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CAN MODERN MEDICINE EVER BE SUSTAINABLE?

Plus can we tackle cancer with better diets?



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WHAT'S REALLY IN YOUR CUPPA?

A special Ecologist investigation into the hidden costs of tea, milk and sugar

What's really in your cuppa?

You may have missed it, but a few weeks ago the Ecologist published a major special report - one of our biggest such projects for several years - examining one of Britain's great institutions, the cuppa.

The issues that lie behind production and supply of most everyday food staples - from cocoa to coffee, beef to bacon, soya to salad, prawns to pineapples - have been investigated and documented (many of them here in the Ecologist) but it seemed that no-one had taken the classic British cuppa and subjected it to such close scrutiny.

This is despite the fact that each day, millions of us take a small bag, drop it into a cup, pour in boiling water, and add a dash of milk plus a spoonful of sugar. We basically start the day with it, we end the day with it, we serve it socially or in times of distress. It's our favourite drink, after water.

For our investigation we sent Verity Largo to Kenya to report on life for some of the thousands of estate workers who live on plantations supplying two of our favourite teas - PG Tips and Lipton. Owners of the Kericho plantation, Unilever, and the Dutch research outfit SOMO, paint two very different pictures of conditions at the Rainforest Alliance-certified estate: you can read our exclusive article online to judge for yourself.

We also reported from Cambodia on the country's growing 'sugar boom' that is leading to increasing conflict over land and resources as rural communities clash with the new breed of 'sugar barons'.

We also looked at why our love affair with milk may not be a good idea; we travel to the US to examine the rise of 'mega dairies'; we asked why the recent victory against the UK's own 'super-dairy' at Nocton may only be the beginning; we revealed the global costs of both tea and sugar; and looked at ethical supply chains.

This is the first in a major new series of special reports that we've got planned for 2011. We'll be tackling a number of important environmental issues in the coming months with a mixture of hard hitting reportage, undercover investigations and unique commentary. This is what the Ecologist does best - we cover the vital and often unreported issues in a way that no other media outlet really can... or does.

We are receiving reports of some encouraging developments apparently coming about as a direct result of our investigations - we'll keep you fully updated in future weeks. In the meantime, if you have comments, feedback - or information or suggestions on issues you think we should be investigating - please get in touch with us by emailing: editorial@theecologist.org

READ WHAT'S REALLY IN YOUR CUPPA? A SPECIAL INVESTIGATION INTO THE HIDDEN COSTS OF TEA, MILK AND SUGAR @ <http://bit.ly/e3evCI>.

Andrew Wasley, editor

Front Cover: NHS Special Report, Page 16 and Tackling Cancer Page 19.

Fair trade carbon credits: will certification benefit people and planet?

Crowded bus station in Kampala. The challenge facing Uganda, and other African nations, is to make carbon trading work effectively and fairly.



In Uganda, as in the rest of the world, carbon trading is a controversial topic. But could the concept of fair trade carbon credits revolutionise the sector, or is it just a distraction from the bigger problems with carbon markets? **Adam Corner** investigates

In the debate about how best to reduce global carbon emissions, there is one topic that never fails to attract controversy: carbon trading. The logic is simple. Things that absorb carbon (like trees) or prevent it from being released into the atmosphere (like energy-efficient cooking stoves) can be assigned a carbon value. By putting a price on carbon, it can be traded on a market. And because nature doesn't care where or how carbon is reduced, the market can work its magic and deliver carbon cuts in the cheapest and most effective way.

Plus, because carbon reductions are typically cheapest in developing countries, carbon trading offers a method of transferring wealth, and of encouraging sustainable

development. On the surface, it sounds like a promising method of tackling climate change whilst transferring wealth to developing countries. And in Uganda – a country that has done nothing to cause climate change, but is already feeling its effects – one might expect that any additional funding for sustainable development would be welcomed with open arms.

But carbon trading is viewed with a great deal of scepticism by many environmental campaigners in Uganda, because there are serious concerns about who will be the real beneficiaries of carbon trading. As Robert Bakiika, of the Environmental Management for Livelihood Improvement in Kampala, says, there is a major risk in locking critical community resources like trees up in complex financing mechanisms:

‘There is a very, very big danger in involving most of our developing countries in financial mechanisms because financial mechanisms are so tricky. And our counterparts the developed countries have designed the system. They have designed the system and we are just players in a system.’

A glance at the economic destruction wreaked by badly designed and regulated financial markets tells you all you need to know about the dangers that

carbon markets pose. In 2009, the Camp for Climate Action targeted the European Climate Exchange in London (the biggest carbon trading platform in Europe). On the same day – and just down the road – G20 protestors were venting their frustrations about the role of greedy bankers and complicit politicians in the rapidly growing financial crisis.

No second chance

The slogan neatly capturing the shared sentiment of the protests was “nature doesn’t do bailouts” – with the obvious implication that if carbon markets failed to tackle climate change, a second chance would not be forthcoming.

But “false solution” or not, carbon markets are already here. As well as the voluntary markets offering guilt-ridden holiday makers the option of offsetting their flights, the EU Emissions Trading System (ETS) is about to enter its third stage. This means that there are important questions about how carbon markets function, and this is something that Bill Farmer, Director of the Uganda Carbon Bureau (UCB), has spent a lot of time thinking about.

One of the leading voices on carbon trading in East Africa, the UCB links companies and individuals who want to buy carbon

credits with people in Uganda who want to sell them. This is nothing remarkable – there are many carbon consultants offering similar services around the world. What makes UCB different is that they want to see carbon credits sold in a way that benefits Ugandans, not the movers and shakers of the financial markets.

‘Our aim is to support individuals and organisations to access the international carbon markets’, says Farmer. ‘There’s a lot of educational content in what we do – especially raising awareness about climate change, and the need for everybody to lower greenhouse gas emissions. A general lack of knowledge about the carbon markets, and little experience in negotiating carbon sales contracts, means that there is a need to support local project developers to avoid being exploited in poor sales deals.’

Market value

According to Farmer, part of the problem is the Euro-centric position of the people who control the carbon market:

‘Their banking headquarters are in London, they are trying to feed these cheap low hanging African fruit carbon credits, and there are groups like us saying “no, that’s outrageous”. Those credits have a market value, and they belong to the people here, and our philosophy is one of fair trade and open access.’

The UCB are trying to develop a process for putting this philosophy into action – fair trade criteria for carbon credits. But what would fair trade criteria for carbon credits look like?

UCB’s intention is to develop a system analogous to the World Fair Trade Organization standards – likely to involve increased accountability and transparency. ‘Carbon revenues need to reach the actual generators of the emission reductions’ says Farmer. ‘(Trading) should be done on a free, prior and



informed basis. That's not achieved by terse small print on a sales agreement.'

Transparency

Rob Elsworth, Policy Officer at the UK climate change and carbon trading campaign group Sandbag, has followed the development of carbon trading closely. 'The key feature of "fair" carbon trading might be a system that puts more emphasis on the sustainable development aspects of the projects generating credits, ensuring they have real transformative effects, create local employment, local health benefits and technology transfer' suggests Elsworth, adding that "'Fair" carbon trading will only be successful if transparency in the current system is dramatically increased.'

The concept of fair trade carbon credits is a fascinating one. Carbon markets' potential to transfer wealth, and promote sustainable development would be significantly enhanced by a system built on fair trade principles. But for commodities like coffee, cocoa and bananas, fair trade means more than just increased transparency. It means a minimum price-per-unit, and a social premium for the local community. Can carbon trading really achieve standards like these?

A Sandbag report from 2010 on the EU trading system makes an interesting observation: while public pressure to improve the ethical and environmental impacts of consumer choices has had a major impact in many sectors, similar pressure is not yet being applied to carbon markets – where environmental gain is (supposedly) the primary objective. So perhaps, through consumer pressure, the carbon trading sector can also be made to work more favourably for producers in developing countries.

