Chapter Two ?? ?
Construction Materials

In this chapter we investigate the importance of building our bodies from the best nutritive materials and consider many of the assumptions underlying our present day diet. We also look at ancestral diets and ask what foods are we really designed to eat? In later chapters we will concentrate on the related subject of the biochemistry of the body, particularly the role of hormones and how they may have changed during man's evolutionary development. The matters arising from the following discussion on 'construction materials' however underlie this more fundamental aspect of our hypothesis.

There seems to be an increasing problem with the food we are eating today. In just one six-week period, newspaper headlines in the United Kingdom announced; 'World alert over cancer chemical in cooked food' (Daily Telegraph May 18th, 2002), 'Children at risk from the junk food time bomb' (Daily Mail May 31st, 2002) and 'Anti-social conduct may be linked to diet, says study', (Guardian, June 26, 2002). This is a small sample of worries arising from recent research. Today, we are told, we risk diabetes, heart disease and cancers from eating the 'wrong sort of food'. Weight problems caused by an addiction to high fat and high sugar convenience foods or simply an ignorance of the alternatives carry the risk of these and other diseases manifesting in later life. One in ten children under four is now classified as obese and heath problems resulting from being overweight cost Britain some two billion pounds a year. It has been estimated that, if we continue eating a 'junk food' diet, in forty years time half the population will be obese. Furthermore specialists also fear that anaemia due to poor nutrition in early life can have long-lasting effects on a child's mental development and learning ability.

Despite such alarming statements, the message has yet to get though. The consumption of such things as 'designer crisps', fizzy drinks and the whole gamut of convenience foods continues to increase whilst real food is widely shunned. It has been estimated that about half our children between the ages of five to eighteen eat no leafy green vegetables at all! We appear hell bent on 'progressing' down the road to ill health.

The situation may be worse still. There are some glaring anomalies in our modern theories of nutrition. Many of the pseudo-scientific assumptions that are the basis for our nutrition take little account of much biological research. There is a huge gulf here.

A BIOLOGICAL VIEW OF NUTRITION ?? ?

Living biological systems, that are the basis of our food, have an extremely complex molecular make up and structure. In the cooking process biologically active material is transformed into something totally different. We assume that this is of no consequence. We do not question the merits of cooking. After all, it makes the food taste better doesn't it? Though some heath professionals tell us to eat more fresh vegetables and fruit, our television, books and magazines are dedicated to delivering a very different message. They put glamour and celebrity into the cooking process. Very rarely do we receive any biological information on nutrition via these channels. Yet the food we eat is of vital importance to us – it is the construction material of our bodies and our sensitive brains. We really do need to ask a surprising question: 'What is the effect of putting our food through a process that turns living nutrition into something structurally very different?'

The widely held opinion that all food is broken down into small units, to a molecular level, which are then used by the body to construct what it needs, is not altogether justified. Large complex molecules can be utilised by our bodies and indeed their assimilation is essential to our health. The whole pharmaceutical industry is based on the ability to get complex molecules through the system in an intact state so that they can change some function. Molecules do not always get broken down and reassembled in the way it is widely assumed. There is a more complex picture here. If the system uses holistic sub-units for construction, not just single molecules or atoms, it may indeed matter what happens to them prior to digestion.

The enzymes found in vegetables are thought by some to be important for they are believed to help support the body's own enzyme system and hence aid digestion and assimilation. It is widely assumed that they are denatured in the stomach but recently it has been shown that 60% to 80% of them can reach the colon intact where they help create the conditions in which beneficial intestinal flora can thrive. If these large and complex molecules can get through our digestive system intact and they are helpful to us in their intact form does it make sense to change the nature of these substances completely prior to consumption? Prolonged cooking breaks down their molecular structure rendering them, in this context, useless.

The brain's neural tissue is a very fatty tissue. It is a highly volatile substance. It is easily oxidised, easily damaged and very delicate. The best fats for building neural tissue include specific chains of fatty acid molecules that are found in seeds, leaves, fish and the meat of animals that eat plants. These substances are incredibly delicate. They become damaged by oxidisation even at room temperatures. They do not hold their integrity in an oxidising environment. If the brain is built from this very delicate material, we could question the wisdom of taking these long chains and heating them to high temperatures in an environment that is full of free radicals and oxygen. Is this the best way to provide our brain and bodies with the material it needs? Essential fatty acids are biologically active when the molecules are in what is known as the 'cis' form. When heated the molecules that make up the fatty acids change their shape to the 'trans' form, and this stops them being metabolised by the body. Heating, particularly frying, seems to be then the worst thing we could do to the chemicals we need for the construction of our brain and bodies. At high temperatures the molecules of unsaturated fatty acids more easily accept atoms of oxygen thus becoming 'oxidised'. These oxygen atoms can later become detached and latch themselves onto other molecules. These unstable oxygen-carrying molecules are known as free radicals. Free radicals can initiate damage in cells and have been associated as a causal factor with diseases like cancer and arteriosclerosis.

One further problem with the assumptions that underlie modern nutrition is that no credence is given to the fact that the complex chemicals in our food do not exist in isolation. The wide variety of different substances in our food, including such things as amino acids, vitamins and fatty acids, exist together in a convoluted matrix. When they are broken down physically by our teeth and stomachs and with enzymes, they are cleaved into relatively complex sub-units that still retain some integrity. Plant-based fatty acids are wrapped in anti-oxidants to protect them against damage. When they are taken from their environment the ideal scenario, from a consumers point of view, is that they are assimilated in as near to their pristine condition as possible.

But, we may ask, does not the stomach with its strongly acidic conditions merely continue the process initiated by cooking? No – many groups of complex molecules whether designed by nature or drug companies pass through this acidic, test tube-like apparatus and survive in an intact enough state to work their magic on our ailments. We do not take the separate components of a drug; we take the complex chemical. Drug companies do not ask us to cook our medicines before we take them! Everyone would regard this as an absurd thing to do but does this not parallel what we do to our food? There are endless examples that disprove the assumed notion that our food is broken down into their component parts. The whole industry of food supplements is dependent on complex chemicals getting through our digestive processes. How would traditional plant remedies that use, for example, Ginkgo or St John's Wort work if this were not the case? The digestive process does cleave the complex chemicals in our food into usable sub-units but this is so very different to oxidising and denaturing the molecules at high temperatures.

The process of cooking has never been a part of biological evolution. Heating food to high, burning levels is a trait that has emerged extremely recently in the three billion years of life on earth. All biology operates within a fairly narrow range of temperatures. It is chemically and enzymically orientated. The flow between species functions within these limits. To bring heat denaturing into the equation, particularly within complex organisms that have established a balance with their environment over aeons of time, is bound to have some repercussions. Heat denatured food is a wholly new substance in evolution. It bears little resemblance to biology. It is not living. Is it reasonable to assume that assimilating this material into our systems – using it to build our tissues especially our highly complex and sensitive neural tissues – will have no effect? Is it not more reasonable to assume it does have an effect and that it may even effect our consciousness? Surely this is a crucial area that is desperately in need of further investigation. If we examine the concept of cooking from the standpoint of standard biological science and take into consideration the delicate and complex nature of living biochemistry it becomes rather an absurdity.

