

# Food control or food democracy? Re-engaging nutrition with society and the environment

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## Abstract

*Objective:* To explore the terms on which nutrition should engage with the global challenges ahead.

*Design:* Analysis of current orientation of nutrition and policy.

*Result:* Nutrition faces four conceptual problems. The first is that nutrition has fissured into two broad but divergent directions. One is biologically reductionist, now to the genome; the other sees nutrition as located in social processes, now also requiring an understanding of the physical environment. As a result, nutrition means different things to different people. The second problem is a misunderstanding of the relationship between evidence, policy and practice, assuming that policy is informed by evidence, when there is much evidence to the contrary. The third problem is that nutrition is generally blind to the environment despite the geo-spatial crisis over food supply, which will determine who eats what, when and how. How can we ask people to eat fish when fish stocks are collapsing, or to eat wisely if water shortage dominates or climate change weakens food security? The fourth problem is that, in today's consumerist and supermarketised world, excess choice plus information overload may be nutrition's problem, not solution.

*Conclusion:* Nutrition science needs to re-engage with society and the environment. The alternative is, at best, to produce an individualised approach to public health or, at worst, to produce brilliant science but be policy-irrelevant.



**Keywords**  
Food policy  
Environment  
Evidence  
Paradigms  
Life science

Nutrition science, like all sciences, does not live in a vacuum; science is framed by context. Nutrition sits in a triangle of food policy-making, fought over by competing forces: the state, food supply chain and civil society (see Fig. 1). Forces within each side of this triangle also compete. Currently, within the supply chain, retailers hold power. State involvement, meanwhile, is fragmenting between different levels of governance: local, national, regional and international. Within civil society, there are tensions over who speaks for civil society: 'ordinary' consumers through polls (but who asks the questions?) or the weekly shopping purchase (the 'consumer votes' theory)<sup>1</sup>? Or 'champions' and partisan activists such as civil society non-government organisations?

The future of nutrition requires some clarity about the terrain, players, purpose and options for which nutritional strategy and policy are to be formulated. This paper explores this challenge, identifying four problems about the role of nutrition.

## Discussion

### **Problem 1: Nutrition or nutritions?**

In recent years, nutrition science has gradually, but not necessarily irrevocably, split. As a result, nutrition means

different things to different people and it might be counter-productive to try to corral all nutrition into one perspective. There is no 'real' or one nutritional canon; there are nutritions. Nutrition science from its earliest formulation has pictured itself as a progressive force, a tool for improvement and social good. Over the last two centuries, nutrition researchers have attempted to systematise knowledge that previously was cultural, which is therefore relativist and lacking universality. It moved from 'folk' knowledge to 'science'.

Today nutrition is highly fragmented intellectually. It ranges across social nutrition (studying the interface of nutrition and society; for instance, differences between social groups), nutritional epidemiology (plotting the contribution of diet to diseases), biochemistry (exploring the biochemical interaction of nutrients and physiology), sports nutrition (optimising performance), animal nutrition (ditto) and psychophysiology (including the study of attitudes and food choice), and more. Nutrition, like other sciences, pulls apart at the margins. So can we speak meaningfully of nutrition?

Two broad directions or paradigms for nutrition are discernible today. One is biologically reductionist and with an interest in nutrients as key factors in individually determined health, the better understanding of which will

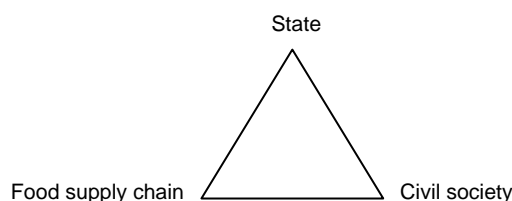
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It is a myth that nutrition science was ever neutral. Nutrition has made advances only when engaged with society. Policy-makers have been weak in responding to evidence from nutrition science, but this failure has also been due to nutrition lacking good champions, coherent organisations, and political will to lobby against and with powerful forces. Rising awareness of the rising global obesity epidemic is shocking nutrition scientists into becoming engaged again.

enable diet to be tailored according to individual needs. The other is rooted in social reform and a more classical conception of public health, in which amelioration of diet, (ill) health and supply chains have to be introduced on a population-wide rather than individualised basis<sup>2,3</sup>. This public health or social nutrition approach is now rightly being deepened by modern understanding of the environmental infrastructure for health<sup>4</sup>, generating a new ecological conception of public health in place of 'classical' sanitarianism or social engineering as public health<sup>5</sup>.