How fair is fair?

But Jutta Kill, a carbon trading

campaigner with FERN (a European NGO that advocates for forest protection and forest people's rights), argues that previous attempts to improve the community benefits of carbon credit schemes have not fared well.

'Numerous certification schemes have recently been developed to address the now widely acknowledged risks that offset projects can pose to forest communities. It is doubtful that a 'fair trade' offset label would fare better than schemes like the Community Carbon Biodiversity Alliance, which appear to be failing in guaranteeing that offsets do no harm to forest peoples.'

Beyond concerns about the capacity of a labelling scheme to solve the problems associated with (unfair) carbon trading, there is also a great deal of scepticism in Uganda about the whole concept of carbon markets, and what they are designed to achieve.

Sarah Kisolo, from the Ugandan organisation RUDMEC which promotes the understanding of sustainable development issues, sees it this way: 'There's a lot of unfairness with carbon trading. Because you can't say "let's continue polluting without reducing the carbon and then you in Africa plant trees to protect us"...I mean that's not fair.'

Distractions

Perhaps the single biggest issue with carbon trading is that the challenge presented by climate change is to reduce not stabilise carbon emissions at their current rate – but carbon trading can only deliver genuine reductions if an overall cap on carbon emissions is in place (which it is not). Making carbon credits "fair" does nothing to address this major flaw in the logic of carbon trading. So might fair trade carbon credits be simply a distraction from the wider issues with carbon markets?

'No certification scheme can remedy the fact that each and every offset - irrespective of the quality of the underlying project - is a dangerous distraction from addressing the key task at hand: drastically reducing greenhouse gas emissions', says Jutta Kill.

'Offsets by definition do not reduce emissions, they only move them from one place to another. This is not just unfair, it is unjust and would seem to make a "fair trade offset" label an oxymoron.'

However, Rob Elsworth cautions that carbon credits should not be dismissed lightly. Although there are examples of carbon credits that have no sustainable development benefits whatsoever, Elsworth suggests that there are some projects that are having a genuinely positive effect on sustainable development, arguing that 'it is these examples that should be prioritised by the EU for use within its carbon market.'

The challenge for Uganda – and other developing countries that have yet to see much in the way of concrete benefits from carbon trading – is to ensure that the right type of carbon credit programmes are established. 'Africa is the continent most affected by climate change' says Bill Farmer, 'so there is a sense of equity in helping it to access carbon revenues via projects that are genuinely additional and are good for the communities in which they are located.'

It is an admirable sentiment. But opinion is still very much divided on whether fair trade carbon credits are an innovation for Uganda, or simply a method of sweetening the bitter pill of carbon trading.

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UK shale gas boom 'may be dirtier than coal'



Methane emissions have been found to escape during the fracturing process to extract shale gas.

Despite outrage in the US over 'fracturing' techniques used to extract shale gas and new evidence its greenhouse gas footprint may be higher than that of coal, the UK has given the go-ahead to companies here to begin drilling. **Tom Levitt** reports from the centre of this potential unconventional gas boom near Blackpool

In the flat lying geology of the Fylde coast the latest site of the UK's burgeoning shale gas boom needs little direction. The 32 metre-high drilling rig, less than one mile away from the village of Singleton, stands out in the mostly low-lying arable farmland. A little more than 2,800m beneath the surface is the target of this activity - natural gas held within deep-lying shale rock formations. To release it the energy companies involved must inject thousands of litres of water and chemical additives down the bore wells at high pressure to blast open cracks.

But this extraction technique, known as hydraulic fracturing or 'fracking' by some, is being met with strong opposition because of concerns about water pollution in the US and new evidence its greenhouse gas footprint could be even higher than coal. With enough shale gas reserves in Europe alone to meet the UK's annual gas needs for 160 years, successful extraction could also have serious implications on the UK's impetus towards renewable energy.

What's more local residents in the Fylde have largely been left in the dark about this local development with the energy minister Charles Hendry accused of rushing to green light the gas fracturing company involved. Even the local MP only found out about what was happening just before Christmas, more than four months after drilling at the first site had started.

US shale frenzy

Although onshore gas extraction is not new, the attempt to target previously untouched reserves by creating fractures deep underground and releasing sufficient flows of gas to make it commercial is, as yet, unproven in

either the UK or Europe. In the US, the past three decades has seen a 'shale frenzy' with thousands of gas wells being drilled but the gas flow has come at a cost. By 2009, the reserves were producing 16 per cent of the US's gas needs and are projected by the US Energy Information Administration to jump to 45 per cent by 2035. But the rush of speculators looking for gas has been followed by claims aquifers are being contaminated by poorly designed wells, leaking gas and concerns over the disposal of chemical fluids after fracturing. US environment officials are now investigating these claims and the state of New York and city of Pittsburgh have, in the meantime, banned any shale gas extraction.

None of these concerns has stopped the Department for Energy and Climate Change (DECC) talking of the opportunity for 'stable domestic supplies', with the British Geological Survey (BGS) recently estimating the UK could be meeting 10 per cent of its current gas needs from shale. On the Fylde coast, residents are angry about being left in the dark. 'No-one has spoken to the residents. That has upset people. They [the shale gas company] just appeared out of the blue,' says Maxine Chew, local councillor for the village of Singleton, which now sits right in the middle of what could become a major region of energy production and the country's first commercial shale gas reserve.

The company behind the UK's shale gas push is Cuadrilla Resources Holdings Ltd, made up of a group of US shale gas experts, who switched attention to Europe after the 'shale frenzy' and a resulting shortage of land in the States. They originally targeted Spain, hence the name Cuadrilla, Spanish for 'small group of people', but saw a greater chance of success in the UK and

the Bowland Shale formation in Lancashire. They settled on sites near Blackpool initially because of a history of onshore gas extraction in the area, with British Gas having at one time explored the area.

Although by their own admission a small player in global energy company terms, they have some significant backers with Lord Brown, former CEO of BP, on the board of directors. When the Ecologist visited their Grange Hill site, near Singleton and about five miles from Blackpool, they were close to reaching the shale gas reserve having drilled more than 6,000 feet - the aim is to reach 9,000 feet. Plans have since been temporarily setback after a small magnitude 2.3 earthquake struck around one mile away from the company's first drilling site, in nearby Preese Hall. They had recently begun fracturing at this site leading to concerns that it may have caused seismic activity.

Cuadrilla admit they cannot say for certain how the fractures they create will spread. The British Geological Survey says fracturing can cause small earthquakes. 'Any process that injects pressurised water into rocks at depth will cause the rock to fracture and possibly earthquakes,' says head of seismology Dr Brian Baptie. However, the BGS estimate this earthquake took place 'significantly deeper' than where drilling is taking place, making any link between the two unlikely.

Despite the media attention so far on Europe's first 'fracturing' shale gas well, the real boom has not even begun. Once fracturing is re-started, if Cuadrilla can prove a commercially viable gas flow from their sites, it could herald a billion-pound shale industry in the region and, almost certainly, the involvement of bigger players such

as Shell or BP. Cuadrilla say they lack the necessary funds to bring the site to commercial scale.

Jonathan Craig, fellow of the Geological Society's Petroleum Group, says he thinks the development of shale gas in the UK is 'mirroring' what happened in the US. 'A small number of very small companies, niche companies, went into the market to test the potential and having established that particular plays looked as if they were going to be productive, the bigger companies came in and provided the funding to develop that.' Unlike the US though, the Crown rather than individual landowners own the gas and other minerals beneath their land. While planning permission has been granted for Cuadrilla by the landowners, there is a possibility, alluded to by energy minister Charles Hendry recently, that a government drive on unconventional gas could see compulsory court orders to allow drilling to take place in areas opposed to it.