To illustrate this point consider this: If we took a transplant organ, for example a liver, and prior to the operation put it in a pan of boiling water, despite the organ looking quite similar it is biologically dead. It would do the patient no good at all! A crude and stark analogy perhaps but it has some relevance to heat denaturing of food prior to consumption. In cooking, the molecules that comprise our food become twisted, shattered and highly oxidised. Yet this is the treatment we routinely give to the sub-units that we build our bodies from.

NUTRITION AND DEGENERATIVE DISEASE ?? ?

This is painting perhaps a one sided and bleak picture. If the situation was so bad why are we still living and supposedly thriving? Man on his rice, beans and meat could be considered the most successful animal on earth at this time. But, as we have seen, we are not as healthy as we should be.

An experiment on animals given purified, processed foods initially showed normal patterns of growth and health but, as they reached adulthood, ailments including calcium loss from bones, constipation, dental caries, and a build up of large populations of harmful bacteria in the colon were revealed. These signs of degenerative ill health are common in our rich western societies. Diseases such as allergies, arthritis, hardening of the arteries, coronary heart disease, emotional disorders, insomnia, teeth and skeletal problems, infections and diseases of the immune system are, according to biochemist and nutritional expert Roger Williams, due to progressive malnutrition.

There is further evidence to suggest that inadequate nutrition is at least partially responsible for many of our Twentieth Century ailments. Simple experiments carried out decades ago by American physician Francis Pottenger made devastating connections between basic nutrition and chronic degeneration in health. As part of his work on adrenal glands of cats, Pottenger noticed that when fed on raw meat the animals were much healthier and also less likely to die from surgery than those fed on cooked meats. Intrigued by this observation, he set up an experiment to investigate the effects of a raw and cooked diet. He experiment lasted ten years and followed several generations. One group of animals was fed on pasteurised milk, cooked meat and cod liver oil and the other on basically the same diet but the meat was raw and the milk unpasteurised. His results showed that the group fed on the processed diet developed a high incidence of allergies, sickness and skeletal problems whilst the raw group were healthy and had a good skeletal structure. The cats in the first group also produced smaller litters of weaker, low birth weight animals and displayed abnormalities in physiology and behaviour. These damaging effects were passed from generation to generation and were only corrected in the fourth generation of animals fed again on raw food.

There are many other studies that corroborate Pottenger's results. In India, Sir Robert McCarrison fed monkeys on their usual diet but in cooked form. All of these animals developed inflammation of the colon and post mortems revealed gastric and intestinal ulcers as well. In Switzerland, O. Stiner did parallel work with guinea pigs. On a cooked diet his animals quickly succumbed to anaemia, scurvy, goitre, dental caries, degeneration of the salivary glands and, when 10cc of pasteurised milk was added to their daily diet, arthritis as well.

Given the profound implications of these studies one would have expected much more research to have been done on the respective effects of raw and cooked foods on humans but no comprehensive work has been done recently. Why not one may ask? Perhaps our multi-billion pound/dollar food industries wouldn't like the results! One further study (but even this one was done half a century ago) sheds more light on this question. In 1950, Dr Mananore Kuratsune, head of the Medical Department of the University of Kyushu investigated the diet that was given to the prisoners Japan took during the last world war. This diet, consisting of around 800 calories per day per 70 kg of body weight, was well under a half of the daily minimum that is recommended to maintain health. The good doctor and his wife ate a raw version of this diet and both remained healthy but when they switched to eating the diet in cooked form all the symptoms of malnutrition that devastated the inmates of the Japanese camps rapidly showed themselves. These included oedema, vitamin deficiency and physical collapse. They were forced to abandon the experiment because they became so ill. They conclusively proved however that what was regarded as a grossly inadequate diet sustained them when eaten raw but did drastic damage when cooked.

Cooking does not destroy all the biologically active material in food, especially light cooking, but a greater bulk needs to be eaten to give us the same structural quality as the food in its raw state. Also humans may be unique in that, in evolutionary development, we reached a higher level of immune function and assimilation that can tolerate more abuse to the system. We appear to be able to eat less than ideal food for years without signs of clinical illness but the insidious degenerative process is at work within. Our individual constitutions and levels of abuse may differ but it is assumed that ill health and disease will get us in the end. Many folk live the last years of their lives with the fear of disease, if not the actuality of it, but does old age and disease necessarily go together?

In the remote Andean highlands of Ecuador, there are communities of people who it is claimed live for 140 years or more and who remain agile and lucid right to the end. Death from heart disease and cancer is unknown in these high mountain valleys but rife in nearby towns. David Davies, who has made a study of these ‘Centenarians of the Andes’, found that the people who have the best chance of a healthy old age are those that actively use their minds and bodies, even towards the end of their life span. He looked at many elements of their life and environment from genetic factors to the tranquillity and lack of stress in their way of life. The folk who lived longest were found amongst those that lived on a subsistence diet, which was low in calories and animal fat. Typically, the main meal of the day was eaten in the early evening and was made up of very small wild potatoes, yukka, cottage cheese and maize or bean gruel. Melons were eaten for dessert. Sometimes green vegetables, cabbage, marrow, pumpkins were added to the menu and sweet corn cobs were often taken to work for lunch. The people working in the fields ate fruit throughout the day. The climate is ideal for citrus fruits, and many other ‘hedgerow’ fruits such as mora (like a blackberry), guava and naranjhuila are abundant too. Meat was only eaten rarely, a type of cottage cheese was made from goat or cow milk and eggs were eaten raw or almost raw.

Though these people were very healthy and extremely long-lived we mustn’t necessarily jump to the conclusion that this diet is perfect for the human system – their diet is restricted by the environment they live in. However, if we look at other communities of long-lived folk the parallels are striking. The Hunzas of north-east Kashmir also live in mountainous regions and have a diet that includes wheat, barley, buckwheat, beans, chick-peas, lentils, sprouted pulses, marrows, pumpkins, cottage cheese and fruit – the famous Hunza apricots and wild mulberries. Meat is again only eaten rarely and, because fuel is in short supply, when food is cooked it is usually steamed; a method of cooking that is the least damaging to the chemical nutrients in the food. Hunzukut males, like the people in the Andean Highlands, are also reported to live to 140 years of age. So, we must conclude that these diets are, at the very least, much more suitable than the ones we depend on in the affluent industrialised countries.