#### *Nutrition as a 'life science'*

Currently, the dominant position in nutrition is what Michael Heasman and I have termed the 'life sciences integrated paradigm'. This takes nutrition down the ontological mineshaft, beyond biochemistry and into nutrigenomics<sup>6</sup>. Nutritional science becomes the search for the nutrient triggers of genetic pre-potential, placing nutrition as the search for ever more microscopic and refined processes. In the words of two proponents: 'dietary intervention based on knowledge of nutritional requirement, nutritional status, and genotype (that is, "individualised nutrition") can be used to prevent, mitigate, or cure chronic disease'<sup>7</sup>. The goal of nutrition, within this paradigm, is to unlock the pathways by which diet delivers (or fails to deliver) nutrients affecting metabolism and signal transduction, and thence gene expression and either normal or abnormal cell growth; the key insight is that common dietary chemicals can affect gene structure. Unlocking genetic pre-potential will enable tailored dietary advice or nutritional cocktails to be engineered to avoid chronic diseases. The search is on for exciting fundamental processes, akin to that of Gowland Hopkins discovering vitamins<sup>8</sup>.



**Fig. 1** Nutrition as contested space between state, food supply chain and civil society

Although today conceiving of the body as infinitely more complex than a mere input–output machine, a core mechanical view remains, enshrining a view that nutritional science can and should contribute to conceiving food as something to be controlled. This legitimises current investments such as probiotics and functional foods<sup>9</sup>. These are technical fixes for disease, requiring expert-led knowledge and turning food into personalised medicine. Food production, according to this view, elides into pharmaceuticals; and nutrition becomes no more than a subset of pharmacology or medicine.

#### *Nutrition as also a social and environmental science*

The other direction for nutrition is currently more marginal, although it too has a distinguished intellectual pedigree, and it ought to be more central. It focuses on how society determines who eats, what, when and how, and with what effects. Social nutrition proposes that nutritional science is also rooted in social policy. Biology's insights need to be harnessed to ameliorate the societal determinants of diet-related (ill) health, of course; but the likely solutions for nutrition problems lie less in unlocking biological pathways than in creating social environments that can deliver 'correct' balances. Nutritional science can and should contribute to social rather than individualised interventions. Change society, and nutrition will follow. The clash between these perspectives – personalised versus societal change – was part of the reason for the tension over the World Health Organization's (WHO) 2004 Global Strategy on Diet, Physical Activity and Disease<sup>10</sup>.

It can be argued that both nutritions should and can coexist, and that there is no fundamental conflict. In practice, one has been squeezing the other. The urgent need now is to right the imbalance, and to rebuild and champion social nutrition. Mining the genome may be exciting and brilliant science but it makes for individualised approaches to public health, which will be of little value in the task of tackling the nutrition transition or inequalities or environmental crisis.

#### ***Problem 2: Nutrition's societal role – provide evidence for policy?***

The second problem is a misconception that nutrition's contribution to humanity is best delivered by providing ever more accurate evidence to inform policy. Take the

issue of advice to eat more fruit and vegetables. This is currently given to consumers either at point of sale, through labelling, or through general dietary advice such as state-approved guidelines. These are too general, and they differ. The UK's Food Standards Agency recommends '5-a-day', 'Eat a wide variety of fruit and vegetables and aim for at least five portions a day'<sup>11</sup>. The USA says it should be '7-a-day' for most adults: four 'servings' of vegetables plus three of fruit<sup>12</sup>. The Danish Veterinary and Food Administration and eight other bodies including the Danish Cancer Society recommend '6-a-day': three fruit plus three vegetables, totalling over 600 g per day<sup>13</sup>. The Greek Ministry of Health recommends '9-a-day' (three fruit and six vegetables, 'including wild greens', a rich source of antioxidants)<sup>14</sup>.

How can we explain such divergence? One avenue would be to explore whether the same evidence is being used or whether some evidence is better than the rest. The Cochrane Collaboration approach epitomises the latter. The theoretical ideal of the relationship between evidence and policy is what we might call a *mutually self-improving relationship*. In this there is a continuous virtuous circle in which: (1) evidence informs policy; (2) policy feeds the search for evidence; (3) there is mutual benefit from repeated feedback; (4) policy is based on best evidence; and (5) data synthesis is best conducted on a systematic basis. One plea for more evidence-based policy in nutrition has argued: '[e]vidence-based nutrition is the application of the best available systematically assembled evidence in setting nutrition policy and practice'<sup>15</sup>.

Laudable though this approach is, it begs evidence that policy does not work in quite that rationalist manner. Is this pursuit of evidence-based policy therefore an admirable mirage, a rational appeal, influenced by medical debate, about the inappropriateness of following practices unless they are properly *based on science*, with the Cochrane Collaboration approach as the 'gold standard' for evidence into practice? Systematic and rigorous reviews of healthcare interventions, based on peer-reviewed journals (shedding 'grey' literature), may be an ideal for surgery, but societies are not surgeries, except for dictatorships. The gap between evidence and policy cannot be resolved by piling on ever more evidence, but by being clearer about what the questions are to which society needs answers.