Local concerns

Local environmental campaigners have not been impressed by what they say was a deliberate attempt by the company to keep a low profile when they first started drilling in August 2010. The Green Party and others say local residents were unaware of the controversy behind fractures created by the drilling techniques in the US. This includes concerns that as much as 70 per cent of the water and chemical mix used to create the fractures can stay underground, with a risk of leakage into aquifers. Local Green Party candidate Philip Mitchell also accuses the company of secretly testing water supplies. However, Cuadrilla say they are merely obtaining baseline figures

for water samples and have no requirement to inform residents. Speaking at their Grange Hill site near Singleton, CEO Mark Miller, pointing out the cement casing they are putting in around the pipes, says he is 'confident' leaks through faulty bore wells, as described in the US, will not happen on their sites.

The Environment Agency say they will ensure that appropriate regulatory controls, aimed at 'preventing pollution and encouraging high standards of environmental practice', are applied. Meanwhile, energy minister Charles Hendry told MPs recently that he had confidence in the safety steps being taken by Cuadrilla. He indicated that they did not plan to bring in any tougher regulations saying, 'we have to strike a balance between regulation and not getting in the way of a legitimate business.'

The local councillor, Maxine Chew, says they have no choice but to 'trust' the company and admits local people are wary about the scale of future development and the prospect of many more wells and frequent drilling. However she says most, like her, remain more concerned about a nearby nuclear manufacturing and decommissioning site and plans for a third nuclear power station at nearby Heysham. A local campaign group recently won legal aid to challenge government approval for the new power stations without considering evidence that they cause an increase in cancer cases in children living nearby. 'We are going to have to make some concessions to operate these facilities but that has not got to be at the cost of the environment or safety, which is what I feel about nuclear,' says Maxine.

By coincidence, the local MP Mark Menzies also has a junior role

with the Department of Energy and Climate Change (DECC) as a Parliamentary Private Secretary (PPS) to the energy minister. He admits the company had initially avoided any local engagement and he had been unaware of what was going on. As such he had been very sceptical about the sudden emergence of a unconventional gas industry in his constituency. 'If only half of what appeared in the US was on the table I would have a problem but that is the difference between the UK and USA. The minute you take your eye off the environmental ball and protecting people you may not then be doing the right thing. So far all the evidence and information I have received has been fine,' he says.

In another coincidence, away from the Fylde coast, some of the best shale gas reserves may be in the Weald Basin, which lies within the Wealden constituency of energy minister Charles Hendry. He himself is a vocal supporter of a shale gas boom, saying the UK should not rely upon 'unstable and volatile regions' for our gas supplies and insisted to the Ecologist recently that he 'certainly would not object to it in my own constituency'.

Renewables lose out

As well as promoting shale gas as a contributor to the UK's energy security, Cuadrilla and the shale gas industry have also highlighted its ability to reduce greenhouse gas emissions, with estimates that burning natural gas produces, on average, 45 per cent less carbon emissions than coal. However, as well as new evidence contradicting these lower greenhouse gas emission claims, there has also been warnings that an unconventional gas boom threatens to derail the UK's renewable impetus.

A Chatham House report last year

said the 'shale gas revolution' had already compounded investor uncertainty in renewables and that 'the serious possibility of cheap, relatively clean gas may threaten investment in more expensive lower carbon technologies'. The world-renowned Tyndall Centre, in a separate report, called for a moratorium until analysis of potential contamination of ground and surface water had been properly investigated. It also agreed that shale gas risked handicapping the UK's long-term carbon reduction targets.

Report author Professor Kevin Anderson told the Ecologist, 'As we repeatedly note, in the absence of meaningful global caps on emissions and in an energy hungry world (with growing energy demand outstripping renewables penetration) additional fossil fuels leads to additional emissions'.

Cuadrilla admit a lot of other energy speculators were closely awaiting the success or otherwise of its shale gas extraction but, CEO Mark Miller, says he still believes, 'nothing we do will change the energy mix'. He said he believed it could help in a 'transitional period', with gas currently making up 40 per cent of the UK's energy needs and 80 per cent likely to be imported by 2020. Local MP Mark Menzies agreed: 'We need to move to decarbonise the economy and focus on the next generation of renewables and the UK needs to make sure it leads the world in that. But no matter how you cut there will still be a role for gas in the immediate future. As the North Sea gas reserves become depleted domestic supplies can be a safe alternative to importing.'

Friends of the Earth say the case for shale gas being a transitional fuel was 'unconvincing' and that, in any case, there was no shortage of

conventional gas. 'We should not be glutting the market and squeezing and pricing out renewables,' says head of campaigns Mike Childs.

Worse than coal

As well as concerns about its impact on growth in the renewable sector, claims that shale gas has a low greenhouse gas (GHG) footprint are also now in doubt. Research published this week in the journal, *Climatic Change*, has found its footprint is 'significantly larger' than that from conventional gas and possibly larger than that of coal because of methane emitted during extraction.

Although it has a shorter lifespan in the atmosphere, methane is 20 times more powerful a greenhouse gas than carbon dioxide and therefore, has a significantly more damaging impact on global warming in the short-term. Natural gas is composed largely of methane and in shale production, as much as 8 per cent of the gas may escape into the atmosphere over the lifetime of a well. The study estimates these emissions are between 30-50 per cent higher than those from conventional gas production, with particularly large amounts of methane escaping during the controversial fracturing process. A large amount of the water and chemical fluids pumped down the well during this process returns to the surface as flow-back and is accompanied by large quantities of methane. More methane is also emitted during the so-called drill out phase when gas is released for production.

Overall, researchers estimate around 2 per cent of the total production of gas from an unconventional shale-gas well is emitted as methane during the set-up of the well. Once emissions during processing and distribution

are added in, they estimate between 3.6 and 7.9 per cent of the total gas in a well is emitted to the atmosphere as methane.

'The footprint for shale gas is greater than that for conventional gas or oil when viewed on any time horizon, but particularly so over 20 years. Compared to coal, the footprint of shale gas is at least 20 per cent greater and perhaps more than twice as great on the 20-year horizon and is comparable when compared over 100 years,' says the study, led by Professor Robert Howarth from Cornell University.

Cuadrilla have indicated that they expect to convert gas produced from their wells in Lancashire into electricity – something the researchers in the study say could lead to less overall emissions. However, even taking this into account, the study concludes the greenhouse gas footprint of shale gas 'approaches or exceeds' coal. DECC admit methane emissions, particularly during fracturing, may increase the carbon footprint of shale but still argue it will be less than coal.

'Providing fugitive [leaks or unintended emissions] emissions of methane can be managed adequately, shale gas can be expected to have a carbon intensity greater than that of natural gas from conventional fields, but significantly lower than that of coal,' says DECC.

Estonia enters the race in scramble to secure rare earths

With China's rare earth industry blighted by claims of toxic pollution, Estonian company Silmet is stepping up production to meet demand for rare earths essential in the manufacture of electrical gadgets and green technologies. **Joel Tozer** reports

In the early 1970s, the town of Sillamäe in the Ida-Virumaa region of Estonia had been taken off the map and, over time, given code names such as Leningrad 1 or Moscow 400. Closed off to the world, the Soviet Union began experimenting with a mixture of acids to try to separate rare earth elements. At the time little was known about how to extract these tight-knit elements and how exactly they could be used.

Today, companies around the world are scrambling to get their hands on any number of the 15 or 16 elements which are essential in the production of high-tech gadgets such as iPods and green technologies such as wind turbines.