There seems to be no definitive study that has so far convinced society as a whole that nutritionally we are barking up the wrong tree (or at least not picking from the right tree). But there are many scraps of information that support the thesis that raw food is the most beneficial option. Lymphocyte production and hence resistance to illness is boosted by consuming the nutrients that occur in optimal proportions and quantities in uncooked vegetables. There are also a huge number of cases in which raw food and raw fruit and vegetable juices have seemingly cured a wide range of illnesses. Migraines, skin complaints, tuberculosis, mental disorders, heart disease, cancers and a host of other diseases have responded favourably to a diet rich in raw food. There are clinics, foundations and institutions throughout the world that offer therapies based on 'living nutrition'. Papers, articles and books (some of variable quality) have been written on the subject too but the message has yet to make the impact that it should. We go on eating sweet biscuits, chips and pies. Our supermarkets are stacked full of refined, highly processed and sugar-rich foods. And our Governmental Health departments, though generally encouraging us to eat more fruit and vegetables, seem unwilling to pass on the advice that is needed if we are to avoid long term degenerative disease. Perhaps we need Government Health Warnings on crisps, custard creams, pasteurised milk and processed wheat breakfast cereals!

Part of the problem here is that our standard diet does of course sustain life and so when things go wrong we tend to blame some external and usually recent causative factor. More and more evidence suggests however that many diseases can be traced to a slow and progressive degeneration of cells and tissues. Another part of the problem is that eating cooked foods conditions the sense of taste very easily, and contributes to an altered food instinct.

HEAT PROCESSING ?? ?

Why should cooking and heat processing food be so bad? Does it not make food more digestible? Yes, food we would have difficulty eating, or indeed staples like taro, cassava and even potatoes, that can be toxic in their raw state, are made more edible by cooking but are these the best foods for us anyway? Taro, *Colocasia esculenta*, is a root vegetable that has been on the human menu for at least 7000 years but it contains poisonous calcium oxalate that is only destroyed by thorough cooking. Cassava, *Manihot esculenta*, needs even more treatment to render its poisonous cyanogenic glucocides harmless. This vegetable needs to be grated, washed, squeezed and then cooked before it can be eaten. If these foods were the only food available to us, we would have to cook to survive, and perhaps this was why we had to start cooking in the first place. But unfortunately there are many negative aspects to processing food in these ways. When plant foods contain poisons it is a necessity to destroy these chemicals by applying heat, but what happens to the chemicals in food that our bodies need, when they are subject to the same treatment?

Vitamins are particularly sensitive to heat. They are not only destroyed but leach out into water during boiling. Cabbage will lose 75% of its vitamin C content by being boiled. Fat soluble vitamins such as A, D, E and K are more stable but even a high percentage of these will be lost by frying and baking. Frozen foods have been found to have only half the amount of vitamin B6 and pantothenic acid that is found in their fresh counterparts and the canning process may destroy up to 77% of essential nutrients. So much of the food that we eat is processed wheat – bread, biscuits, pasta, pastry etc but such grains also lose a very high percentage of their vitamin B6 and pantothenic acid content when they are processed, along with a large proportion of their minerals and trace elements.

In addition to such nutrient loss, heating food can denature proteins to such an extent that our digestive enzymes cannot process them further. Proteins are constructed from chains of amino acids. At least eight of these are essential for human nutrition. We need a constant supply of these amino acids to build the physical structures of our bodies and the chemicals that run our functions. One of them, glutamine, the amino acid that appears to help prevent arthritis, may be destroyed by heat. Cystine and lysine too are completely destroyed when, for example, a steak is grilled at a temperature of 239 degrees Fahrenheit. As cooking reduces the value of our protein foods, we have to eat more of them to provide what our bodies require but this entails a risk. High protein consumption has been linked to early ageing and the development of many degenerative diseases. Excessive protein consumption not only causes deficiencies in many essential vitamins but also causes minerals such as calcium, zinc and magnesium to leach out of the body. Protein assimilation also produces toxic residues such as amyloid. This fatty waxy substance, found in large quantities in the tissues of meat eaters, interferes with the transportation of nutrients, damages cell membranes and DNA and has been linked to degenerative diseases such as arthritis, heart disease, atherosclerosis and cancer.

The examples of the detrimental effects of consuming processed foods are seemingly endless – Phosphatases (enzymes that break down phosphorus containing compounds) in milk are destroyed by pasteurisation rendering the calcium insoluble and making milk constipating. Heated unsaturated oils like safflower have been found to contain numerous poisonous compounds – some are powerful oxidisers and others are carcinogens. In May 2002, a worldwide alert was issued after scientists announced that much of the food we eat contains significant levels of acrylamide, a chemical known to cause cancer, affect fertility and damage the nervous system. Acrylamide occurs in fried, baked and processed foods ranging from biscuits, bread and crisps to chips and meat. It is formed in the cooking process and longer cooking means more acrylamide is formed. Amongst the products tested in the British study (crisps, crackers, processed breakfast cereals and chipped supermarket potatoes) some had levels of acrylamide 1,280 higher than international safety limits. It is particularly nasty stuff; as a genotoxic carcinogen it has no safe dose. As 30 to 40 percent of cancers are caused by diet, acrylamide (and foods cooked in a way that encourages its formation) could possible emerge as one of the major causes of this devastating illness so prevalent in our world today.

Perhaps Paul Kouchakoff of the Institute of Clinical Chemistry at Lausanne provided the most striking evidence that cooked foods are unsuitable for our diet. He found that when we eat cooked foods white blood cells (leukocytes) rush to the blood vessels supplying the intestines to defend the body against the perceived threat of invasion. This effect was termed digestive leucocytosis and thought to be a normal reaction to the ingestion of all food but then it was found that raw food doesn't trigger this reaction. This research was done decades ago. Why hasn't it been followed up? Its implication is enormous not only to theories of nutrition but also to the developmental history of man.

Although cooking foods for all but brief periods of time destroys many valuable nutrients a group of health-promoting nutrients known as phytochemicals do not appear to be so affected. These phytochemicals are biologically active substances in plants and are present in fruits, vegetables, grains and legumes. They are responsible for such things as colour, flavour and natural disease resistance but when we eat them they not only provide us with energy and raw materials for construction but also have been found to protect us from cancer. They may do this in a number of ways. For instance, supforaphane, a phytochemical found in broccoli, can activate enzymes in our cells that removes carcinogens before they can cause any harm. Flavinoids, found in citrus fruits and berries keep cancer causing hormones from latching on to cells in the first place. Genistein, found in soya beans, kills tumours by preventing the formation of capillaries needed to nourish them. Indoles, found in cabbages and Brussels sprouts, increase immune activity and make it easier for the body to excrete toxins, and saponins found in beans and lentils, may prevent cancer cells from multiplying. We are only just beginning to discover the benefits of these substances and as they are extremely numerous (it has been estimated that there are 10,000 different phytochemicals in tomatoes alone) there is much more to find out. Generally we do know however that diets high in fruit, vegetables, grains and legumes appear to reduce the risk of a number of diseases, including cancer, heart disease, diabetes and high blood pressure. Phytochemicals may survive the cooking process (Genistein for example is present in such processed products as tofu and miso soup) but the antioxidants that are also present in a fruit and vegetable-based diet and which also protect cells from cancerous growth are more vulnerable to heating. It seems therefore that to extract the most health benefit from our food we should not only eat a diet of predominantly fruit and vegetables but that we should eat it with little or ideally no cooking.

