

**Flavonoids are substances found in plants which can protect the body against a wide range of diseases. They can cut heart disease and slow the spread of cancer**

**Flavonoids are powerful anti-oxidants and protect the blood vessels – easing vein disorders and symptoms of diabetes**

**Over the last 50 years we've eaten fewer and fewer flavonoids. This may be linked to the increase in allergies, arthritis and asthma**

**Good flavonoid sources include cocoa, chocolate, tea, red wine and the berry fruits**

**Soy beans and the isoflavones in soy may be the single most important anti-cancer food source**

**Soy can lower cholesterol levels – and protect against heart disease**

## *Chapter 6*

# Plant magic – flavonoids and isoflavones

The flavonoids are one of the most important groups of compounds derived from plants. Over 20,000 have now been identified since the early days when they were all lumped together as Vitamin P in 1936 by the great Hungarian biochemist Szent Gyorgyi (who also discovered Vitamin C).

Following Szent Gyorgyi's discovery, pharmaceutical companies brought out a range of medicines containing Vitamin P but, by the '60s, most had disappeared. As a natural compound, P could not be patented and because nobody knew exactly what P was, how best to measure it, or even whether P was a single compound or a group, the drug companies found it difficult to produce a reliable product.

Modern techniques have resolved these problems. The flavonoids have been identified and divided into approximately 12 sub-types, many of which have profound therapeutic activities.

Each of these groups is under intensive study. Interestingly enough, the results often mirror long-established folk medicine. For example, it has been discovered that one group of flavonoids especially good at mopping up damaging free radicals in the liver is found in particularly high levels in milk thistle<sup>(23)</sup>, a herb traditionally used to treat liver disease.

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Another type of flavonoid which quenches free radicals in the lining of arteries occurs in very high concentrations in hawthorn and yarrow<sup>(24-26)</sup>, two plants which have long been used to treat cardiovascular disease.

These are not coincidences. Not all herbal remedies are effective but the tradition goes back thousands of years and is based on generations of experience. Very often, the herbal lore in different countries and even different continents turns out to rely on the same herbs and plants to treat the same diseases, and this again is no coincidence.

So it is not entirely surprising that when the tools of modern science are brought to bear on traditional herbal remedies, they uncover a wealth of valid medical information – information which is forming the basis for new, rational and often highly effective forms of preventative and curative medicine.

### VITAMIN P

Vitamin P's Hungarian discoverer named it after Paprika (a rich source of this group of compounds and a staple in Hungarian cuisine); and Permeability, as the extract was effective in reducing bleeding and bruising.

In this respect Vitamin P seemed to resemble Vitamin C, and Szent Gyorgyi concluded that the two vitamins worked together in the body. Although his views subsequently fell from fashion, more recent work shows that he was broadly correct: at least one group of flavonoids, the leucoanthocyanidins, can save guinea pigs dying from scurvy by substituting for Vitamin C<sup>(52)</sup>. (Guinea pigs and humans need Vitamin C in their diet, all other mammalian species make their own.)

There are well-documented reports of scurvy in humans being cured by infusions of pine bark, a rich source of flavonoids. The same flavonoids, combined with Vitamin C, are highly effective in the treatment of cardiovascular conditions<sup>(53-56, 62-64, 78-82)</sup>.

## Where do flavonoids come from?

Flavonoids form a vital but, until very recently, sadly neglected part of human nutrition. The Western diet contains anything between 25 mg and 1g of flavonoids per day<sup>(1, 2, 3)</sup>, and the level of your flavonoid intake is now considered by some to be a major factor in determining your risk of developing coronary artery disease<sup>(3)</sup>, and cancer<sup>(4, 5)</sup>.

### Flavonoid sources

**Flavonoids are found in fruits and vegetables like apples, prunes, citrus fruits and cabbage, and particularly in the following foods (type of flavonoid in brackets):**

- **Red and yellow onions, shallots, apples (quercetin)**
- **Grapeseed, red wine, maritime pine bark, haws, flowers and bark of hawthorn, most parts of the yarrow, leaves and buds of hazel tree (procyanidins)**
- **Walnuts, blackberries, pecan nuts (elagic acid)**
- **Coffee (caffeic acid)**
- **Tomatoes (chlorogenic acid)**
- **Green tea, black tea (catechins)**
- **Rosemary (carnosic acid)**

## THE DEFENCE BOOSTERS : Flavonoids & isoflavones

Even if you don't know what flavonoids are, you are almost certainly already eating them. The question is whether you are eating enough of the right ones to stay healthy.

Flavonoids are found in a huge variety of edible plants, fruits and vegetables, including apples, prunes, citrus fruits, cabbage, lettuce, tomatoes and tea<sup>(6, 7)</sup>. But although they are so common, most of us are likely to be flavonoid depleted<sup>(3)</sup>, thanks to changing eating habits. We're eating less than half the amount of fresh fruit we did at the turn of the century, and more processed fruit<sup>(99-101)</sup>. The highest concentrations of flavonoids in fruits and vegetables tend to be found in the skin and seeds<sup>(6)</sup> and industrial processing methods almost invariably discard these parts.

The flavonoids concentrate in the external tissues and core to defend the plant, and its DNA, against external threats. Many flavonoids are powerful anti-oxidants, and high concentrations of these compounds in the skin or peel of a plant protect it from free radical damage generated by UV in sunlight. Flavonoids also have potent anti-viral, anti-bacterial and anti-fungal properties, and the flavonoid 'ring' around the plant provides an important defence shield against pathogen attack.