The evidence-based approach to policy has professional appeal to those with scientific training or aspirations. One has argued: '[d]espite some groups using evidence based policy as a fig-leaf, it seems difficult to argue with the idea that scientific research should drive policy'<sup>16</sup>. But the role this ascribes to the researcher is of seller awaiting a buyer, 'a retail store in which researchers are busy filling shelves of a shop-front with a comprehensive set of all possible relevant studies that a decision-maker might some day drop by to purchase'<sup>17</sup>. Nor is the ideal cycle of ever-improving relationship of research to

policy what happens in the real world of nutrition policy. This is for a variety of reasons.

The first is politics. The government of the day may oppose the evidence, as it does not fit ideology or other commitments. Most countries have such experience. In the UK, a well documented case was the burying of the Black Report on Inequalities in Health in 1980, requested by a previous 1974–1979 Labour Government<sup>18</sup>. Sir Douglas Black, a distinguished physician, and colleagues summarised the data on the impact of inequalities on public health and made proposals on how to tackle it, including strong recommendations on public food, such as school nutrition. The incoming Conservative Government, which received the report, did not like it, published only 500 restricted copies and refused to act on it. A scandal ensued, but policy remained opposed to the evidence. The dynamics were repeated with another report a few years later<sup>18</sup>. Such politics have been documented for the USA<sup>19</sup>.

The second factor can be lobbying, where an interest group works actively to stop the implications of evidence being turned into policy. This process may never be in public. In 2002–2004, the sugar industry of the USA lobbied hard within the US government to encourage the USA to weaken or slow the WHO's Global Strategy on Diet, Physical Activity and Health, based on the joint WHO/Food and Agriculture Organization (FAO) Technical Report 916<sup>20</sup>. In 1982–84, a not dissimilar attempt to deflect the implications of evidence for nutrition education was documented in the UK. A government-approved health education strategy working party was torn apart after it emerged that powerful elements of the processed food industry (sections selling processed, salty, fatty, sugary foods) tried to weaken the report and health education strategy being proposed<sup>21</sup>. This lobby in fact back-fired and led to a sharp rise in public awareness, but no change in policy.

Should nutrition scientists therefore give up trying to make policy more evidence-based? No! But there has to be better expectation, as well as realisation of policy-making processes. A typology of policy–evidence relationships can be identified:

- Policy in search of evidence.
- Policy without evidence.
- Policy with out-of-date evidence.
- Policy lagging behind evidence.
- Policy with partial evidence.
- Policy denying evidence.
- Evidence in search of a policy.
- Policies all with evidence which all conflict.

Even if the rational-scientific ever-improving cycle of evidence and policy did dominate, limits are built in to the policy production cycle. Policy-makers have relatively short time horizons; in democracies, electoral cycles dominate. Researchers have longer time horizons, but they too are often dominated by demands for funds, high-status

outputs and the manufacture of reputations. Meanwhile, practitioners – whether parents feeding children, dietitians offering advice or farmers growing crops – are forced to deal with the immediate. In fact, only those with power have the luxury of surveying all time zones.

In the real world of policy, the policy–evidence relationship can be complex and policy-making can be political (some say this is inevitable). But it is possible to unravel both the experience and desirability of clearer relationships between evidence and policy. Nutritional science should be more discriminating, and as is argued below, get better lobbies, more focused and better organised itself. Policy-making is always in transition. There is never a policy vacuum; the world cannot be frozen pending the discovery of evidence to inform it.

### ***Problem 3: Does nutrition depend on the environment?***

In the 1980s and 1990s, people who resisted the mounting evidence about the impact of diet on health frequently argued that nutritionists could not agree on what advice to give consumers. In fact, although state policy advice might differ, as was illustrated above, there was considerable scientific agreement<sup>22</sup>. This consensus failed fully to be translated into policy; there was resistance from vested interests. A more effective criticism – but equally dangerous to the food industry critics trying to stave off action to curb their excesses – would have been to say that nutritional information was insensitive to the environmental determinants of food supplies. The environment is nutrition's invisible infrastructure, everywhere but nowhere.

The thousands of advice books, let alone state guidelines, collectively call for action, but they too often fail to connect with other evidence and discourse. How, for example, can consumers follow common advice to eat fish when the stocks are in serious decline and when even fish-farming is environmentally hazardous? Yet this advice is almost as unanimous as to the warning about the crisis of over-fishing<sup>23,24</sup>; at best the advice is to only consume certain more plentiful species. The nutrition literature is near unanimous as to fish's benefits, although there are some legitimate concerns about contaminants<sup>25,26</sup>. These are generally downplayed by official nutrition bodies (if acknowledged at all) as lower risk than not consuming the beneficial *n*-3 fatty acids. The UK's Food Standards Agency stated: '[a]ll foods can carry some risks. It is a question of balancing benefits and risks. The known benefits of eating oily fish outweigh any possible risks'<sup>27</sup>. Do not consumers expect both good oily fish *and* pollutant-free fish? Must consumers choose which evidence – nutritional, environmental or toxicological – they accept?