'Outside of China, there are very few people who know about the hydrometallurgy of rare earths. I believe that the largest concentration of those people are right here in Sillamäe, Estonia,' David O'Brock, CEO of the rare earth supplier, Silmet, said.

Despite the name, rare earth elements are actually fairly

common. Several of the elements produced in Estonia including cerium, lanthanum, neodymium, are more abundant in the Earth's crust than lead and silver. The hard part is finding deposits that can be mined cheaply.

Many countries are reluctant to mine rare earths because of the high cost of processing the acids that are used in production and the amounts of low-level radioactive waste that are produced.

With the current crisis over radioactive leaks in Japan, the dangers of nuclear power are back on the global agenda, but few people realise that their iPhones or hybrid cars are creating problems in other small corners of the globe.

In recent years, lax environmental policies have allowed China to dominate the rare earth market, currently providing at least 95 per cent of the world's supply. Recent reports of toxic waste polluting water streams and farming crops have hampered the booming industry.

Last September, amid a sea

territory dispute, Chinese customs officials placed a trade block on all rare earth shipments to Japan for two months. Then, in an attempt to clean up the industry and preserve its resources, China recently announced a 40 per cent cut back to all of its 2011 rare earth exports.

This blocking of supply sent a wave of panic through many countries that rely on rare earth elements. Elements like cerium, which is used as a polishing powder for flat screens commonly used in televisions, computers and car windscreens. China's export quotas have also seen the price of rare earths double, with Chinese cerium reaching 90 dollars a kilogram, compared with 35 to 40 dollars last November.

Estonia's production to expand

David O'Brock says the prices of all of Silmet's rare earths have at least doubled in the last three months. The problem facing Silmet is that it cannot get enough materials to meet demand.

For many years, Silmet struggled to make a profit from rare earths, with Mr O’Brock admitting that 2010 was the first year the company made a profit. Luckily, the factory was able to survive due to its production of tantalum, which is used in compact electronics, and niobium which strengthens steel in alloys.

‘If you look at how much the exports have declined over the past two years from China, we can assume that there is about 20,000 to 40,000 tonnes on the market free outside of China on the market today,’ Mr O’Brock said. ‘Every year this amount is growing probably by

a good 10 per cent.’

Silmet is now looking to expand its production of rare earths. While Mr O’Brock would not elaborate on the exact details of the plan, he said the company was looking to invest more money this year than they have over the past five years on expansion and beyond.

‘Now is a good time to invest and we’re doing that,’ Mr O’Brock said. ‘We’re also looking at alternative sources of raw materials. You could pick one or more of the 200 [raw material] projects outside of China today.’

The Silmet factory doesn’t represent any real threat to China’s

chokehold of rare earth supply, currently producing around 3000 metric tonnes per year, or 2 per cent of global supply. But Gareth Hatch, an analyst at Technology Metals Research, in Illinois says it still represents potential diversity in the market.

‘Any restrictions in supply from the primary source, China, naturally means that facilities such as the Silmet plant grow in strategic importance,’ he said.

Inside a rare earth plant

Situated at the edge of the Baltic Sea in northeast Estonia, the Silmet factory forms the centerpiece of



Inside the rare earth separation plant, a worker checks the levels of each machine. Photo: Joel Tozer

the industrial town. Every month, a shipment of rare earth carbonate, containing a mixture of titanium, tantalum, niobium and varying quantities of rare earths, arrives at the factory from Russia.

Before the packages are collected, the company has already cleaned their hands of the radioactive waste that many other producers have to consider. In any rare earth deposit, a certain amount of thorium exists, which when refined, leaves behind a slightly radioactive waste.

'When the mineral is cracked in Russia the uranium and the thorium come off at that time. So our partners in Russia take care of that,' O'Brock said.

Inside the factory, the smell of nitric acid immediately hits the back of your throat. 'This will clear your sinuses in no time,' Mr O'Brock said. To begin the processes of separating the elements, the acid is used to dissolve the powder into a liquid.

A key issue with rare earth production is what to do with the acids after the elements are separated. While all other countries use hydrochloric and sulfuric acid in separation, Silmet are using the nitric acid and turning the waste into a fertilizer that is sold to local companies.

'All the process waters that we use are processed here on site, recycled, reused and treated as need be. So, essentially we don't have any "waste streams" from our production,' Mr O'Brock said.

On the second floor, the liquid is put into an extraction system where all the elements are separated. Silmet only keeps the four most abundant elements – lanthanum, cerium, neodymium and praseodymium – while all of the other rare earths are sold to its customers in China.

Production at the Silmet plant hasn't always been 'waste free'. Since 1948, the site was used as a uranium processing plant, which is said to have provided materials for the USSR's first atomic bomb. At the back of the factory, uranium and rare earth waste was dumped into a tailings pond, just metres from the sea.

For more than fifty years, the waste was left uncovered to the open air and its contents were at risk of spilling into the sea at any time. When Silmet shut off its waste diversion in September 2003, about six million tonnes of waste was left behind, including 1200 tonnes of uranium alone.

Cheryl Rofer, a chemist from Santa Fe, New Mexico, was the co-director of the 1998 NATO workshop that proposed plans to clean up the site. One concern was making sure the waste was secured. 'The dam was underlain by Cambrian blue clay, which could slip under the weight of the tailings and collapse the dam,' she said.

A joint project, funded by the European Union and all of the states on the Baltic Sea, saw the pond covered at the end of 2009. It is expected that the pond will be safely contained for more than 1000 years. However, small but 'safe' amounts of waste are still believed to enter the sea.

A shortage of rare earth?

The use of rare earths in a wide range of consumer and energy saving products is only relatively new. Tiny amounts of rare earth are used in each product. But, as it comes into more common usage, the demand for these elements is set to grow rapidly.

While the world's reserves of rare earth elements in countries such as the United States, Australia, Brazil

and Russia is extremely abundant, the current supply continues to fall short of global demand.

But Gareth Hatch says that while some rare earths are experiencing significant demand, such as neodymium, the supply of rare earths will continue to grow.

'There are plenty of other deposits around the world that are already well underway towards production, and if they come on stream, will satisfy the world's needs for the foreseeable future,' he said.

Australian company, Lynas Group, is currently rushing to complete a massive project in Kuantan, Malaysia, that is said to be able to provide a third of world's demand for rare earths in two years. The company hopes to have the project up and running by November this year.

The factory will process ore from a mine in Western Australia, but few details have been given on how the company plans to deal with the slightly radioactive waste.

'I would have thought that there is a much bigger negative impact on the environment from transporting the materials from the mine to the port, from the port to the next port, to the processing unit and processing it in some "foreign country" where it is perhaps no longer under strict controls,' Mr O'Brock said of the project.

Why our growing taste for cheap Brazilian beef is devastating the Amazon



Consumer demand for cheap meat may be steadily growing, but the hidden impacts of this trend are only now becoming clearer

Brazil's cattle sector has become the largest driver for deforestation globally, overtaking palm oil plantations in Asia. With the UK sourcing 40 per cent of its processed beef from Brazil, campaigners are now calling for a consumer boycott. **Chris Pala** investigates

A team of scientists has calculated that eating a kilo of beef raised in pastureland carved out of Brazil's Amazon forest emits the equivalent of a ton of carbon dioxide into the atmosphere, leading to calls for a boycott.

'This is shocking,' says Andre Giacini de Freitas, a Brazilian who is president of the Forest Stewardship Council, the world's leading green label for forest products. 'We need to shut down markets for products made with unacceptable practices like deforestation.'

'Supermarkets need to stop selling Brazilian beef now,' adds Tara Garnett, director of the Food Climate Research Network at the University of Surrey. The UK imports 40 per cent of its processed beef (tinned, prepared or cooked) from Brazil. Europe accounts for 14 per cent of Brazil's exports, preceded by the Middle East (27 per cent) and Russia (23 per cent).