### Wash, but don't throw away the skin



The highest concentration of flavonoids is found in the leaves, skin, peel or seeds of fruits and vegetables – which are mostly discarded in processing.

### Flavonoids are part of the plant's own defence mechanism

Another reason for the high concentrations of flavonoids in the plant's outer parts is that many of these versatile compounds are brightly coloured, and are used by the plant to attract insects or birds for pollination and seed dispersal.

## Flavonoid depletion

What are the results of flavonoid depletion likely to be? We can begin to answer that question by reviewing all the therapeutic things that flavonoids do – and it's a long list.

Many flavonoids have anti-bacterial, anti-fungal, and anti-viral effects. Although they are designed as defence compounds for plants, fortunately for us they work against the micro-organisms that cause disease in humans too<sup>(9-11, 65-70, 86, 102)</sup>. For example, certain flavonoids are able to inhibit viruses such as HIV<sup>(12-20)</sup>.

Many members of the flavonoid group have powerful anti-oxidant, anti-allergic and anti-cancer properties and boost the immune system.

Other flavonoids inhibit enzymes involved in inflammation, the breakdown of bone and cartilage, and vascular spasm<sup>(12-20)</sup>. They block the release of histamine, reduce inflammation, strengthen

capillaries and slow the leakage of antibodies into the blood stream<sup>(103-106, 169, 170)</sup>. And finally, some flavonoids are thought to increase levels of anti-oxidant enzymes like SOD (Super-Oxide Dismutase)<sup>(188, 189)</sup>.

The overall effect is anti-inflammatory – so you'd expect flavonoids to alleviate allergy symptoms and chronic inflammatory diseases such as arthritis, asthma, coronary artery disease and Alzheimer's. And there's a growing body of evidence that flavonoids do indeed have an important contribution to make in these areas.

## STONE AGE FLAVONOID CONSUMPTION

During the period when homo sapiens evolved, our diet contained large amounts of flavonoids. I believe that the decline in our flavonoid intake, particularly in the last 50 years, is linked to the current increase in degenerative and inflammatory illness.

Our immune systems appear to have become unbalanced and sterols, and this may be because vital dietary checks and inhibitors, like flavonoids, have been reduced. This would result in an increase in inflammatory illnesses such as asthma, coronary artery disease and arthritis; and is likely to be one of the main reasons why vegetarians live longer than omnivores<sup>(21, 215)</sup>.

## How the plant magic works

The key to the role of flavonoids is that many of them are extremely potent anti-oxidants<sup>(119)</sup> and anti-inflammatory agents<sup>(12-20)</sup>.

Different flavonoids work in different tissues of the body; some can enter the brain, for instance, whereas others appear to concentrate in the lining of blood vessels. This means that different flavonoids can be used to target different tissues<sup>(23-31)</sup>. For example, a flavonoid which is taken up by the lining of capillaries might be expected to be good for capillary function – and the ginkgo flavonoids, widely used to improve blood flow to the brain, hands and feet, do just this.

Many flavonoids neutralise free radicals, including the highly dangerous hydroxyl radical<sup>(37, 38)</sup>. One group is particularly good at quenching the radicals which cause liver damage<sup>(23)</sup> (these are the flavonoids found in milk thistle).

## Genetic protectors

The flavonoids concentrated in the pips and seeds provide protection for the plant's precious genetic material.

Powerful blenders are now available which can liquify fruit and vegetables, pips and all. Drunk immediately, this is a great way to give yourself a good dose of anti-oxidants, flavonoids and fibre!

## Four types

**There are four types of flavonoid anti-oxidant:**

- **Type 1a – neutralise free radicals**<sup>(23, 32-38, 57)</sup>
- **Type 1b 'chain-breakers' – stop the cascade of lipid (fat) peroxidation**<sup>(39-43)</sup>
- **Type 2 – bind and neutralise free iron**<sup>(41, 44-46)</sup> **and copper**
- **Type 3 – neutralise free oxygen**<sup>(46, 47)</sup>

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## Anti-oxidant league table

- 1 Rosehips, pomegranates, blueberries, prunes, blackberries, raisins, raspberries, dates<sup>(2,49)</sup>
- 2 Garlic, kale, strawberries
- 3 Spinach, Brussels sprouts, plums<sup>(241)</sup>

Some flavonoids bind to dangerous free iron and copper in the body, thereby stopping free radical formation<sup>(41, 44-46)</sup>. Many are capable of locking up free oxygen<sup>(46, 47)</sup> and preventing the oxidation of ascorbic acid, thereby protecting Vitamin C in fruit, fruit juices, and in the body.

## Quercitin

One flavonoid, quercitin, found in onions and apples may be one of the most cardio-protective substances yet discovered<sup>(48, 49, 224, 227)</sup>. The Zutphen Elderly Study<sup>(3)</sup> measured the flavonoid content of the diet of their subjects and discovered that the number of cardiac deaths in the group eating the most flavonoids was a quarter of the death rate in the group which ate the least flavonoids. And quercitin accounted for two-thirds of the total flavonoid intake.

In fact, all mortality rates were lower in the high flavonoid group, even when other dietary anti-oxidants such as Vitamins C and E were ruled out.