Another example of the gulf between nutrition and environment is the common exhortation to eat ample fruit and vegetables, without considering how these are grown or whence they arrive in the consumer's mouth. Supply-chain management 'efficiencies' mean a remarkable

growth in 'food miles', the distance food travels down the supply chain<sup>28,29</sup>. The burden of food transportation is now considerable. High-income countries can afford to stop farming, despite having good land and climate, and import more. In Britain food today travels 65% further by road than it did two decades ago due to centralised storage; a quarter of all lorry traffic is for food. The price consumers pay – the biggest factor in food choice, not nutrition – does not reflect the true price of production. In one study the financial burden for the UK of such externalised costs has now been calculated<sup>30</sup>. The implications are that it is better to eat produce grown as near to the point of consumption as possible. If there is a choice between eating an organically produced food which has trucked many food miles and an intensively grown but more local one, environmentally it is probably better to choose the latter.

The ideal, in this two-option scenario, would surely be a product meeting both criteria. Working out how to juxtapose the environment and nutrition is not simple. Within the environment, there are different foci. Taking transportation, should consumer benefit focus on noise, oil, climate change or water? One study looking at CO<sub>2</sub> emissions (but not costing them) found a complex story in that localisation is not necessarily the optimum strategy for reducing CO<sub>2</sub> emissions, although distance is a clear factor<sup>31</sup>.

Food's environmental infrastructure is also human. Who is to grow the food of the future or tend the soil on which food (and culture) depend? Over the past 50 years the number of actual farmers has declined by 86% in Germany, 85% in France, 85% in Japan, 64% in the USA, 59% in Korea and 59% in the UK. In the USA there were close to 7 million farms in the 1930s, but less than 1.8 million by the mid-1990s. Today in the USA there are more full-time prisoners locked up in gaol than full-time farmers, less than 1% of the population<sup>32</sup>. In what will be the greatest movement of people in history, the Chinese government intends to move an estimated 530 million people from country to town in coming decades. Remaining rural labour might become more conventionally efficient, but what about the social dislocation or the environmental impact<sup>33</sup>? China's urban population increased from 72 million in 1952 to 370 million in 1997, but the plans for 2020 will take that urbanised population to 60%<sup>34</sup>.

National policy is silent as to how such environmental or (agri)cultural considerations are to be linked to nutrition or translated into practice. In lieu of science helping consumers to choose, morality becomes the arbiter. Is *fair trade* to rich countries, giving more money to a hard-pressed developing country producer, more worthy of support than keeping a local supplier in business or reducing food miles? Nutritionists must participate in making sense of competing data and demands or harsh economic criteria will dominate.

**Problem 4: Can good nutrition (policy) be left to consumer demand?**

Nutrition has a fraught relationship to consumerism and a poor understanding of the food economy's dynamics. Since the early to mid-twentieth century, the period which enshrined the productionist paradigm and for which nutritional evidence was so formative<sup>35,36</sup>, the food economy at national and international level has been transformed in the name of consumers. There have been changes from farm to plate in:

- How food is grown – for example, mass use of agrochemicals, hybrid plant breeding<sup>37</sup>.
- How animals are reared – for example, factory farms, intensive livestock rearing, prophylactic use of pharmaceuticals to increase weight gain<sup>38</sup>.
- A shift in scientific focus from chemistry to biology – for example, the emergence of biotechnology as applied to plants, animals and processing<sup>39,40</sup>.
- Food sourcing – for example, a shift from local to regional and now global supply points, with a blurring of the notion of seasonality and a tendency to monoculture on the farm belying the biodiversity on the supermarket shelf<sup>41–43</sup>.
- Forms of processing – for example, use of extrusion technology, fermentation, wholesale use of cosmetic additives to disguise products and yield consistency<sup>44</sup>.
- Use of technology to shape quality – the goal of mass production to deliver consistency and regularity (uniformity) is now focused on the development of niche products with 'difference'<sup>9</sup>.