A Marks and Spencer spokesman said the company sells no Brazilian beef. At Sainsbury's, spokesman Tom Parker said, 'Like all UK retailers, we have no choice but to source our corned beef from South America, as there are no suitable canning facilities in the EU.' But, he

added, 'The Brazilian beef that we use in our canned range and our frozen ready meals and pies makes up less than 1 per cent of the total amount of beef we sell and we are working with our suppliers to switch to British beef.'

To emit a ton of CO₂ equivalent greenhouse gases, you'd have to drive a car that uses 10 litres every 100 kilometers for 5,800 km. The findings come at a time Brazil plans to double its beef exports by 2018. At stake is whether or not the goal can be reached without further deforestation.

Export market

Between 1996 and 2006, Brazil's beef exports rose eight-fold to over two million tons of carcass weight (about 1.4 million tons of edible meat) a year, where it has roughly remained, making it the world's top beef exporter, in part because large swaths of the Amazonian forests have been burned. About 80 per cent of these areas were turned into low-yield pastureland for Zebu beef originally imported from India that thrive in tropical climates but produce less meat than Western breeds.

Brazil's cattle sector has become the single largest driver for global deforestation, overtaking palm oil plantations in Asia. Because of it, the country produces more greenhouse gases than India, even though its population is 16 per cent that of India's.

Christel Cederberg, the leader of the scientific team, says they calculated the carbon footprint of Brazilian beef because no one had done so before. 'Most of these carbon footprint calculations for beef were done in Europe,' she notes.

'When we started getting results, we were really surprised,' says Cederberg, a senior researcher at

SIK, the Swedish Institute for Food and Biotechnology in Gothenburg. 'But when you think logically about it, it's not so strange. You're destroying one of the most carbon-rich ecosystems in the world to create one of the most inefficient uses of land in agriculture.'

The study was published on Jan 31 in *Environmental Science and Technology* of Washington, D.C. Brazilian beef has a relatively high carbon footprint even when deforestation is not taken into account: it's about 40 kg of CO₂e per kg of edible meat, compared to averages of 36 kg for the European Union.

That's because most pastureland contains poor soil and can only support one head of cattle per hectare. The soil is particularly bad in the Amazon - where a constant shower of rain and dead leaves are absent - and it is rapidly exhausted and then abandoned. For every deforested hectare being grazed by a cow, there's another half-hectare or so on average that is being either used - briefly - to grow soybeans or has been abandoned, creating a so-called secondary forest that is much poorer in carbon, fauna and flora, according to Cederberg.

On top of that, European beef cattle are slaughtered at the age of 16 months or so, usually in conjunction with dairy production, she says. In Brazil, cattle are killed when they are three years old and little dairy is produced, so the yield of food per hectare is one of the lowest in the world.

While about 35 per cent of Brazilian cattle is located in the nine Amazon states, only 6 per cent of the total beef production comes from lands deforested in the last 20 years, says Cederberg.

Carbon footprint

Tesco, which declined to comment

for this article, is the only British supermarket chain that analyzes the carbon footprint of some of its foods. It uses the rules of the British Standards Institute, which calls for examining only the emissions caused by growing a particular animal in a particular place. Since most exported Brazilian beef comes from non-deforested pastures, its carbon footprint does not include the carbon produced in burning the forest in other parts of the country or the much lower carbon uptake of deforested land.

'The problem with that,' says Cederberg, 'is that it doesn't give a true picture of the whole industry.' Here's why: since Brazilian consumption has been relatively stable in the 96/06 decade, she explains, the growth in production has been driven by the seven-fold increase in exports.

'In order to export the beef it used to consume, Brazil has had to create new supplies for the domestic market, and that's where the Amazon deforestation comes in,' she says. Thus, the true carbon footprint of a kilo of beef from the southern pampas should be the national average footprint, not the footprint of an animal raised there, she says.

So the team calculated the effects of deforestation into the national production and came up with 62 kg of CO₂e per kg of meat. Added to the 40 kg of CO₂e per kg for just the methane, nitrous oxide and CO₂, the true average footprint of a kilo of Brazilian beef is 103 kg of CO₂e, nearly triple the European footprint, she says.

The study's timing makes it unusually influential. It was published just as the British Standards Institution was undertaking its first revision of the standards for calculating a product's carbon footprint - the

first in the world – that it published in 2008. Known as Publicly Available Specification (PAS) 2050, it originally provided for taking into account land-use changes such as deforestation, but did not define it.

In effect, explains Brian Such, who is in charge of the revision process, it excluded indirect land-use change – say deforestation in one part of a country in order to facilitate beef exports from another part – because there was no internationally accepted methodology for its quantification and the issue was (and continues to be) irrelevant for most products.

Roland Clift, a co-author of the paper on the carbon footprint of Brazilian beef, has been providing arguments to the Steering Group that is revising PAS 2050 for including indirect land-use change in the new PAS, which will be published in April.

‘Our argument is that, where it’s clear that the total volume of production couldn’t be achieved without land-use changes like deforestation, they must be treated as associated with the product; so the appropriate figure is the Brazilian average rather than the value specific to the piece of land where that particular piece of meat was pastured,’ says Clift, who is Emeritus Professor of Environmental Technology at the Centre for Environmental Strategy at the University of Surrey.

‘The 2011 version of PAS 2050 standards will facilitate the inclusion of indirect land-use change for certain sectors where they’re relevant like meat and horticulture,’ says Such. ‘It’s a natural evolution.’

The International Standards Organization (ISO), which has designed ways to calculate a whole organization’s carbon footprint, is also developing a methodology

that will be applicable to specific products and services. There is already a requirement that indirect land-use change be considered for inclusion in carbon footprint studies, once an internationally agreed procedure emerges, Such adds.

Consumer pressure

If both the British and international organizations end up in effect including deforestation in the carbon footprint of Brazilian beef exports, resistance from consumers and environmentalists could add a layer of pressure on the government and the industry to improve yield on existing pastureland and stop deforestation, says the carbon footprint study’s authors.

Meanwhile, the amount of forest cut down each year has fallen to its lowest level since Brazil’s National Institute for Space Research started taking and analyzing satellite pictures. After a peak of 29,000 km² in 1995, it fell to 13,000 km² in 2008 and 6,400 km² in 2010, the institute reported in December.

Analysts say this is a result of a combination of factors ranging from government policies to depressed demand after 2008 and to campaigns by environmentalists. Andre Muggiati of the Greenpeace Amazon Campaign says: ‘Using the carbon footprint out of the context that deforestation is going down demonizes Brazilian meat in general and does not really help to solve the problem of deforestation.’

He says he’s confident that his country’s meat exports can double even if deforestation ends by 2018, the date that is the goal of his campaign. ‘Studies have shown that it’s possible to have not one but three heads of cattle per hectare, so it would be no miracle,’ he says.

Luis Fernando Pinto isn’t so sure. An agronomist who heads Imaflora,

a Brazilian forest conservation NGO, he agrees that Brazil’s pastureland is so poor that a little improvement would go a long way – things like small amounts of fertilizers or lime and rotating crops and pastures.

‘You can divide large pastures into smaller plots and put the cattle in the best ones to feed the cattle so they gain weight faster and can be slaughtered sooner, which would cut the methane they emit through digestion,’ he says. ‘You could mix legumes with the grasses that dominate our pastures.’ But it would cost money.

The main advantage to current low-productivity methods based on deforestation is that they are the cheapest, he says. ‘If we maintain this low productivity, it will still be necessary to cut trees.’

A study published in *Science* a year ago found that ‘recent developments finally make feasible the end of deforestation in the Brazilian Amazon, which could result in a 2 to 5 per cent reduction in global carbon emissions.’