Since Zutphen, two more trials have found that quercitin (a powerful anti-oxidant and anti-inflammatory agent<sup>(48, 49, 224)</sup>) is cardio-protective<sup>(225-226)</sup>.

There was some controversy over whether quercitin is absorbed from the gut, because little is found in the bloodstream<sup>(50)</sup>. Recent work shows that quercitin and related compounds are absorbed<sup>(223, 234, 235, 245, 246)</sup> and concentrated<sup>(193-205)</sup> elsewhere in the body<sup>(51, 83)</sup>.

There's other evidence that flavonoids are absorbed. Tannins, for example, which consist of long chains of flavonoids linked together, protect against stroke in hypertensive animals<sup>(65)</sup>. Tannins are found in, eg tea, wine, quince and persimmons.

Or try eating a good helping of beetroot. The purple pigment in beets consists of flavonoids which, when eaten, are absorbed from the gut and excreted in the urine – a colourful fact you can check for yourself!<sup>(210)</sup> Combine beets with rhubarb or spinach at the same meal to get the most spectacular results<sup>(247)</sup>.

## Procyanidins

Procyanidins are an extremely promising group of flavonoids. They are well absorbed from the gut<sup>(55, 264)</sup>, and are already used



## INCLUDE

Onions in your diet.

High flavonoid intake cut heart disease risk by 75% in one study. And the flavonoids were mostly quercitin from onions<sup>(3)</sup>.

Onions were traditionally used to 'help the heart'.

## Men – Caution!

Quercitin has been shown to kill prostate cancer cells<sup>(250)</sup>. However, very high doses of quercitin given to male rats makes their testicles shrink<sup>(51)</sup>. There's a warning here for self-medicators: a little quercitin is a good thing, but don't overdo it!

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(in the form of pycnogenol and grapeseed extracts) to treat arthritic conditions, because of their ability to quench free radicals and stop the breakdown of synovial (lubricating) fluid inside inflamed joints.

These flavonoids also target blood vessels and, once there, protect the connective tissue in the artery walls by exerting a powerful anti-oxidant, anti-inflammatory and anti-permeability effect. They also block enzymes which have a destructive effect on the connective tissues (see Chapter 14, Heart disease)<sup>(58, 59, 74-76)</sup>.

These protective actions mean the high procyanidin content of black grapes (and red wine) is probably one of the main factors underlying the so-called French paradox. The French eat a high fat diet, yet are relatively immune from heart disease<sup>(60)</sup>. There are probably several factors involved, including the widespread use of olive oil, but there is evidence that consumption of two to four glasses of red wine a day reduces the risk of a heart attack by an astonishing 40 per cent<sup>(107, 176-180)</sup>.

Hawthorn and yarrow plants, both exceptionally rich in procyanidins, have long been used to treat angina and circulatory problems<sup>(24-26, 61)</sup>. Hawthorn is reported to alleviate the pains of angina within a month or two of treatment which, if due to 'defurring' of the arteries, is breathtakingly fast. I know of serial angiograms, taken in a South African hospital, which apparently demonstrate that atheroma can indeed be made to shrink within a period of months<sup>(111, 112)</sup>. The fact that hawthorn also strengthens the heart beat<sup>(228)</sup>, which would tend to make angina worse, supports the anti-atheroma claims – see Chapter 14, Heart disease.

### RED WINE

Moderate amounts of alcohol reduce blood platelet stickiness<sup>(108, 181)</sup>. In addition, flavonoids in red wine and in grape juice are powerful and specific inhibitors of platelet clotting<sup>(182-185, 212)</sup>.

Red wine (but not white wine) produces a significant rise in the anti-oxidant capacity of the blood plasma<sup>(114, 187)</sup>, lasting for up to four hours. This is related to its ability to stop LDL cholesterol being oxidised<sup>(109, 110)</sup>. In addition, red wine (but not white wine) is reported to increase levels of the 'good' HDL cholesterol<sup>(187)</sup> – and its valuable protective enzyme, paraoxonase.



2-4 glasses of red wine a day may reduce heart attacks by 40 per cent – (see the Wine List on page 235).

### Angina?

Try a hawthorn or yarrow supplement. These have been reported to alleviate pain in as little as 1-2 months.

## Flavonoids used in medicine in Europe

- **Grape and wine extracts, which contain procyanidins, are being used to treat circulatory disorders, ulcers, dental caries, and to provide radiation protection**
- **Pycnogenol (also contains procyanidins) is used to treat varicose veins, diabetic retinopathy and heart disease**
- **Bilberry extracts are used in ophthalmology, and circulatory diseases**
- **Milk thistle extracts are given to aid liver function**
- **Cerebral vascular problems are widely treated with ginkgo**

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## Using flavonoids to treat illness

### Heart disease

Anyone concerned about reducing their risk of cardiovascular disease should take flavonoid supplements. These valuable micro-nutrients block the disease at many key points, including the first: chronic, sub-clinical inflammation of blood vessels, termed Endothelial Dysfunction (ED).