- The workforce – what, where and how labour works; there has been a dramatic shedding of labour on developed world farms but a retention of pools of cheap labour (immigrants) to do the manual tasks such as picking and grading; there is also a strong push to 24-hour working<sup>45,46</sup>.
- Marketing – for example, a new emphasis on product development, branding and selling; this has accompanied a dazzling display of apparent choice, with thousands of products vying for consumer attention<sup>47,48</sup>.
- Retailers' role – they have emerged as the main gateways to consumers, using contracts and specifications to gate-keep between primary producers and consumers; retailers are the new food powers<sup>49</sup>.
- Distribution logistics – for example, use of airfreight, regional distribution systems, 'trunker' (heavy lorry) networks, satellite tracking<sup>50,51</sup>.
- Methods of supply-chain management – for example, centralisation of ordering, application of computer technology, application of batch/niche production to mass lines ('flexible specialisation').
- Moulding of consumer tastes and markets – for example, mass marketing of brands, the use of product placement methods, huge investments in advertising and marketing, and the targeting of particular consumer types<sup>52</sup>.
- Level of control over markets – for example, rapid regionalisation and moves towards globalisation, and the emergence of cross-border concentration<sup>53</sup>.

The twentieth-century revolutions have been immense, but contrary trends within the food system are also to be

**Table 1** Dimensions of the modern food system

Sector	On the one hand...	On the other hand...
Policy goals	Intensification Quantity Food control	Extensification Quality Food democracy
Farm	Animal-focused Large farms Labour replacement Monoculture Long-distance food	Plant-focused Small farms Labour retention Biodiversity Local food
Processing	Assembly Factory cooking De-skilled/machine-minder	Cooking Home cooking Skilled/artisanal
Culture	Hypermarket Global food Fast food Consumerist Advertising/marketing	Street market Regional food Slow food Citizen Education
Nutrition	Nutrient-light Domination by cheap commodities like sugar and fat Individual approach to health Nutrigenomics	Nutrient-rich Nutrient-diverse Population approach to health Social nutrition
Economy	Food prices exclude external costs (e.g. health, environment) Cheap/low prices Industrial/post-industrial	Full-cost accounting Expensive/high prices Craft/industrial



**Table 2** Different approaches to food, nutrition and health policy, by paradigm

Policy focus	Productionist paradigm	Life sciences integrated paradigm	Ecologically integrated paradigm
Relationship to general economy	Trickle-down theory; primacy of market solutions; inequality is inevitable	Corporation-led due need for large private-sector science budgets	Population approach via real stakeholder consultation; health as economic determinant; inequalities require societal action
Direction for health policy	Individual risk; reliance on charity; safety is prime concern	Public–private partnerships; personal insurance; safety and nutrition some concern but approached by risk management and hazards control	Social insurance including primary care, welfare and public health services
Approach to diet, disease and health	Implicit acceptance of societal burden of disease; inability to act on problems of over- and undernutrition	The right to be unhealthy; a medical problem; individual choice is key driver; demand will affect supply; niche markets	The right to be well; entire food supply geared to deliver health
Food business	Commodity focus; industrial-scale ingredients and processing; costs of ill-health not included in price of goods	Commodity focus with niches; underpinned by public costs but subject to pressure to shift costs from public to private	Costs internalised where possible; needs to develop more robust mass production controls; emphasis on 'natural' products and processing
Environment	Tendency towards monoculture; limited consideration of costs; pressure on resources to produce food; <i>ad hoc</i> adjustment; industrial chemical dependency	Reinforces monocultural tendencies but some rhetorical concern about diversity; gradualist; acceptance of importance; hi-tech industrial approach to problems; tries to reduce industrial chemical dependency	Biodiversity at heart of thinking; works with ecological assumptions; development of robust ecological systems; minimised industrial chemical use
Consumer culture	Individual responsibility; self-protection; consumerism dependent on willingness to pay as consumer	Access and benefits according to capacity to pay	Societal responsibility based on a citizenship model; defined rights as citizenship; authentic stakeholder involvement
Role of the state	Minimal involvement; avoid 'nanny state' action; resources are best left to market forces	Balance of public and private sector; rhetoric of minimal state accompanied by strong state action in some sectors; enabling regulation	Sets common framework; provider of resources; corrective lever on the imbalance between individual and social forces

noted: global versus local; hi-tech versus low-tech; simple versus complex diets; ready-made versus 'fresh' foods; individualised versus population approaches to health; etc. Table 1 provides a summary, with some analysts noting a dominance of the left-hand column over the right<sup>54–56</sup>. Nutritional scientists need to ask with what implications for health?

Consumers are said to be sovereign in this new order, but academics (and finance analysts) have reservations about this truism; the power lies with retailers, in most levels of economic development<sup>57,58</sup>. Retailers are gatekeepers between supply and consumption<sup>59,60</sup>. This process is advanced in Europe, but happening worldwide<sup>61</sup>. Prior to enlargement of the European Union, one 2003 study showed how, in the 15 member states, there were 3.2 million farmers feeding 250 million consumers, via 170 000 outlets, from 88 600 processors and manufacturers; but this supply and demand was funnelled through only 600 supermarket chains with 110 key buying desks<sup>62</sup>. This picture occurs in specific commodities too; three companies, for instance, have over 50% of the Brazilian

soya feed trade to Europe<sup>53</sup>. Contracts and specifications are the control mechanism, not state regulations. In fact, a dual system of regulation and governance has emerged: the state's and corporations', sometimes in harmony, sometimes in tensions, sometimes merely operating in different spheres<sup>63</sup>.