However, it would cost between \$7 billion and \$18 billion, the authors concluded. Without revenue from rich countries, ‘Ending deforestation in the Brazilian Amazon in 2020 with less than 20 per cent of the forest cleared would be an extraordinary and extremely difficult achievement, perhaps unique in the history of frontier expansion.’

‘It’s very unlikely Brazil can double its beef exports without the forest paying a price,’ agrees de Freitas, the head of the Forest Stewardship Council. ‘Market forces can influence the large producers and the slaughterhouses, but it’s much harder to discourage small producers from taking the cheapest route to start cattle farming, which is to burn down forest illegally.’

Special report: can the NHS ever be green?

Delny Britton investigates the hidden impacts of western mainstream medicine - including pollution from pharmaceutical products, high carbon emissions and adverse drug reactions - and asks whether the healthcare sector can ever be truly sustainable

While slow to enter the choppy waters of sustainable development, the healthcare sector is now making up for lost time by addressing its own contribution to climate change and the pressing need to become 'future proof'. In February 2011 the NHS Sustainable Development Unit (SDU) for England published its 'Route Map for Sustainable Development', a blueprint for a sustainable health service. The Route Map builds on the SDU's Carbon Reduction Strategy, released in 2009, which sets out ways of meeting the Climate Change Act's ambitious target of at least a 34 per cent reduction in carbon emissions compared to 1990 levels by 2020 and a massive 80 per cent reduction by 2050.

For an organisation still in its infancy - having formed in 2008 - the SDU has made impressive strides towards visualising a sustainable health system and the components needed to achieve it. Using the Triple Bottom Line (TBL) approach - an accepted way of analysing an organization's economic, social and environmental impacts and performance as well as its capacity for sustainable growth - it is examining a broad range of areas in which the NHS can become more resource efficient, including buildings that encourage low



carbon use, lowering the carbon impact of procurement, minimising the creation of waste, ensuring efficient water use and promoting care closer to home.

It certainly needs to. The healthcare sector based on western, mainstream medicine is not only a significant consumer of resources but one of the highest industry users of energy. The SDU has calculated that the NHS produces 21 million tonnes of CO₂ every year, making it the largest public sector contributor to climate change. Drug production has been estimated to account for four million tonnes of CO₂ a year (a fifth of all emissions), the equivalent of an extra 750,000 cars on the road.

Speaking at the launch of the Route Map, Sonia Roschnik, Operational Director at the SDU, said she believed the NHS could be sustainable 'but it's going to take a tremendous amount of will and big effort. If we want to introduce a zero tolerance to carbon and zero tolerance to environmental impact we could. It's up to us.'

Carbon emissions are, understandably, an immediate sustainability concern for the NHS, particularly given such challenging emissions targets. But applying the TBL more broadly across the healthcare sector reveals a system that fails to meet the needs of the present generation, let alone one that enables future generations to

meet their own needs.

Environmental decline

Contribution to climate change is not the only damaging environmental impact associated with western mainstream medicine. In the past decade there has been increasing concern over pollution of the aquatic environment by pharmaceuticals, most visible in developing countries where cheap drugs are produced for the massive Western markets of the US and Europe. One drug manufacturing area in India has been described by scientists as 'Bhopal in slow motion'.

Away from such manufacturing centres, pharmaceuticals are now a widespread source of chemical pollution and have infiltrated aquatic ecosystems around the globe. This is because bioactive chemicals that are ingested or applied to the skin ultimately enter the water system, either through lavatories or through bathing and showering. Trace amounts of numerous different human and veterinary medicines can now be detected as far afield as the Arctic, while drinking water in major cities around the world is contaminated by low concentrations of sex hormones, antibiotics and antidepressants - all of which have the potential to interfere with complex biological functions.

Aquatic toxicologists have warned that climate change will cause differences in the movement, quality and distribution of water that could affect stream acidity all over the world. This change in pH could increase the toxicity of pharmaceutical contaminants in fresh waters.

The NHS is now working in partnership with suppliers to try to reduce the environmental impact of pharmaceutical production, particularly that of carbon emissions, but 'the trajectory at which we use and develop them will eventually have to stop' said Dr David Pencheon, Director of the SDU. 'There will

come a time when we have to revisit where pharmaceuticals sit in the whole healthcare spectrum. It's in everyone's interest we make sure there's a sustainable pharmaceutical industry but at the same time we must make sure we're doing more good than harm.'

Social ills

Western mainstream medicine is a lifesaver in acute and emergency situations and has improved outcomes for many previously fatal conditions, yet the focus on secondary intervention in the treatment of chronic lifestyle diseases such as diabetes and obesity is 'simply a quick fix that does nothing to tackle the root causes of ill health,' according to David Hunter, Professor of Health Policy and Management at Durham University.

And there is growing evidence that western mainstream medicine puts lives at risk. In the UK more than 250,000 patients are admitted to hospital each year suffering from adverse drug reactions (ADRs) and around 10,000 people die from this cause, according to a 2004 study published in the BMJ. ADRs are thought to cost the NHS a staggering £2 billion per year, and if deaths from hospital acquired infections and surgical and medical errors are added to the equation, the toll - and costs - are even higher.

The ultimate irony is that despite their potential to cause serious harm due to toxicity or misuse, evidence for the efficacy of many 'conventional' primary care based interventions is often flimsy, according to Professor George Lewith from Southampton University's Complementary and Integrated Medicine Research Unit - particularly for chronic benign illnesses such as irritable bowel, asthma, migraine, depression and musculoskeletal pain.

Less carbon-intensive and environmentally damaging healing modalities already exist in the form of complementary and alternative

medicine (CAM) but despite 'substantial' use of CAM in England, according to a national survey last year, there has been little integration of these modalities into the NHS. 'We know there are other models of care where the evidence base is as good as some traditional therapies' said Dr Pencheon. 'Many of them, like acupuncture for example, are far more sustainable but we wouldn't trade sustainability for effectiveness.'

Clinicians and PCT managers claim that evidence based research guides their decisions when it comes to CAM, yet many researchers believe the focus on evidence based medicine is too limited for complex systems such as CAM and other approaches to healing. Furthermore 'GPs generally don't understand how these therapies work and are guided by tacit perceptions of research literature' said Dr Lesley Wye, Research Fellow at Bristol University's Primary Health Care Unit. 'The real issue here is around power, which GPs are generally reluctant to hand over either to patients or to alternative practitioners.'

Dr Rosy Daniel, consultant in Integrated Medicine and Director of Health Creation, which helps individuals and organisations achieve optimum health through the use of integrated healthcare products and services, views integrated medicine - which combines mainstream medicine with certain CAM modalities and self-help therapies - as the medicine of sustainable healthcare. 'It looks at the whole person in the context of community and empowers people to be proactive and responsible for their own health. We cannot go on propping people up with ever more expensive drugs and procedures.'

Economic abyss

Health expenditure in the UK and in all other developed countries around the world has been growing unchecked for decades.

We currently spend over £100bn annually on the NHS, roughly ten times in real terms what was spent when the service started in 1948 on a budget of £437m. The health service receives the biggest share of funding of all public sectors, and at a time of swingeing cuts in public spending it has been ring-fenced against them. Yet while the coalition government has pledged to increase NHS funding until 2015, these increases amount to just 0.4 per cent per annum, not the 4.9 per cent needed to keep pace with rising costs.

A growing funding gap between what the NHS needs and what it might get was identified back in 2006 in a study commissioned by BUPA, although the predicted gap of around £11 billion by 2015 appears now to be a huge underestimate. 'What we couldn't have foreseen was the financial crisis and the effects of the recession' said Michael Ridge of Frontier Economics, a co-author of the report. 'A conservative estimate of the shortfall is now £20 billion, which the government is nervously hoping can be made up by improved productivity and efficiency within the service, but the real figure may be as high as £30 billion by 2015.'