ED is caused by many factors including smoking, homocystenaemia, a diet high in saturated fats and low in anti-oxidants – but especially by flavonoid depletion. The flavonoids are critical to vascular health. They target blood vessels where they act as anti-oxidants, anti-inflammatories and anti-glycosylants. If the diet is low in flavonoids, inflammatory factors (such as excess cholesterol) predominate. If the diet is also low in other micro-nutrients needed for vascular repair (Vitamins C and B6, the minerals zinc and copper etc), chronic inflammation leads to progressive vascular damage, causing varicosity in veins and atheroma in arteries<sup>(62-64, 115-117, 216-222)</sup>.

When arteries are inflamed, the subtle balance of factors which make healthy blood vessels constrict and dilate appropriately is disturbed. Vasodilating influences are blocked, so that constriction predominates. The arteries tighten, causing hypertension; in many cases, excessive salt consumption makes things worse.

### Prevention and cure

I can heartily recommend a procyanidin flavonoid supplement like grapeseed or bilberry extract to most people, because although these compounds are very safe<sup>(96-98)</sup>, and occur in many fruits and vegetables, we do not eat enough of them.

This is because they are mostly found in the rind, pips and seeds that we generally discard. Grape seeds, an excellent source of these compounds, are usually spat out or pass through the body. Quince, another rich source, is too astringent to eat uncooked and cooking destroys most of the procyanidins.

The greatest source of these compounds in most people's diet

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is red wine, which not only explains the French Paradox but also the fact that alcoholics who favour red wine tend to outlive those who drink beer or spirits<sup>(56)</sup>.

Red wine, it seems, contains enough of these flavonoids to protect against some of the free radical damage that causes the cirrhosis and pancreatitis which kill many alcoholics <sup>(190-192)</sup>.

A recent report in the British Medical Journal confirmed all my ideas about the health benefits of flavonoids. This trial showed that the more wine you drink, the lower your risk of death, not just from coronary artery disease but from all causes of death, including cancer<sup>(176, 179)</sup>.

Danish scientists found that spirit drinkers were more likely to die than teetotallers, and beer drinkers as likely to die as non-drinkers, but in those who drank three to five glasses of wine each day, the risk of death from all causes was reduced by an amazing 52 per cent<sup>(176, 179)</sup>.

This pattern had already been hinted at by others<sup>(107, 177, 178)</sup>; and is supported by the fact that, although alcohol consumption is stable in Denmark, a recent shift from beer and spirits to wine drinking has coincided with a fairly dramatic fall in deaths due to coronary artery disease<sup>(179, 180)</sup>.

Although alcohol itself has some cardio-protective effects<sup>(181)</sup>, it is the procyanidin flavonoids in wine that do most of the good<sup>(186)</sup>, and these are predominantly found in red wine rather than white wine. If the Danes had looked at the health benefits of red wine in particular, they would have probably found even greater health benefits<sup>(182-184, 212)</sup>.

Grape juice has some beneficial (ie anti-clotting) effects<sup>(185)</sup> but it's prepared aerobically (ie: it's exposed to the air during production), so some of the valuable flavonoid content is lost. Wine, on the other hand, is prepared anaerobically (ie: in sealed containers where oxygen reactions don't take place) – and so the procyanidins are preserved.

As recently as 25 years ago, the medical establishment's view was that the flavonoids had no place in clinical medicine<sup>(174)</sup>. A quarter of a century is a long time in medicine. We can now see

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- **Hawthorn is particularly valuable in treating coronary artery disease and heart failure**

**Its flavonoids help to reduce atheroma<sup>(111,112)</sup>.**

**They are also unique in increasing the strength of the heart muscle while decreasing the risk of arrhythmias<sup>(228,229)</sup>**

**They also lower blood pressure by blocking Angiotensin Converting Enzyme, which is another strongly cardiac-protective factor<sup>(230)</sup>**

### What's in a name?

Procyanidins have several other names, including anthocyanidins, procyanidolic oligomers (PCOs), oligomeric procyanidins (OPCs), and pycnogenols.



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### Anti-cancer effect



Red wine contains resveratrol, a flavonoid which raises levels of the 'good' HDL cholesterol and reduces platelet stickiness<sup>(182-184, 243)</sup>.

Resveratrol also has a wide range of anti-cancer properties<sup>(233, 118)</sup>, as does catechin, another red wine flavonoid.

The combination of the two, given in a red wine extract, increased life-span in cancer-prone mice by 50 percent or more<sup>(234)</sup>.

### But avoid too much alcohol!

Even with red wine, there's a point at which the flavonoid benefits are outweighed by the dangers of high alcohol intake.

The official (Dept. of Health) guidelines are 21 units (glasses) a week for men and 14 for women. If you want to take higher doses of flavonoids, switch to supplements.

### WINE AND RADIATION

Procyanidins have been shown to protect animals from radiation, because they neutralise the free radicals formed by the radiation<sup>(71)</sup>.

This strongly suggests that they could be used to protect against damage during radiotherapy. I recommend a half bottle of good red wine (at least!) to anyone about to entrust themselves to the tender mercies of their local Radiology Department, combined with Vitamin E and GLA<sup>(72)</sup>, together with C and Co-enzyme Q10.

This is no joke – Chernobyl victims were advised to drink Crimean red wine, which is known to have a very high procyanidin content<sup>(54)</sup>. Russian scientists are well aware of the radio-protective effects of procyanidins – their astronauts are routinely given an extract of green tea.