The dynamics of this restructuring are highly significant for nutrition science because they shape what food is eaten, how much is paid, the range of nutrients taken, the cultural meaning of food, and the ecological impact of the mode of production: in short the entire shape of nutrition that nutritionists monitor. As a result, nutritionists are like demographers counting bodies as they fall off the cliff, studiously refraining from engaging with the forces shepherding the process. Of course, nutrition must monitor but it must also engage with the motives framing market realities. The futility of not doing so is illustrated by advertising, the systematic attempt to mould consumer consciousness. The two leading commercial ad-spend budgets of the world each amount to \$1.7 billion a year, vastly more than the entire health education budgets of

governments<sup>55</sup>. What health education programme, based on nutrition, can match such power?

## Conclusion

The old food policy paradigm is running out of legitimacy. Its dictates, partly evidence-based on nutrition of the day (1930s and 1940s), were to raise output, go for quantity and reduce prices; poor supply, waste and affordability being barriers to health. A resulting policy equation dominated the twentieth century:

Science + capital + state support (finance + policy)  
 → increase production, which if distributed appropriately  
 → health + well-being.

The resulting efficiency, managerial control, new technologies and processes, replacement of labour by machinery, and more have reduced the rate of undernutrition even though numbers have risen. But today's food world is more complex and 'messier' and requires a paradigm shift. Table 2 contrasts paradigms oriented to productionism, life sciences and integration of ecological public health into food.

What might determine the future and which paradigm triumphs or if they coexist? The rapidity of the obesity epidemic has shaken policy-makers' complacency. The WHO/FAO Technical Report 916, and the accompanying Global Strategy on Diet, Physical Activity and Health, was well-timed and population- rather than individual-based. Other tipping points likely to generate policy change are likely, and include:

- Oil, on which the efficiencies of productionism depend<sup>64</sup>;
- Water, the availability of which is already poor and likely to get patchier<sup>65</sup>;
- Climate change, which is likely to reshape what is grown and where<sup>66</sup>;
- Soil, on which agriculture depends<sup>55</sup>;
- Military or political uncertainties;
- Social dislocations due to urbanisation, rural decline, unemployment, etc.

It is a myth that nutrition science was ever neutral; nutrition's advances have been mainly when engaged with society. Nutrition scientists must get tougher, more active and organised. Nutrition need not be constrained by narrowly conceived interest. The profession could learn from the best non-government organisations and, for all its differences, learn from the experience of tobacco. The evidence mounted for half a century, but it took campaigns to win policy change. Where is the nutrition Greenpeace, or 'Nut-peace', prepared to go out on a limb, arguing the unpopular case for protecting the seas? Where is the consensus eco-nutrition collaboration, plus lobby, parallel to the policy work of the International Panel on Climate Change?

It is time for nutrition science to become more open and partisan, and more discriminating about whom it might work with and inform. Nutritionists can choose between Food Control, in Sir William Beveridge's resonant phrase<sup>67</sup>, or Food Democracy<sup>55,68</sup>. Rather than seeing outside demands as 'polluting' pure nutritional science, it is more appropriate to perceive them as an opportunity to rebuild diversity within and about nutritional research and thinking. Nutrition must engage with society and environment or risk a slide into policy irrelevancy. The evidence deserves better.

