the opportunities and pitfalls that modern scientific pursuits offer. We must continue to profess control and leadership in the application of science and nutrition to the foods we produce. After all, that's what we have been trained to do. It's exactly what Dr JC Andrews had in mind when he championed the instigation of food technology itself.