There is a large body of scientific and anecdotal evidence that extols the virtues of raw foods. For example, they raise micro-electric potentials throughout the body, boost metabolic functions, increase resistance to illness and the speed of healing, and enhance the transportation of nutrients through the capillaries which, in itself, aids the removal of toxins from the whole body system. Leslie and Susannah Kenton in 'Raw Energy' summarise the benefits of raw food concisely.

'Over quite a short time an all raw, or nearly all raw diet, does several things. It eliminates accumulated wastes and toxins. It restores optimal sodium/potassium and acid/alkali balance. It supplies and/or restores the level of nutrients essential for optimum cell function. It increases the efficiency with which cells take up oxygen, necessary for the release of energy with which to carry out their multifarious activities.'

They also highlight, with many examples, how raw diets have helped to heal numerous diseases including arthritis, diabetes and cancer and how they help to retard ageing too. This all adds weight to the assertion that building and running our systems on a less than ideal nutrition has far reaching consequences, but do these consequences go beyond issues of health and fitness? Can elements within our diet effect our consciousness?

Rutin, a bioflavinoid found in buckwheat, apparently, even in small doses, can alter brain waves and lift depression. A diet high in raw foods seems to reduce stress, fatigue and even minimise the effects of jet lag. A raw diet provides ample amounts of magnesium and potassium that if lacking contributes to fatigue; blood sugar levels are stabilised too and this helps to lift the spirits, kick the blues and abolish mood swings. Experiments with specific raw foods found that sunflower seeds were particularly effective in depressing cravings associated with addictions like smoking.

Stress, one of the many scourges of our modern age, may be at least in part a result of over-acidity in the body. All the foods we eat are either acid or alkaline-forming and, not surprisingly, sugar, meat, coffee, concentrated proteins and all the processed foods using white flour are acid forming. A proper acid/alkali balance is achieved by eating about 20% of acid forming foods to 80% of alkaline forming which (you've guessed it) are most vegetables and fruit. A society comprised of individuals that are eating a predominantly acid-forming diet is going to be one filled with stress, anger and rage. Is it just a coincidence that our televisions are now screening many documentaries on these problems while the sales of convenience foods have gone through the roof? A recent study on anti-social conduct also showed that nutrition affects behaviour. When young offenders were given supplements of vitamins, minerals and fatty acids, infringements, including violent ones, were dramatically reduced. (More on this in Chapter Six.)

Although the evidence is subjective it does appear that societies that had a more vegetable/fruit-based diet were happier and had a more contented population. Indian Vedic texts recommend a vegetable/fruit-based diet for enhanced mental and spiritual awareness. The Etruscans, it seems had a largely vegetable and fruit diet. Life for them approached an ideal; their society was peaceful and artistically rich before the militaristic Romans took over. Chinese mythology too harks back to a golden age in which the culture was not only supremely peaceful but also lived on uncooked foods.

The venerable Chinese Cha'an master, Dr Sheng-yeng tells the story of meeting an old monk who was living as a hermit in the mountains of Taiwan. This monk had no kitchen or even the means of boiling water. He drunk water in just the way he found it, bathed in cold water and ate his food raw. According to his traditions, people were originally very healthy and ate everything raw. Their bodies were hardy and they never became sick. Then someone came along who discovered fire. People began cooking their food and contracting diseases. It was only at that point that diseases needed to be classified and cures found.

Most religions give some indications of what is the best diet for leading a spiritual, balanced, harmonious and healthy life. Even in Genesis it is written that 'The Lord God made trees spring from the ground, all the trees pleasant to look at and good for food'. God also said, 'I give you all plants that bear seed everywhere on earth, and every tree bearing fruit which yields seeds: they shall be yours for food'. The Buddha said 'For fear of causing terror to living beings let the Bodhisattva who is disciplining himself to attain compassion refrain from eating flesh'. The German philosopher, Arthur Schopenhauer noted 'Since compassion for animals is so intimately associated with goodness of character, it may be confidently asserted that whoever is cruel to animals cannot be a good man' and H.G. Wells also remarked, 'In all the round world of Utopia there is no meat'.

It is enlightening to note the contrasting features of diet and behaviour that exist in our two nearest living relatives. Bonobos and chimpanzees are very closely linked species but of the two bonobos are thought to be the closest to us. They have an almost exclusively vegetarian diet whereas chimps eat a little meat. The difference in their societies is marked. Bonobos are more laid-back and less aggressive than chimps that in turn seem more stressed and prone to violent flare-ups. It may also be no coincidence that it is the male chimps, that form the hunting parties and eat the most meat, that are also the most aggressive. There may of course be many contributing elements to the behaviour of their respective societies but this link with diet is one worthy of further consideration.

HUMANS ARE BY NATURE FRUGIVOROUS ? ? ?

As with all organisms, hominids in the course of evolution were locked into the biological matrix of their environment. Whether our diet consisted of insects, fruit or meat it was all biologically active material. There is no question that we arose out of a tropical forest ecosystem and that like most other primates our diet was primarily plant-based. Some primates eat a bit more of this or that – much coverage has been given recently to meat eating chimps but this comprises a relatively small percentage of their diet. Despite their skill in capturing live prey, chimpanzees actually obtain about 94% of their annual diet from plants, primarily ripe fruits. Primate biochemistry is largely based on plants and a plant-based diet is what hominids were eating during their evolutionary development.

The lack of plant material in the fossil record has led, according to Richard Leakey, to an over emphasis on meat eating as a component of the early hominids' life. He also finds some of the recent work on tooth analysis 'surprising'. The teeth of *Australopithecus robustus* fall into the fruit-eating category. The patterns of wear and the small scratches left on the enamel appear very similar to that of the forest dwelling chimpanzees yet here was a hominid which was supposed to live on the plains in an era when the climate was dry and the vegetation mainly grass. The examples of *Ramapithecus* teeth that have been similarly analysed show exactly the same pattern, and the teeth of *Homo habilis*, the first creature to be awarded Homo status, also has smooth enamel typical of a chimpanzee. This evidence is extremely relevant. All the early hominids and their great ape cousins were mainly fruit eaters. The teeth of *Homo erectus* suggest a more omnivorous diet. The enamel from their teeth show scratches and scars that are compatible with grit damage possibly from consuming bulbs and tubers. As a response to a cooling climate and a contraction of the forest did this species widen its diet to adapt to a new environment? Some forest would have remained intact along the wetter river systems. Chimpanzees and gorillas survived there along with, we suspect, another hominid whose teeth were very well adapted to fruit eating – *Homo sapiens*.