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## References

- 1 Dickinson R, Hollander SC. Consumer votes. *Journal of Business Research* 1991; **22**: 335–42.
- 2 Porter D. *Health, Civilisation and the State. A History of Public Health from Ancient to Modern Times*. London: Routledge, 1998.
- 3 Rimlinger GV. *Welfare Policy and Industrialization in Europe, America and Russia*. New York: John Wiley, 1971.
- 4 McMichael AJ. *Human Frontiers, Environment and Disease*. Cambridge: University Press, 2001.
- 5 Lang T, Barling D, Caraher M. Food, social policy and the environment: towards a new model. *Social Policy & Administration* 2001; **35**: 538–58.
- 6 Chadwick R. Nutrigenomics, individualism and public health. *Proceedings of the Nutrition Society* 2004; **63**: 161–6.
- 7 Kaput J, Rodriguez RL. Nutritional genomics: the next frontier in the postgenomic era. *Physiology & Genomics* 2004; **16**: 166–77.
- 8 Wood TB, Gowland Hopkins F. *Food Economy in War Time*. Cambridge: Cambridge University Press, 1915.
- 9 Heasman M, Mellentin J. *The Functional Foods Revolution: Healthy People, Healthy Profits?* London: Earthscan, 2001.
- 10 World Health Organization (WHO). Global Strategy on Diet, Physical Activity and Health. *57th World Health Assembly*, WHA 57.17, agenda item 12.6. Geneva: WHO, 22 May 2004.
- 11 Food Standards Agency. *How much Fruit and Veg should I be eating?* London: Food Standards Agency, 2005.
- 12 US Department of Agriculture (USDA). *Dietary Guidelines for Americans 2000*. Washington, DC: USDA Center for Nutrition Policy and Promotion, 2000.
- 13 Ministry of Family and Consumer Affairs, Veterinary and Food Administration. *Fruit and Vegetables – Daily Intake*. Copenhagen: Veterinary and Food Administration, 2005.
- 14 Ministry of Health and Welfare, Supreme Scientific Health Council. *Dietary Guidelines for Adults in Greece*. Athens: Ministry of Health and Welfare, 2002.
- 15 Brunner E, Rayner M, Thorogood M, Margetts B, Hooper L, Somerbell C, *et al*. Making public health nutrition relevant to evidence-based action. *Public Health Nutrition* 2001; **4**: 1297–9.
- 16 Black N. Evidence based policy: proceed with care. *British Medical Journal* 2001; **323**: 275–9.
- 17 Lomas J. Connecting research and policy. *Canadian Journal of Policy Research* 2000; **1**: 140–4.