Healthcare costs are being driven up by a toxic combination of increasingly costly medical technologies, an ageing population and a rising tide of preventable lifestyle diseases. Capital and operational costs of diagnostic devices such as computed tomography (CT) scanners and magnetic resonance imaging (MRI) units are high and the rising number of scans performed each year means that overall expenditure has risen sharply. In the US medical imaging is now a \$100-billion-a-year industry, and other developed countries are following a similar growth trajectory.

The story is similar for pharmaceuticals, with both the volume of drugs prescribed

and their total cost increasing exponentially worldwide. According to Department of Health data, a person in the UK now receives around 16 prescriptions a year on average, twice as many as 20 years ago.

Pharmaceutical drugs are now the first line of defense against preventable lifestyle diseases, many of which - heart attacks, high blood pressure, stroke and diabetes for example - are strongly linked to obesity, a condition most prevalent in deprived areas of the country. NHS costs associated with inequality are now well in excess of £5.5 billion a year according to the 2010 Marmot Review of Health Inequalities, and will rise significantly in future if no action is taken.

Sustainable healthcare

Public expectations of health care continue to increase at a far faster rate than other public services, including education, and consequently medical progress has no obvious endpoints or constraints. 'No matter how much money is spent, no matter what the health gains, they never seem enough', observes Daniel Callahan, Director of International Programs at the Hastings Centre, in the forward to his book *False Hopes*, a sober look at the obstacles to sustainable healthcare systems.

But tomorrow's world of limited resources - particularly oil, the energy source that permitted western mainstream medicine to proliferate in the first place - dictates that a linear expansion of medicine's social and technological complexity is not an option. 'We are focusing on the efficiency of present business models but also recognise that we have to look at transformational issues in order to achieve a truly sustainable healthcare system' said Dr Pencheon.

Pouring resources into rescuing growing numbers of people who are leading unhealthy lives is an

unsustainable exercise. There is now a wide consensus amongst public health professionals that attention must be shifted upstream in order to address the cause of chronic ill health and health inequalities.

'We need to be focusing on things like education, transport, housing, employment - the totality of how the environment could be reshaped to support health' said Professor Hunter. 'If spending on the NHS wasn't ring-fenced we'd be able to take public health and health inequalities more seriously and see resources directed to where the pay-off was highest. Conditions like obesity are a societal problem that can't be fixed by focusing on individual behavior. The government needs to be concentrating on the structural determinants of health.'

Forum for the Future's vision of the health system of 2025 sees joined-up policy development as central to the system's effectiveness. Cross-budgeting between government departments will allow interventions that contribute to sustainable development and improved health to be planned and paid for holistically. Shorter working hours, greater service accessibility, more contact with the environment, growing localisation of production and consumption and redistribution of wealth towards the poor - all key drivers of health and wellbeing - will produce benefits across the social spectrum and aid the sustainability agenda. The SDU looks, optimistically if perhaps unrealistically, to a time when going to hospital is seen as a failing of the health and social care system.

An integrated, creative approach to health is now the only way forward. Perhaps the real bottom line is whether a society hooked on medical intervention is ready to support such a bold but crucial move towards sustainability.

What role does nutrition really play in tackling cancer?



A book by leading biochemist Dr Lawrence Plaskett champions the power of the body to destroy tumours naturally. Why this happens is not always clear but a change of diet and other nutritional and naturopathic measures can aid recovery, says **Michael Finucane**

The Nutritional Therapy of Cancer, a remarkable book by the respected Dr Plaskett - biochemist, medical researcher, food industry expert, practitioner of nutritional, herbal and homoeopathic medicine and founder of the Plaskett Nutritional Medicine College - comes as something of a surprise because when cancer is diagnosed, most of us assume that treatment will follow the usual orthodox medical paths of operation, chemotherapy and radiation. Nutrition will hardly figure as a possible part of the reversal of the disease and the medical profession derides it as follow-up therapy following successful conventional treatments. Dr. Plaskett realised, early in his career, the power of the body to destroy tumours, naturally. Why this happens is not always known but a radical change of diet and other nutritional and naturopathic measures have been shown to aid some of these means of recovery.

Cancer arises because weakened cells succumb to damage by environmental influences and it is not in dispute that nutritional measures that strengthen the cells against these influences prevent cancers from forming. What is in dispute is that nutritional measures can enable the body to reject established cancers and Dr. Plaskett set out to design a biochemically based, nutritional cancer therapy which could bring about reversal. His therapy was taken up by The Nutritional Therapy Cancer Trust in 1997 which used it to treat a substantial number of cancer patients until 2006. Well over half who closely followed the therapy went into full remission and, as far as could be told, were free from the disease and back in health. The purpose of his book is to contribute to the future development of

improved cancer treatment and with the backing of the Trust's results, to encourage further, properly regulated trials by those who work with cancer, including doctors, so that the therapy comes part of mainstream medicine.

Along with all animals and plants, humans are composed of cells which are made up, mostly, of a kind of jelly called protoplasm. This protoplasm is protected by a membrane which allows desirable material in and keeps out or expels the unwanted, one of the most important being the removal of sodium and the admittance of potassium. Inside the protoplasm there is the nucleus which is also protected by a membrane and outside the nucleus there are small organs called, 'organelles'. The nucleus of the cells are able to store information in substances such as protein or nucleic acids - its DNA - which enable it to produce new cells of the same kind. The energy to operate and reproduce comes from food - carbohydrates, fat and protein.

All the biochemical reactions that take place in the cell are called its 'metabolism' which must maintain an equilibrium so the cells' structures and materials remain largely unchanged. Within this equilibrium, however, it must be able to adapt in order to survive or to contribute to overall body function and it is in constant contact with other types of cells through control mechanisms, which ensure the ordered functioning of the whole body. In cancerous cells, inter-cellular communication is disrupted, particularly in relation to the rate of cell division and the retention of cells within their own organs or tissue.

Toxic attack

In the battle to survive, cells are attacked by a range of toxins, the most vulnerable parts being its

enzymes (which influence other substances without themselves changing), membranes and nucleic acids. The heavy metals, for example, inhibit the enzymes, other toxins damage the DNA (mutagens), and fatty substances, such as trans-fatty acids attack the membranes. The toxins use the medium of molecules called 'free-radicals' which react at speed with other, nearby, molecules causing cell damage resulting in ageing and an array of chronic diseases from diabetes to Alzheimer's, rheumatoid arthritis and cancer. Even in those who have a genetic pre-disposition to one of these diseases, it will not appear unless it is triggered by toxins. The body does provide protection against free-radicals but poor nutrition will downgrade it along with environmental factors such as industrial pollution. Ultimately, if the toxic 'load' becomes too great the cell dies. If cancerous cells died then, of course, all would be well but instead they survive as severely damaged cells which just manage to cheat death.

There are two stages in carcinogenesis - 'initiation' and 'promotion' - each brought about by different chemical toxins. Many researchers believe that with today's toxic environment, most people are already 'initiated' and are only waiting to be 'promoted'. Cancer starts in a single cell and the actual development of the disease depends on specific changes to the DNA and at least two of these 'events', and probably several, must coincide in a single cell before malignancy occurs. The 'mutations' to the DNA can be caused by chemical mutagens (some antibiotics are mutagens), by ionising radiation or ultraviolet light. The rate of division of normal cells is restricted to the number required for their function but in tumour cells this control system is destroyed and they start to

multiply. When the tumour weighs a few grams it starts to release millions of cancer cells into the blood, every day. The kill rate by the immune system is impressive and most will not form secondaries, with 1 per cent of the cells surviving twenty four hours and 0.1 per cent lasting two weeks. Only some of them have the ability to metastasise and, with cancer cells it is, 'survival of the fittest', thus, making it crucial to catch the disease early. The more advanced it becomes the more resistant the tumour is to treatment. The doubling time of the size of the tumour varies a lot but is generally from one to twelve months and from the first lone cell to diagnosable size is from two and a half to thirty years.