There is evidence that primates given a choice will select fruit in preference to any other food. Fruit is a rich, nutritious and easily digestible food. If it is available this is what all the great apes prefer to eat. However other foods are eaten regularly. Our nearest relative, the bonobo, eats between 60% and 95% fruit depending on the fruit productivity of its specific habitat. The rest of its diet comprises mostly shoots and herbs and a small amount of insects, eggs and the occasional small mammal. What humans in the forest ate is unknown but it is likely that they would have eaten a similar balance of foodstuffs. They would not have been purely ‘vegetarians’. Even figs contain a small amount of insect matter as their pollination mechanism results in eggs and larvae of small wasp species remaining in the fruit. These insects may have served as an important source of essential micronutrients such as vitamin B12 as well as providing a little extra protein. Apes eat fallback foods like bark in times of fruit scarcity. It may have been the case that humans in the forest developed strategies to maintain a high percentage of fruit all the year round. Being efficient bipeds may have given them the potential to travel easily between widely separated fruit sources. The quest for distant fruit trees may have even honed their bipedal adaptation. The larger arboreal primates are known to travel on the ground between distant fruit trees as it is more efficient than travelling in the trees. Archaic humans being better-adapted bipeds than apes would have found this way of life much easier.

There has been much study and even more speculation about what sort of diet our teeth and guts are best designed for. From the type of dentition, gut length and toxicity of foods like meat, a very strong case can be built that *Homo sapiens* is designed to eat and process a largely fruit-based diet. The brain’s requirement for food and the gut’s requirement for energy, optimal acid/alkali balance and the structure of the intestines all point to a frugivorous diet. A shift to fruit specialisation answers all the problems and anomalies that have spawned countless conflicting theories.

Katherine Milton, Professor of Anthropology at Berkeley University, California, has carried out important work on diet and primate evolution. Her research has led her to believe that ‘the strategies early primates adopted to cope with the dietary challenges of the arboreal environment profoundly influenced their evolutionary trajectory’. This has a great significance for us today for the foods eaten by humans now bear little resemblance to the plant-based diets anthropoids have favoured since their emergence. She believes these findings shed light on many of the health problems that are common, especially in our industrially advanced nations. Could they be, at least in part, due to a mismatch between the diets we now eat and those to which our bodies became adapted over millions of years?

The plant-based food available in the forest canopy comprises fruit and leaves but subsisting on this diet poses some challenges for any animal living here. For a start, it is high in fibre that is not only difficult to break down and hence digest but also takes up space in the gut that may otherwise be filled with more nutritious foods. Many plant foods also lack one or more essential nutrients such as amino acids, so animals that depend on plants for meeting their daily nutritional requirements, must seek out a variety of complimentary food sources. Fruit is usually the food of preference for it is rich in easily digested forms of carbohydrate and relatively low in fibre, but its protein content is low too (their seeds may be protein rich however). Leaves offer a higher protein content but they are lower in nutrients and contain much more fibre. Balancing these constraints have led to different strategies that are reflected in behaviour and physiology. Colobine monkeys have compartmentalised stomachs (a system analogous to ruminants) that allows fibre to be fermented and hence processed very efficiently, but humans and most other primates pass fibre largely unchanged through their digestive systems. Some fibre can be broken down in the hind-gut of these latter species but the process is not as efficient as that in the Colobus.

Milton's research focused on two contrasting species of South American primates, howler and spider monkeys. These two species are about the same size and weight as each other and live in the same environment eating plant-based foods, yet they are very different. Howler monkeys have a large colon and the food passes through its digestive system slowly whereas spider monkeys have a small colon through which food passes more quickly. These physiological differences relate to dietary specialisation. The foundation of the howler's diet is young leaves. 48% of their diet is leaves with 42% fruit and 10% flowers. The spider monkey diet comprises 72% fruit, 22% leaves and 6% flowers. Another fundamental difference is that, although these animals are the same size, the brains of spider monkeys are twice the size of howlers. Very significantly, Milton comments that 'the spider monkeys in Panama seemed 'smarter' than the howlers – almost human'. This is something we have commented on before. Big brains and a diet high in fruit appear to go together. Why should this be so? Could this brain enlargement result from the need to memorise the location of productive fruit trees, as some have suggested, or did, as we propose, elements within the fruit itself fuel this change more directly? Animals such as squirrels and even birds like jays memorise the locations of stored food most efficiently without an overlarge brain thus it seems that something else must be responsible.

Although Milton has concluded that it is quite difficult for primates to obtain adequate nutrition in the canopy, she observed that spider monkeys consumed ripe fruits for most of the year eating only a small amount of leaves. Bonobos also appear to find enough food to eat easily for much of their time is spent in other 'social' activities. Thus being a fruit-eating forest primate appears a very viable option, but one question remains; if fruit is so low in protein, how do these fruit specialists obtain an adequate supply of these essential nutrients? Milton found that spider monkeys pass food through their colons more quickly than leaf-eaters such as howler monkeys. This speed of transit means that spider monkeys have a less efficient extraction process but as much more food can be processed, it more than makes up. By choosing fruits that are highly digestible and rich in energy, they attained all the calories they needed and some of the protein. They then supplemented their basic fruit-pulp diet with a very few select young leaves that supplied the rest of the protein they required, without an excess of fibre. Of course, by processing so much fruit, a large quantity of chemicals that naturally occur in fruit will also be absorbed. It should also be noted that wild fruit contains a higher percentage of protein than the cultivated fruit that is available to us humans today. It is clear that many wild primates are able to satisfy their daily protein and energy requirements on a diet largely or entirely derived from plants. It is likely that our ancestors in the forest did too.

We can now return to the human digestive process. The wild fruit that was the mainstay of our diet for the longest and most significant part of our evolutionary history contains more fibre than the fruit we buy today in our shops. Chimpanzees take in about 100 grams of fibre a day compared to about 10 grams that the average western human consumes. At one time it was believed that humans did not possess microbes capable of breaking down fibre. Studies on the digestion of fibre by 24 male college students at Cornell University however, found that bacteria in their colons proved quite efficient at fermenting the fibre of fruit and vegetables. The microbial populations fermented some three-quarters of the cell wall material, and about 90% of the volatile fatty acids that resulted were delivered to the blood stream. It has been estimated that some present day human populations with a high intake of dietary fibre may derive 10% or more of their required daily energy from volatile fatty acids produced in fermentation. Furthermore, recent experimental work on human fibre digestion has shown that our gut microflora are very sensitive to different types of dietary fibre. We are very efficient at processing vegetable fibre from dicotyledenous sources (flowering plants like fig trees, carrots and lettuces) but are less so from monocotyledens (grasses and cereals). This provides yet another pointer to the archaic diet of humans as being largely fruit-based and indicates that the grass seed that we eat so much of today in cereals, biscuits and much else is a poor substitute.