- 18 Townsend P, Davidson N, Whitehead M. *Inequalities in Health: the Black Report and the Health Divide*. Harmondsworth: Penguin, 1990.
- 19 Nestle M. *Politics of Food*. Berkeley, CA: University of California Press, 2002.
- 20 Sugar Association (USA). *WHO Report on Diet, Nutrition and Prevention Misguided*. Washington, DC: The Sugar Association, 3 March 2003.
- 21 Walker C, Cannon G. *The Food Scandal*, enlarged and updated paperback ed. London: Century, 1984.
- 22 Cannon G. *Food and Health: The Experts Agree*. London: Consumers' Association, 1992.
- 23 Royal Commission on Environmental Pollution. *Turning the Tide: Addressing the Impact of Fishing on the Marine Environment, 25th Report*. London: Royal Commission on Environmental Pollution, 2004.
- 24 Pew Oceans Commission. *America's Living Oceans: Charting a Course for Sea Change*. Washington, DC: Pew Charitable Trusts, June 2003.
- 25 Hites RA, Foran JA, Carpenter DO, Hamilton MC, Knuth BA, Schwager SJ. Global assessment of organic contaminants in farmed salmon. *Science* 2004; **303**: 226–9.
- 26 Jacobs MN, Covaci A, Gheorghe A, Schepens P. Time trend investigation of PCBs, PBDEs, and organochlorine pesticides in selected *n*-3 polyunsaturated fatty acid rich dietary fish oil and vegetable oil supplements; nutritional relevance for human essential *n*-3 fatty acid requirements. *Journal of Agricultural and Food Chemistry* 2004; **52**: 1780–8.
- 27 Food Standards Agency. *Salmon Study in Science Magazine: Statement on Dioxins in Salmon*. London: Food Standards Agency, 9 January 2004.
- 28 Jones A. *Eating Oil*. London: Sustain, 2002.
- 29 Paxton A. *The Food Miles Report*. London: Sustainable Agriculture, Food and Environment (SAFE) Alliance, 1994.
- 30 Pretty JN, Ball AS, Lang T, Morison JIL. Farm costs and food miles: an assessment of the full cost of the UK weekly food basket. *Food Policy* 2005; **30**: 1–20.
- 31 Garnett T. *Wise Moves*. London: Transport 2000 for the Department of Transport, 2003.
- 32 Halweil B. Where have all the farmers gone? *World-Watch* 2000; **13**: 12–28.
- 33 Gulhane N. *Chicken feet and communism: will large-scale urbanisation in China undermine its own food security?* MSc thesis, City University, London, 2004.
- 34 Dickie M, Kynge J. China may shift 500 m people in growth drive. *Financial Times*, 11 November 2003.
- 35 Boyd Orr J. *Food and the People*. London: Pilot Press, 1943.
- 36 Smith DF, ed. *Nutrition Scientists and Nutrition Policy in the 20th Century*. London: Routledge, 1996.
- 37 Goodman D, Redclift M. *Refashioning Nature: Food, Ecology and Culture*. London: Routledge, 1991.
- 38 Clunies-Ross T, Hildyard N. *The Politics of Industrial Agriculture*. London: Earthscan, 1994.
- 39 Goodman D, Sorj B, Wilkinson J. *From Farming to Biotechnology*. Oxford: Blackwell, 1987.
- 40 Fowler C, Mooney C. *Shattering: Food, Politics, and the Loss of Genetic Diversity*. Tucson, AZ: University of Arizona Press, 1990.
- 41 Friedland WH, Barton AE, Thomas RJ. *Manufacturing Green Gold: Capital, Labour and Technology in the Lettuce Industry*. Cambridge: Cambridge University Press, 1981.
- 42 Barrett H, Illbery B, Browne A, Binns T. Globalization and the changing networks of food supply: the importation of fresh horticultural produce from Kenya into the UK. *Transactions of the Institute of British Geographers* 1999; **24**: 159–74.
- 43 Dolan C, Humphrey J. Governance and trade in fresh vegetables: the impact of UK supermarkets on the African horticulture market. *The Journal of Development Studies* 2000; **37**: 145–76.
- 44 Millstone E. *Food Additives*. Harmondsworth: Penguin, 1986.
- 45 Lawrence F. *Not on the Label*. London: Penguin, 2004.
- 46 Feder E. *Strawberry Imperialism*. The Hague: Institute of Social Studies, 1977.
- 47 Hawkes C. *Marketing Food to Children: the Global Regulatory Environment*. Geneva: World Health Organization, 2004.
- 48 Thrupp L-A. *Bittersweet Harvests for Global Supermarkets*. Washington, DC: World Resources Institute, 1995.
- 49 Raven H, Lang T. *Off our Trolleys?: Food Retailing and the Hypermarket Economy*. London: Institute for Public Policy Research, 1995.
- 50 Hughes D. *Building Partnerships and Alliances in the European Food Industry*. Wye, Kent: Wye College, University of London, 1994.
- 51 Trienekens JH, Zuurbier PJP, ed. *Proceedings of the 2nd International Conference on Chain Management in Agri- and Food Business*. Wageningen: Department of Management Studies, Wageningen Agricultural University, 1996.
- 52 Ferguson H. Watching the world go round: atrium shopping and the psychology of shopping. In: Sheilds R, ed. *Lifestyle Shopping: The Subject of Consumption*. London: Routledge, 1992.
- 53 Vorley B. *Food Inc.: Corporate Concentration from Farm to Consumer*. London: UK Food Group, 2004.
- 54 Tudge C. *So Shall We Reap*. London: Penguin, 2004.
- 55 Lang T, Heasman M. *Food Wars: The Global Battle for Mouths, Minds and Markets*. London: Earthscan, 2004.
- 56 Coleman WD, Grant W, Josling T. *Agriculture in the New Global Economy*. Cheltenham: Edward Elgar, 2004.
- 57 Reardon T, Swinnen JFM. Agrifood sector liberalization and the rise of supermarkets in former state-controlled economies: comparison with other developing countries. *Development Policy Review* 2004; **22**: 515–23.
- 58 Hu D, Reardon T, Rozelle S, Timmer P, Wang H. The emergence of supermarkets with Chinese characteristics: challenges and opportunities for China's agricultural development. *Development Policy Review* 2004; **22**: 557–86.
- 59 Dobson PW, Waterson M, Davies SW. The patterns and implications of increasing concentration in European food retailing. *Journal of Agricultural Economics* 2003; **54**(1): 111–26.
- 60 Dobson P, Clarke R, Davies S, Waterson M. Buyer power and its impact on competition in the food retail distribution sector of the EU. *Journal of Industry, Competition and Trade* 2001; **1**: 247–81.
- 61 Heffernan W, Hendrickson M, Gronski R. *Consolidation in the Food and Agriculture System. Report to the National Farmers Union*. Columbia, MO: University of Missouri: Department of Rural Sociology, 1999.
- 62 Grievink J-W. The changing face of the global food supply chain. Paper presented at conference on *Changing Dimensions of the Food Economy*. The Hague: OECD, 6–7 February 2003.
- 63 Marsden T, Flynn A, Harrison M. *Consuming Interest: The Social Provision of Foods*. London: UCL Press, 2000.
- 64 International Energy Agency (IEA). *World Energy Outlook*. Geneva: IEA, 2003.
- 65 Clarke R, King J. *The Atlas of Water: Mapping the World's Most Critical Resource*. London: Earthscan, 2004.
- 66 Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2001: Synthesis Report and Summary for Policy-makers, approved at the IPCC Plenary XVIII (Wembley, United Kingdom, 24–29 September 2001)*. Geneva: IPCC Secretariat c/o World Meteorological Organization, 2001.
- 67 Beveridge W. *Food Control*. Oxford: Oxford University Press, 1928.
- 68 Lang T. Towards a food democracy. In: Griffiths S, Wallace J, eds. *Consuming Passions: Food in the Age of Anxiety*. Manchester: Manchester University Press, 1998.