Other micro-nutrients also have radio-protective effects, including lycopene, a flavonoid found in tomatoes, which has been shown to reduce mouse mortality after radiation by an amazing 50 per cent<sup>(73)</sup>.

that this versatile group of plant compounds offers simple solutions to many of the major health problems of our time.

### Vascular problems

Because of the ability of procyanidins to keep blood vessels healthy, it's not surprising that reports have appeared describing improvements in varicose veins, oedema and haemorrhoids<sup>(78-80)</sup>.

Anyone suffering from any of these should try a procyanidin product for at least two months, although in some cases improvement is noticeable in one month. Vitamin C should be taken with it, and in serious cases an additional glucosamine supplement (see Chapter 10, Amino sugars) is advisable.

Alternative sources of flavonoids which help blood vessels include ginkgo and horse chestnut seed extract. This was traditionally used in Germany to treat chronic venous problems and recently shown to be as effective as, or more effective than, wearing compression stockings<sup>(206-209)</sup>.

### Diabetes

In diabetes, the capillaries become especially fragile, and micro-bleeds in the capillaries supplying the retina are a common cause of blindness.

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Pycnogenol, an extract from the bark of maritime pine consisting mainly of procyanidins, has been used for many years in France to prevent diabetic blindness. Studies show that it is safe<sup>(96-98)</sup> and it can be remarkably effective in stabilising and improving vision in diabetic patients<sup>(81, 82)</sup>. As above, Vitamin C and a glucosamine supplement are also recommended.

Another important cause of sight loss in diabetics is the growth of new blood vessels supplying the retina. The procyanidins block this effect, another reason why they are helpful in this condition.

Other flavonoids can help diabetics too. The cholesterol in the blood is more prone to oxidation than in non-diabetics<sup>(232)</sup>, which is one reason why diabetics suffer more heart attacks. In a recent study, a flavonoid preparation (Diosmin) not only reduced the rate of cholesterol and lipid oxidation but also reduced the rate that proteins were damaged (cross-linked) by the excess blood sugar<sup>(175)</sup>. This would not only reduce blood vessel damage in the eye and elsewhere in the body, but also protect against cataracts and renal damage, where excess cross-linking is involved.

### Skin care

Procyanidins are being incorporated into the latest cosmetics<sup>(65)</sup>. They form a protective shield around the collagen and elastin fibres which give skin its firmness and texture, and protect them against the enzymes which break down these fibres, and against free radical damage too<sup>(58, 59, 74-76)</sup>.

It's early days, but procyanidin's anti-allergic, anti-inflammatory and anti-oxidant properties could constitute a major cosmetic break-through; especially when combined with other anti-ageing nutrients such as the amino sugars (see Chapter 18, Skin).

### Dental care

Procyanidins target the bacteria which cause dental decay. The flavonoids seem to stop the bugs sticking to the teeth and to dental plaque. Some dental scientists are looking at these flavonoids as a way of slowing down tooth decay<sup>(212)</sup>. The anti-inflammatory effects may also help to control or minimise



### LOOK FOR

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a supplement that contains mixed procyanidins and polyphenols, eg grapeseed or bilberry extract, at 200mg or more a day.

Citrus flavonoids have a role to play, but may not be as powerful as the procyanidins.

For treatment purposes, the procyanidin/polyphenol dose



### INCLUDE

Lots of fruit and vegetables with a high flavonoid content in your diet, ie prunes, dark cherries, blueberries, raisins and currants.

Prunes have one of the highest ORAC ratings of all, ie they have a proven capacity to absorb large numbers of damaging free radicals.

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## LOOK FOR

...

Green tea extract in a supplement.

This polyphenol complex has good all-round protective

gingivitis (gum disease) which is responsible for more tooth loss than dental decay.

## Athletic Injury

Whether it's a sprain, strain or muscle tear, an athletic injury is accompanied by inflammation. The procyanidins are particularly helpful here because of their profound anti-inflammatory actions. They inhibit many of the destructive enzymes involved in the inflammatory process<sup>(58, 59, 74-76)</sup>; and also inhibit the release of histamine and other important inflammatory mediators<sup>(77)</sup>.

Athletes who wish to minimise the impact of any injury would be well advised to take a preventative dose of procyanidins, combined with a good amino sugar preparation (see Chapter 10, Amino sugars).

## Tea and B

High levels of flavonoid intake may increase homocysteine levels in some people: so they should always be combined with betaine and B vitamins<sup>(251)</sup>.

## Osteoporosis

At least one flavonoid derivative, ipriflavone, has been shown to reverse the process of osteoporosis, and rebuild old bones (see Chapter 15, Bones).

## The flavonoid-cancer story

Vegetarians live longer. They have less cancer and fewer heart attacks too<sup>(83, 84)</sup>. But you don't need to go the whole hog, because omnivores who eat above average amounts of fruit and vegetables can cut their risk of most cancers by 50 or even 75 per cent<sup>(85, 248)</sup>.

We already know that Vitamins A, C, E and carotenoids, which are only found in fruit and vegetables, have anti-cancer properties, but the flavonoids may be even more promising.

Flavonoids boast an extensive array of anti-cancer effects which add up to an extremely impressive cancer defence package:

- Free radicals damage DNA. Many flavonoids are potent anti-oxidants which mop up large numbers of free radicals, and reduce the

## Tumours and flavonoids

Tumours can only grow if they can stimulate the growth of a new blood supply<sup>(156-168)</sup>. The flavonoids can block tumour growth by preventing the growth of new blood vessels<sup>(144-150)</sup>.