The chimpanzee gut is strikingly similar to the human gut in the way it processes fibre. As the fraction of fibre in the diet increases, both humans and chimpanzees increase the rate at which they pass food through the gut. These similarities indicate that when food quality declines both these primates are evolutionarily programmed to respond to this decrease by increasing the rate at which food passes through the digestive tract. And this compensates for the reduced quality of the food available. It appears that the human system, like the chimps and bonobos, is designed for a plant-rich fibrous diet. We are not designed for a diet high in carbohydrate and low in fibre. And definitely not designed to eat meat! Meat eating in man has been, on an evolutionary time scale, a very recent development. It certainly couldn't have influenced the development of our physiology. Though the passage of food through the guts of spider monkeys, chimps and humans is faster than leaf specialists like howlers, it is much slower than carnivores. Meat hanging around in the digestive system is bad news because of the toxicity of the stuff. The transit time for the passage of food through a carnivore's gut is between 7 and 26 hours while for humans it is between 40 and 60 hours.

There are some differences between human and ape gut structure that has led one camp of researchers to speculate that our intestines are similar to those of carnivores. We do indeed have a shorter colon and a longer small intestine than the great apes but these differences are more appropriately explained by a specialist fruit diet, not a carnivorous or grain-based one. Fruit is easier to digest than leaves, tubers and other plant materials and has a lower fibre content. Thus a specialist fruit eater would not need such a long colon as other apes that have more fibrous bulk to deal with. And another feature of humans, that is strongly indicative of our vegetarian origins, is our inability to synthesise our own internal vitamin C. This trait is very rare but where it occurs, the animals concerned (such as guinea pigs) eat a plant-based diet. In these cases ample supplies of the vitamin are available within the food.

Vitamin C plays many extremely important roles within the human body. Research seems to be always finding more functions for this 'miracle chemical'. These have been summarised by Dr. Ross Pelton in his book 'Mind Foods and Smart Pills'. Vitamin C stimulates the immune system, enabling one to better resist diseases. Terminal cancer patients taking megadoses of vitamin C have been found to live longer. It promotes faster wound healing and reduces the amount of cholesterol in the blood. It is a powerful detoxifier and protects against the destructive power of many pollutants. In addition, it protects the body against heart disease, reduces anxiety, promotes sleep, and is a natural antihistamine. A severe deficiency causes scurvy, and eventually death.

Increasing intake has been found to increase mental alertness and brain functioning in a variety of ways. Vitamin C is the main antioxidant that circulates in the blood. When available in sufficient quantity, blood carries it around the body, washing over the cells to create a bath of protection. Whenever a free radical turns up, a molecule of vitamin C gives up one of its own electrons to render the free radical ineffective. According to Pelton, this process may take place somewhere between 100,000 and a million times a second, depending on the body's level of metabolism and the amount of vitamin C available. Unfortunately, with each radical decimated, a molecule of vitamin C is lost, so the body rapidly loses its supply of vitamin C.

Vitamin C is particularly a key player in keeping our neural system healthy. The body has a system that operates like a kind of a pump to concentrate vitamin C around our nerves and brain tissue. These tissues have more unsaturated fats than any other organs in the body, making them more vulnerable to attack by free radicals and oxidation. The vitamin-C pump removes vitamin C from the blood as it circulates to increase the amount of vitamin C in the cerebrospinal fluid by a factor of ten. The pump then takes the concentrated vitamin C from the cerebrospinal fluid, and concentrates it tenfold again in the nerve cells around the brain and spinal cord. Thus our brain and spinal cord cells are protected against free radical damage by more than a hundred times as much vitamin C as our other body cells.

For such an important chemical it is extremely odd that we are dependent on vitamin C from outside sources. But how much of it does the body need? Research carried out by the Committee on Animal Nutrition demonstrated that monkeys needed around 55 mg. of vitamin C per kilogram of body weight. When this measure is extrapolated to humans, a 150-pound person would need a daily intake of 3,850 mg. Nutritional science recommends that a human needs 45 mg. each day. This is just enough to prevent scurvy but not enough to keep the body functioning at an optimal level. We would not and indeed do not obtain the sort of levels our bodies really need from a diet high in meat and low in vegetables/fruit but we would from one high in fruit, shoots and leaves. Analysis of wild plant foods eaten by primates shows that many of these foods contain notable amounts of vitamin C. The young leaves and unripe fruit of one species of wild fig was found to contain some of the highest levels ever reported. Our closest living relatives, the great apes, eat a diet that contains between 2 and 6 grams of vitamin C every day. When our ancestors were living in the forest they would have consumed similar amounts.

In contrast, we can and do produce our own vitamin D. This vitamin cannot be obtained from a leaf/fruit based diet but it can from a carnivorous one, thus if we were truly designed to eat meat we would have less need to synthesise our own. Being able to synthesise vitamin D and not vitamin C is then a strong indication of our true ancestral diet and the one we are really adapted to. The mountain of evidence that reveals that eating meat is an unhealthy option further strengthens this case. One recent study showed that vegetarians were 24% less likely than non-vegetarians were to die of ischaemic heart disease. Surely if we were evolved to eat a high percentage of meat in our diet, we would not suffer such negative health effects.

What would be results from studies, such as the one involving the students at Cornell University, if they included participants that abstained from wheat products too? Would results show an increase in digestive efficiency? A diet high in carbohydrates, especially refined carbohydrates, (cakes, biscuits, pasta, etc) dumps large amounts of glucose rapidly into our bloodstream. This can cause insulin resistance in which the absorption of glucose from the bloodstream is disrupted. This in turn can lead to obesity, adult onset diabetes, hypertension, heart attacks and strokes. It can also lead to an excess of male hormones, which, amongst other effects (aggression?), encourages pores in the skin to ooze large amounts of sebum. Acne promoting bacteria thrive on sebum. Up to 60% of 12 year olds and 95% of 18 year olds in modern society suffer from acne yet it is almost unknown in subsistence societies such as the Kitava islanders in Papua New Guinea and the Ache of the Amazon. The Inuit people of Alaska also used to be free of acne but they began to be affected by these skin complaints after they started to eat processed foods.

The problem with eating highly processed carbohydrates may be more far reaching still. If refined cereal consumption results in an excess of male hormones it could also have an effect on the immune system for we know that the thymus gland starts to shrink in response to these hormones at the time of puberty. Grain products have also been associated with coeliac disease, an auto-immune condition of the gut and some researchers suspect they trigger rheumatoid arthritis too. It is highly significant that these foods have the ability to alter the quantity or at least the activity of our hormones. It is another example of the way our diet can affect the way our bodies work. It is possible, probable even that they also affect the way we act and thus moderate our sense of self. If we compare refined carbohydrates with fruit, we can see that fruit has a much lower glycaemic index, which means it is digested more slowly thus avoiding the problems of the 'glucose rush'. The chemicals within fruit also reduce the activity of sex hormones. They thus have the diametrically opposite effect to that of refined cereals.