Early victims

The first clear example of an environmental cause of cancer was in 1775 when soot caused chimney sweeps to develop the disease in the scrotum. Lancashire mill workers got cancer on the parts of their body which were constantly exposed to lubricating oil and workers who extracted oil from shale were also at risk. In the last century cigarette smoking was linked with cancer along with the exhaust of motor vehicles and the output of factory chimneys. All these cases were the result of combustion but since then a wide range of chemicals have been found to be powerful carcinogens, including polychlorinated biphenyls which are used in making electrical equipment, plasticisers in plastics and food packaging. These PCBs were also found to suppress the immune system. Nitrates and nitrites are other hazards which can be added to the list of hundreds of chemical carcinogens.

One damaging agent at low levels will not necessarily cause disease but when different agents are

present together their potency may be increased with devastating effect. If two can cause problems then what effect will hundreds of chemicals cause, when combined? This has never been properly investigated.

Apart from chemicals, two other causes of cancer need to be examined - viruses and radiation. Generally, human cancers are not directly caused by viruses but in some forms they play a contributory role by damaging cells, particularly the DNA. One example is Hepatitis B which is a risk factor in the subsequent development of liver cell carcinoma, especially when combined with exposure to aflatoxin. Ionising radiation is another source of cell damage. Since man was on earth he has been exposed to 'background radiation' from the earth, rocks and cosmic rays, though our nutritional 'status' strongly influences our ability to withstand certain levels of radiation without developing cancer.

Nutritional solutions

Therefore, the naturopathic view is that cancer is caused by toxic damage to living human cells. Sometimes it is only one toxin or a few, but more often it is accumulations of numerous environmental toxins, each one, individually, acting at sub-clinical levels. Their effect will be more pronounced in those with some degree of genetic susceptibility or where their diet is, or has been seriously deficient or out of balance with respect to nutrients, particularly, micro-nutrients.

Naturopathic and holistic medicine dictates that the way to overcome disease is by restoring the body's natural power to heal itself. Dr. Plaskett takes the view that nutritional and orthodox medicine should work together and he advocates surgery to remove the primary tumour. One reason for this

is that the body can concentrate its defences on the secondaries and the other is that if the body does succeed in destroying the primary tumour its disintegration will release a huge amount of toxins into the circulation, which the body hardly needs when it is struggling against the disease.

There is also the difficulty of whether radiotherapy should be used as it depresses the immune system and the tendency among naturopaths is to accept its use when there is a large benefit. Chemotherapy is in a different category. Although it can be effective in some specific types of the disease its success rate with many of the commonest cancers has been very poor and cellular damage, which includes damage to healthy cells, is often so great, that attempts to enhance the immune system with nutritional therapy are doomed to failure.

Largely preventable?

Along with other chronic diseases, cancer is largely preventable and before examining its treatment it is crucial to understand how to reduce the risk of succumbing to these diseases, as this impinges on treatment. The research evidence on the anti-cancer effects of phytonutrients, which are derived mostly from non-toxic plants, is vast. Generally, diets high in organic fresh fruit and vegetables are effective and in the USA, the National Cancer Institute found that those who had five servings of fruit and vegetables, daily, had half the chance of cancer of the digestive and respiratory tracts than those who ate under two servings. High vegetable intake, also, increases the anti-oxidant, carotenoids in the blood which have been strongly shown to inhibit carcinogenesis. Cancer, itself, suppresses the immune system and the indication is that the

carotenoids enhance the immune system, quench free radicals and inhibit mutagenesis.

Like the carotenoids, the flavonoids, which include oranges, chocolate and beans, are anti-oxidants. There is, also, strong evidence that a regular intake of onions gives some protection, particularly, from gastro-intestinal malignancies. Garlic, particularly fresh, inhibits cancer and Aloe vera is useful when taken with other components. Turmeric is, also, an effective inhibitor.

Trace elements - the minerals present in enzymes or which act as enzyme promoters - are, also, critical. Of these, selenium is the most important while Zinc is essential for DNA repair and for boosting the immune system - the mechanism for cancer cell destruction.

Vitamin protection

The elimination of toxins is another critical factor and Vitamin C is an important de-toxifier. Vitamin A has an outstanding record of protection against toxicity and Beta-carotene and Vitamin E protects cell membranes by absorbing free-radical damage and guards against chronic diseases, generally.

Other important factors are salt and sugar and chlorine. Cells normally retain a delicate balance of low sodium and a high potassium but when the cell is degraded by toxins, sodium can enter the cell and potassium can leak out - a factor in chronic illnesses. When this process goes too far the cell dies. Too much salt in the diet, when there are other factors, can result in it directly entering the cells, disturbing the sodium / potassium balance. Too much sugar in the diet is generally toxic and, therefore, should be restricted. Chlorine in drinking water is another hazard as it causes toxic reactions in the body and a suitable water treatment

should be installed in the home.

When it comes to the treatment of cancer, the naturopath's approach is to bring the fight to the tumours through the body's own defence mechanisms - the tumours would not be there in the first place if those systems had been working properly (the exception being when the amount of cancer-causing agents has been overwhelming).

To optimise the chances of overcoming the disease the patient has to be fed with a wide range of the important anti-cancer nutrients and phytonutrients and in relatively large amounts. There are, at least eight different mechanisms by which nutrients may have an anti-cancer effect. These include using anti-oxidants to quench free radicals; anti-proliferative nutrients to slow tumour growth, such as, the flavonoids and Vitamin A; increasing production of detoxifying enzymes with the use of vegetables such as cabbage and magnesium; encouraging genetic repair to cancer cells so that they become normal again (zinc and garlic is useful for this); inhibiting metastasis with, for example, the nutrient Bromelain; stimulating the immune system with Aloe vera or Bromelain; inhibiting the growth of new blood vessels that the tumour needs, with soya bean or Isoflavone and inducing the spontaneous death of tumour cells with, for example, the Brassica vegetables. Some phytonutrients have multiple effects, such as green tea and Noni fruit.

Trials

It is important that not all these nutrients should be in the form of supplements and the diet should be rich in whole, unprocessed fruit and vegetables and be alkali-forming rather than acid-forming which is, probably, essential for recovery from serious chronic illness of almost any kind. This

provides the dietary fibre needed for good intestinal action and gives some assurance that important phytonutrients, present in foods, but not yet identified will be included in the diet.

Over the eight years of the trials, the Nutritional Therapy Cancer Trust applied the therapy to patients with the most common cancers and ranging in age from two years to those in their seventies. The majority needed two to three years treatment and forty patients - 57 per cent of those who followed the protocol - fully recovered. Of those who died some appeared to have defaulted in using some parts of the therapy and others died well beyond the length of their original prognosis. Also, the cases available for study did not include all the patients who undertook the therapy so there may be more than the known 40 survivors. When one considers that these were patients who had been, largely, written off by orthodox medical doctors, it is astonishing that this has not come to public attention.

Dr. Plaskett's book is an exhaustive and carefully compiled study which fills a huge gap in the general understanding of cancer and other chronic diseases and deserves wide attention. Orthodox medical practitioners should, particularly, heed its contents.

The Nutritional Therapy of Cancer, by Dr. Lawrence Plaskett, Lulu Enterprises UK Ltd, 263 Putney Bridge Road, London, SW15 2P, United Kingdom. Book ID 7314657. www.lulu.com