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amount of DNA 'hits'. Free radicals also damage cell membranes. This damage might also lead to tumour formation, so once again anti-oxidants, like flavonoids, should help.

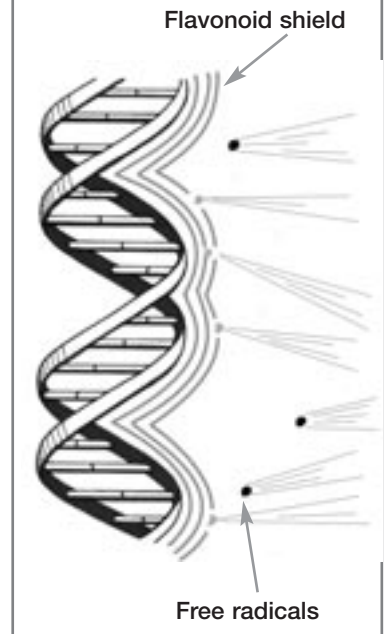
- Some flavonoids bind to the histones around DNA, forming a shield around it<sup>(89)</sup>.
- 'Free' iron atoms in the body can generate large amounts of free radicals. Various flavonoids bind to iron, and make it inert<sup>(41, 44-46)</sup>.
- Flavonoids bind to some carcinogens very avidly, and neutralise them<sup>(67, 88)</sup>.
- Many chemical carcinogens in the diet (or inhaled in cigarette and other smoke) are neutralised by enzymes which make them soluble so they can be excreted from the body. Some flavonoids stimulate the body to make more of these enzymes, with the result that some carcinogens are more rapidly detoxified, and excreted more efficiently<sup>(90, 242)</sup>.
- Conversely, flavonoids reduce the activity of other enzymes which can make carcinogens more dangerous<sup>(90,242)</sup>.
- Various flavonoids can boost the immune system. They enhance the action of the natural killer cells, and boost the body's own anti-cancer substances, interferon and interleukin-2<sup>(95)</sup>.
- Flavonoids can block the start of tumour growth<sup>(91-93, 124)</sup>. Once a cancer has started, they can inhibit the invasiveness of cancer cells<sup>(94)</sup>, and prevent the ingrowth of new blood vessels<sup>(236-240)</sup>.
- Flavonoids can also force cancer cells to commit 'suicide'<sup>(118, 271)</sup>.

These effects help to explain the up to four-fold reduction in cancer associated with higher consumption of fruit and vegetables mentioned earlier. It also helps explain the 20-fold difference in the risk of certain cancers between different countries.

### Flavonoid Shield

The DNA in your body cells is constantly under attack from free radicals.

Some flavonoids have an affinity for DNA and act as a protective shield against this attack, lowering the risk of damaging DNA and therefore cancer.



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### Pycnogenol

Pycnogenol, an extract of pine bark rich in flavonoid compounds known as procyanidins, is used by many nutritional therapists.

Pycnogenol combines wide-spectrum efficacy with an excellent safety record<sup>(86-98)</sup>, as does quercetin<sup>(58,59, 74-76, 121-123)</sup>.



### INCLUDE

Try to eat onions and cooked or processed tomatoes frequently and drink two cups of tea (preferably green) a day.

Some flavonoid-rich dishes would be tomato and onion pizza sprinkled with rosemary; leek or onion soup, flavoured with black pepper and thyme; or mixed dark fruits.

For more enriched recipes, see the *Health Defence Cook Book* by Portia Spooner and Dr Paul Clayton, also published by Accelerated Learning Systems Ltd.

**If we knew exactly which fruits and which vegetables contained which flavonoids, and how best to combine them, it should be possible to cut the risk of many cancers by up to 90 per cent, perhaps even more.**

Not surprisingly, a great deal of nutritional research is concentrating on just this area. Some of the most active and best researched compounds include:

- quercetin – onions
- elagic acid – walnuts, pecan nuts
- caffeic acid – coffee beans
- chlorogenic acid – tomatoes
- epigallocatechingallate – tea
- carnosic acid – rosemary
- genistein – soy

This is by no means an exhaustive list, but all of these have been shown to possess anti-cancer effects in cell culture and animal experiments. So a diet rich in all the above would make an excellent basis for a cancer-free lifestyle.

It should also include turmeric, which contains curcumin. Curcumin has extensive anti-mutagenic<sup>(126, 130)</sup>, anti-carcinogenic<sup>(127)</sup>, and anti-tumour powers<sup>(128, 130)</sup>.

Curcumin also has an important role in any anti-arthritis nutritional plan – and it should be considered as an ingredient in any supplement that aims to protect joints.

Garlic should be on the menu too; the garlic compound diallyl sulphide has anti-cancer effects<sup>(129)</sup> (for more about anti-cancer diets, see Chapter 13, Cancer).

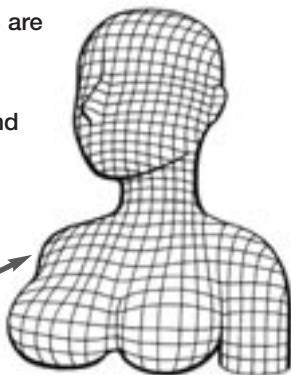
## Beyond chemotherapy

The flavonoids have one final anti-cancer property that may be the most significant of all: their ability to slow cell migration. Inhibiting the movement of cells not only reduces tumour growth, but it also reduces the risk of metastasis – the spread of cancer to other parts of the body.