The orthodox view, avidly held by many, is that meat and particularly the high protein content of meat, was *somehow* responsible for the enlargement of our brains. This of course ignores the established link between brain size and a fruit diet, and the likely scenario in which our brains *stopped* expanding when we left the forest and started to eat meat! But there is one theory that particularly links our large brain size and our relatively short small intestine to a change to a meat diet. The brain needs a large amount of energy to function and so does the gut. The assumed 'higher quality' meat diet theoretically allowed more energy to fuel the brain with a shorter small intestine. This reasoning is flawed on several fronts. Firstly meat is supposed to be easy to digest and to be a high-energy food but fruit is much more easily digested and provides more readily available energy too. Secondly, if there were a sufficient external pressure to bring about such a change as a shortening of the gut, we would expect other adaptations and changes towards a carnivorous diet as well. Certainly we would not expect adaptations to be heading in the opposite direction. Our teeth, for instance, are nothing like the teeth of a carnivore. The teeth of our nearest relative, the bonobo, are much better adapted to eating meat than human teeth are, and bonobos hardly eat any meat. In fact it is known that bonobos are if anything are more intelligent than chimpanzees and it is chimps that eat at least some meat. If meat were such a powerful brain expansion food we would expect it to be the other way around. So, if bringing meat into the diet of an ancestral human was enough to shorten the gut and expand the brain (both major changes), where are the parallel changes in areas that would be needed to cope with a meat diet? If we look at areas such as dentition, the physiology to digest meat and the ability to catch it, we find nothing that looks even vaguely carnivorous. If we lined up the three most evolved species of primates – chimps, bonobos and humans – we would have to conclude that humans are in fact the least adapted to eat meat. Humans have much smaller teeth and they cannot chase the meat nearly so well! Also there is a structural distinction between carnivore guts and frugivore/vegetarian ones. Our guts are like the non-carnivores – they are folded, smooth and still significantly longer than a carnivore gut. There is a difference in saliva too. Carnivore saliva is acid but the saliva of humans is alkaline which provides the right functional environment for digestive enzymes, such as amylase to break down starch.

Now, if we ask what sort of food really fits these human adaptations we are forced to the conclusion that it is fruit. Fruit fits the brain/gut energy equation, the shorter gut, the ease of digestion, the low toxicity and the small teeth. Fruit is easy to assimilate and the nutrition it provides is in a form that needs very little conversion to the real requirement of the brain - glucose. (The sugar in wild fruit tends to be rich in glucose and fructose compared to cultivated fruit that has been bred for its sweeter tasting sucrose content.) Humans thus have a proportionately shorter small intestine than chimps and bonobos not because of increasing levels of meat in our diet, but because of an increased specialisation on sugar-rich fruit. High quality fruit is low in toxicity and provides all the fuel the brain needs. Meat conversely is more difficult to digest, particularly without cooking, and then to turn protein into sugar requires yet more energy. So meat as an energy food doesn't make as much sense as fruit that is full of fruit sugars which are easily assimilated and take little conversion.

PROTEIN, FATTY ACIDS AND WATER ? ? ?

We need to look at the whole matter of protein requirement in a little more depth. Perhaps we do not need as much as is widely assumed. The time of our life when we need the richest and highest quality of nutrients is in our first few years of life when our bodies and brain tissues are rapidly growing. At this time, infants depend on breast milk so we would expect that human breast milk would have a high protein content. *But this is not the case.* Human breast milk has a protein content of only around 5%! Breast milk is sweet and rich in fat, providing sugar to physiologically fuel the baby and fat to build it. It is a low protein food.

Recent research has illuminated the vital necessity of adequate polyunsaturated fats for brain development, particularly in forming nerve fibre membranes. But in their first four months, babies do not produce the enzymes needed to make certain long-chain fatty acids. The only source of these acids is in the milk they consume. The food mothers eat during their breast-feeding stage has been found to affect the balance of fats in their infants. In one study, the baby of a mother who ate a diet that excluded all animal products had twice as much polyunsaturated fat in its adipose tissue than did babies whose mothers were omnivorous. The conclusion was that babies breast-fed by mothers who ate an exclusively plant-based diet have better brain development because of the role of polyunsaturates in the growth of neural membranes. This study again points to the suitability of a fruit-based diet and its link to neural development. It strongly suggests that a plant-based diet is better for brains than a meat one and cast further doubt on the theory that an ancestral change to a diet high in meat had anything to do with our brain enlargement.

In the first year of life, no less than 60 percent of a baby's energy intake fuels brain growth. Referring back to Katherine Milton's spider monkey study, we could ask whether they were really eating leaves for their protein content. They may have been primarily after additional essential polyunsaturated fats.

Fatty acids play an essential role in the structure and function of the brain. Two of them alone, arachidonic acid and docosahexanoic acid, constitute 20% of the dry weight of the brain and over 30% of the retina. These are biologically, highly active compounds that perform numerous regulatory functions in the brain and the rest of the body. Many of them can be synthesised by the body if the diet provides enough of the raw materials for construction, but some such as linoleic (omega 6) and alpha-linolenic (omega 3) acid must be supplied directly via the food we eat. Animal studies have shown that neural integrity and function can be permanently disrupted by deficits of fatty acids during foetal and neonatal development. These nutrients are extremely important. Research has indicated that infants may benefit markedly from the long chain polyunsaturated fatty acids naturally present in breast milk. It is highly likely that most of us are chronically short of these nutrients as they are in short supply in our modern diet and, even more crucially, are absent from many baby formula foods.

Considerable evidence is now accumulating that indicates that deficiencies in essential fatty acids is a major contributory factor in a range of interrelated childhood disorders including attention deficit and hyperactivity disorder, dyslexia, asthma, allergies and even autism. It has been shown that correcting these deficiencies can significantly help, but unfortunately a number of additional factors can interfere with the way our body synthesises these so essential compounds. These factors include high levels of stress hormones in the body, deficiencies of vitamin and mineral co-factors (especially zinc), and too high a level of saturated or hydrogenated fat (the fat we get from animal products). In addition the balance of essential fatty acids needs to be right. In our modern diet we tend to over consume omega 6. Too much '6 to 3' will cause problems. Just adding supplements without sorting out other elements of the diet will therefore not maximise the benefit.

All wild foods routinely eaten by monkeys have been found to contain notable amounts of alpha linolenic and linoleic acid. The diet of our human ancestors would have been similarly rich in these essential fatty acids. It seems that our physiology is most compatible with these foods. If they do not comprise a high percentage of our diet the result will be poor health. In fact analysis of wild plant foods eaten by free-ranging primates shows that these foods are generally high in the nutrients necessary for human health. Wild primates ingest a greater proportion of many minerals, vitamins, dietary fibre as well as the essential fatty acids than most modern human populations. Perhaps the present recommended daily requirements for these dietary components have been set far too low. Grains (and roots) tend to be low in many of the essential nutrients humans require and that we not only eat large amounts of these foods but also cook them exacerbates an already dire situation.

And then there is the matter of water. Most humans today are chronically dehydrated. This simple fact causes much ill health. According to Dr F. Batmanghelidj, most of the painful degenerative diseases of the human body are caused by a simple lack of water. He has concluded from his studies that asthma, diabetes, arthritis, angina, obesity, Alzheimer's, high cholesterol, hypertension, dyspeptic pain and many other maladies are signals from a body that is desperately thirsty. Batmanghelidj has given many detailed examples of why the body needs water for perfect physiological function and what happens when the system is dehydrated. (Dehydrated joints lead to swelling and pain, a dehydrated mucous layer in the stomach permits acid penetration that can lead to ulcers etc.) His book 'Your Body's Many Cries For Water' is highly recommended. A diet of fruit and vegetable matter is of course mainly water. We are much more prone to dehydration if the bulk of the food we live on is dry - like grain and especially wheat-based products. If our bodies work more efficiently when we live on the diet that provides not only the nutrients that we need, but also basics like our water requirement too, we can only conclude that this diet is the one we have been 'designed' for.

If we look at the requirements of a complex tropical primate (say a human), in terms of evolutionary biochemistry, primate evolution and molecular biochemistry, we would end up with a nutritional ideal far from the elements of our modern diet. Modern nutrition finds no support from any other scientific discipline apart from its own. So why are the links between disciplines not made? Just too many assumptions are made about food. Nutritional research tends to start from the basis that our 'meat and two veg' diet is normal and healthy but critical and logical questioning from a biological standpoint reveals the crucial problems that are now manifesting in the degeneration of our health. The research that has been done reveals glaring anomalies that are not given their true weight and have not been followed up. They desperately need to be. The implications are far reaching. If we are correct, wholesale changes will need to be made to our farming, food processing and retailing industries.

BIOCHEMICAL COMPLEXITY ?? ?

We must also be aware at the biochemical complexity of a varied plant-based diet. A single cell in say a tropical fruit is mind boggling in terms of its chemistry. Volumes could be dedicated to what is happening to one cell of one species. As well as vitamins and minerals, there are volatile essential oils, natural antibiotics, plant hormones, bioflavinoids, chlorophyll, anthocyans and different forms of fibre. The effects of these substances on the human body have been rarely studied but, when they have, the evidence suggests that they contribute to heath. Some pigments, such as chlorophyll may even help protect the body against damage from pollutants and radiation.

Nutritional 'science' talks about carbohydrates, fats and proteins and little else. There is a large credibility gap between such simplistic notions and what is really going on. If our evolutionary origins are linked to this complexity, not merely of one cell in one fruit but to many whole fruits of many species, each one a unique biochemical factory, then what are the implications of such a radical change to the diet we have today?

If all the world's pharmaceutical companies worked together at synthesising chemical compounds they couldn't get near to the number that a single tropical forest tree manufactures. During the most critical period in our evolution, we were locked in to this complexity. The products of the forest are incredibly rich and delicate. Fruit, shoots and leaves contain hundreds and thousands of different chemicals. This formed the womb of our evolution that nurtured us for countless generations. It is casually assumed that we evolved in the forest and fruit formed an important element of our diet, but the full implications of this have never been discussed or delved into in any detail - until now. A botanical biochemical perspective has not before now been considered as part of the anthropological model.

An avocado may just be a piece of fruit but from a biochemist's point of view it is still an enigma. There is so much of its biochemistry that has yet to be discovered. Pharmaceutical companies could reproduce a few of the chemicals within and crudely synthesise them, but the fruit in all its complexity is of a different order entirely. How one chemical acts synergistically with another raises the complexity of the system to an exponentially higher level. Primates in the forest were made from and evolved within this level of complexity. Primates do not just eat the fruit – they are of the fruit.

As individuals, we do not consider this level of complexity of livings things when we are making life decisions such as what to eat and how to heal ourselves. Growing and running a human body takes, it is estimated, over 50,000 chemicals. Nutritional science has recognised a number of vitamins, minerals and amino acids that we need for basic health but this is a tiny fraction of the chemicals that are available to us in our food - particularly in fruit. It is also reasonable to assume that these nutrients do not work in a simple isolated fashion but work together in complimentary ways to achieve the best for us. It is simplistic to assume that we just need a handful of vitamins and minerals and that these can be supplied via highly processed foods or supplemented in tablet form. Author Micheal Colgan agrees. Writing about vitamins he says:

'The multiple interaction of these essential substances is the basis of their biological function. And the adequacy of that function depends on the substances being supplied to the body in the same mixtures and concentration that occur in raw and unprocessed foods.'

If, as is accepted, humans evolved in a tropical forest and their very evolution depended on the fruits of the forest, then what effect is our present day diet having – a diet extremely different from that our bodies and brains have been genetically programmed to utilise?

We need to emphasise that primates evolved in an environment with a unique biochemistry. This environment may have been stable for millions of years, and, over such long stretches of time, this rich chemical matrix would have had a very real and highly significant effect. The biochemistry of the forest fruit would have impinged very directly on the neural endocrine system of the forest dwelling hominids. How did this work? Was there something in the biochemistry of the forest fruits that acted directly on the autonomous DNA systems of our ancestors? Was a link or tangible interdependence forged?

As the fruit-eaters were also the disseminators of the seeds, a co-evolutionary mechanism may have been established. If a certain fruit, for instance figs which we know contains chemicals that inhibit the breakdown of neurotransmitters, had a powerful effect on the consumer - it may have tasted better or even made the hominid feel better - it would have been selected more often and hence dispersed more efficiently. If the chemicals in the fruit also enhanced neural expansion, a very rapid feedback could have occurred. Selecting only the more powerfully loaded fruits would fuel this process even more. The hominids may have even unwittingly 'managed' the forest environment by selecting and dispersing only these most beneficial fruits. This mechanism could have lead to a very rapid evolutionary leap. Animals do select the things they want and this can modify the environment around them.

To recap then we can see that cooked food and, in particular our highly processed 21st Century ones, have a whole host of effects on our bodies and minds that are just not considered by the general population, the medical profession or our food production industries. But are these effects more far reaching still? Would our human potential be greater if we built our tissues from a balanced diet of living and vibrant foods free from toxins or chemical residues? If our neural biochemistry is detrimentally affected by poor diet then all our other systems will be too. The brain regulates so many other functions. If we construct the brain – the control unit and the most sensitive part – from low-grade materials, it will affect the whole organism.

If in the distant past, humans and proto-humans ate a diet consisting mainly of fruit, then the chemicals contained within the fruit would have flowed through their bodies for countless generations. What effect did this have on our evolution? We could not have eaten sugar and monoamine oxidase inhibitor-rich fruit everyday without some effect. Could such a diet have caused, for instance, a lengthening of 'childhood'? The very long juvenile period is just one notable feature of the human species that deserves a thorough investigation. To unravel all the ramifications of this fruit/human biology connection would take several lifetimes of study but we will make a start in the next chapter.