## How cancer spreads and how flavonoids can protect you.

**1** The reason why our bodies keep their shape is that the cells in our organs and tissues are held together by a dense network of collagen, elastin and other fibres.

**Collagen and elastin fibres make up the skin matrix**



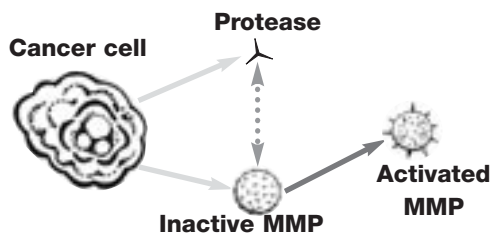
These fibres form a tough matrix outside the cells which prevents most cells from moving around too much. This “extra-cellular” matrix can be visualised as rather like netting.

**2** Cancer cells secrete a comprehensive range of enzymes which they use to dissolve the matrix as they multiply and spread.

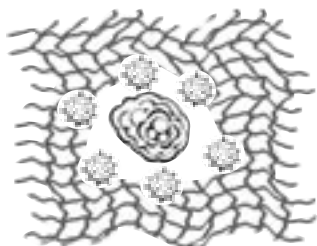
These enzymes are called the **Matrix Metalloproteases**, or **MMPs**.

MMPs are so destructive that cancer cells cannot produce them internally, or they would blow themselves apart!

Instead they secrete MMP precursors which have a built-in ‘safety catch’. When these precursors are safely out of the cell, a group of secondary enzymes strips away the safety catch and activates the MMPs.

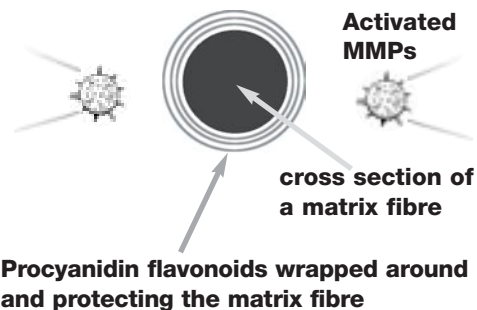


**3** The MMP enzymes begin to eat holes in the matrix to allow the cancer cells to spread<sup>(131-136, 151, 152)</sup>.



MMPs are crucial to cancer growth and spread; the more MMPs a cancer cell produces, the more malignant it becomes<sup>(133, 137-143)</sup>.

**4** Procyanidin flavonoids (eg bilberry or grapeseed extract) shield the matrix fibres and protect against MMPs<sup>(58, 59, 74-76,94)</sup>.



Refer to page 213 for a six step Defensive Plan against Cancer.

## THE DEFENCE BOOSTERS : **Flavonoids & isoflavones**

### **Stealth/ Counter-stealth**

Cancer cells can hide from the immune system by coating themselves with blood platelets, sticking them in place with a 'glue' called thrombospondin.

Some flavonoids may block thrombospondin, thereby exposing the cancer cell to immune attack. This potentially valuable anti-cancer property could easily be tested.

### **Early results**

Some preliminary work has been done using anti-cancer micro-nutrient programmes as outlined in Chapter 13, Cancer, in which flavonoids play an important role.

Only a very limited number of patients have been treated, but several have responded surprisingly well, showing various degrees of remission – with none of the toxic effects caused by orthodox treatments.

It forms the basis of a completely new approach to cancer that is certainly kinder, and probably more effective than anything we have seen before. The biotechnology industry is pumping millions of dollars into this area, but the nutritionists got there first – and so can you.

Cancer cells secrete enzymes commonly known as MMPs (see page 93) which allow them to spread in the body. Biotechnology firms have synthesised a number of MMP-inhibitors, and preliminary results indicate that cancer growth and spread can be significantly reduced. The beauty of this strategy is that there are relatively few side effects. At least two drugs have already produced positive clinical trial results<sup>(154, 155)</sup>.

But as so often seems to be the case, there is a nutritional equivalent. Procyanidin flavonoids, as in grapeseed extract, reduce the invasiveness of cancer cells<sup>(94)</sup> by wrapping themselves round the matrix fibres, and shielding them from MMPs<sup>(58, 59, 74-76)</sup>.

Combine the procyanidins with soy (and soy nutrients like genistein) and other beans which contain protease inhibitors, which block the formation of active MMPs<sup>(125)</sup>, and you have a powerful nutritional anti-cancer programme.

The illustrations on page 93 show how cancer cells attack the structure of body tissue – and how flavonoids can create a protective shield.

A combination of beans and peas, together with procyanidin flavonoids, should give significant protection against the spread of cancer. For maximum effect they should be taken with genistein, lycopene, selenium and soy-derived protease inhibitors, which appear to arrest cancer in other, complementary ways (see Chapter 13, Cancer).

### **Soy – protein without the fat**

According to popular belief, animal proteins are complete while plant proteins are incomplete.

This is one reason why Western governments put so much stress on animal protein production, and it is also one of the

reasons why we suffer from so much heart disease, cancer and osteoporosis.

Sadly, the whole nutritional (and environmental) disaster is based on a mistake. The useful protein content of foods is not simply a question of quantity, but also digestibility. The most up-to-date method of assessing this is the Protein Digestibility Corrected Amino Acid Score (PDCAAS), as used by the World Health Organisation<sup>(261)</sup>. On this scale, soy scores 1, the highest rating possible – the same as animal proteins and better than any other plant food<sup>(252, 298-300)</sup>.

Soy's oil content is also interesting. There is very little saturated fat, and no cholesterol. About eight per cent of soy oil is linolenic acid<sup>(263)</sup>, one of the Omega 3 fatty acids otherwise found in fish. This suggests that soy oil may help to reduce the risk of heart disease if taken with vitamin supplements (see page 127).

But soy can do so much more for our health.

### Soy and cancer

About one in 11 British women will develop breast cancer at some time in their lives. In Japan, the figure is as low as 1 in 65. The cancer detectives, the epidemiologists, have studied the problem intensively<sup>(278)</sup>. And many believe two dietary factors play a crucial role – selenium and soy.

The Japanese diet contains more of the anti-oxidant mineral selenium than the typical Western one does, and that's thought to protect against breast cancer. There is evidence that a high intake of soy products might also be protective.

A wealth of new research has revealed that soy beans not only have an unequalled nutritional profile, they are also the most important single source of dietary anti-carcinogens.

At a 1989 National Cancer Institute meeting in Washington, a panel of international experts identified no fewer than six families of anti-cancer compounds in soy beans<sup>(264)</sup>. Each one of these appears to be able to reduce the risk of cancer on its own. In combination, their synergistic anti-cancer effects<sup>(265)</sup> are likely to be considerable. This unusual combination of anti-cancer

#### The anti-cancer food

No less than six anti-cancer compounds have been found in soy beans – and where soy is widely eaten, many cancers are rarer.

Selenium and soy appear to be two factors which give Japan a far lower rate of breast cancer than the UK.



# THE DEFENCE BOOSTERS : Flavonoids & isoflavones

nutrients undoubtedly helps to account for the very low rate of many cancers in countries where soy is widely eaten.

Oddly enough, some of the anti-cancer nutrients have been known for many years. But because they inhibit certain metabolic processes, they were labelled anti-nutrients, or low-grade toxins. Now it appears that these anti-nutrients may be soy's crowning glory.

Here are the six anti-cancer elements in soy beans.

## Experimental evidence that soy inhibits cancer

Lab experiments have shown that soy's protease inhibitors reduce the incidence of cancer in the breast, skin and bladder<sup>(266)</sup>, and in the colon<sup>(267)</sup>, lung<sup>(268)</sup>, pancreas<sup>(269)</sup>, mouth<sup>(270)</sup> and oesophagus<sup>(271)</sup>.

- **Protease inhibitors (lectins)** – which block genes which promote cancer

Soy beans contain growth-inhibiting substances called protease inhibitors, which act to reduce the spread of cancer (see Chapter 13, Cancer).

Recent work has demonstrated that protease inhibitors also block the action of a number of genes which cause cancer. Most protease inhibitors are destroyed by cooking, but there is evidence that enough survive to confer a significant protective effect<sup>(282, 297, 322-324)</sup>.

- **Phytate** – can act as an anti-oxidant

The second anti-cancer ingredient is phytate, generally regarded as another anti-oxidant nutrient because it binds iron. But in certain conditions this is a good thing, as excess (free) iron in the body is a potent source of free radicals, and a potential carcinogen.

When phytate binds iron, it is effectively acting as an anti-oxidant. This helps to explain why phytate is a powerful inhibitor of colon cancer<sup>(273)</sup>, where free iron is one of the key causative factors. (I don't recommend phytate for everyone, however. Iron deficiency anaemia is still widespread, particularly among women of child-bearing age, and too much phytate could worsen an existing anaemia.)

- **Phytosterols** – protect against carcinogenic bile acids

Third up are the phytosterols, the plant equivalents of cholesterol. They are poorly absorbed and remain in the gut, where they are thought to protect against the harmful effects of certain (secondary) bile acids. These bile acids

## Full of beans

Increase your intake of both legumes (beans) and soy bean products.



They appear not only to reduce the risk of developing cancer, but also help slow its spread<sup>(288)</sup>.

are formed from cholesterol and have mutagenic and carcinogenic properties. This may be why some phytosterols are capable of reducing the incidence of colon cancer by as much as 50 per cent<sup>(274)</sup>.

- **Saponins** – anti-mutation, anti-oxidants

Fourth on the list are the saponins, anti-oxidants<sup>(275)</sup> which protect against free radical damage. Lab tests have shown that saponins prevent mutations that can lead to cancer<sup>(276)</sup>.

- **Phenolic compounds** – protect DNA

Fifth are a group of phenolic compounds. These too possess anti-oxidant activity, and are thought to protect DNA from attack by certain categories of carcinogen<sup>(277)</sup>.

### Isoflavones – most potent of all

The above is an impressive array of anti-carcinogens, but I have left the sixth and best till last. Soy beans are extremely rich in a sub-group of the phenolics known as isoflavones, and these are among the most potent anti-carcinogens of all.

Isoflavones block oestrogen, a hormone linked to an increased risk of breast and other hormone-dependent cancers. They act rather like Tamoxifen, a drug widely used to treat and prevent breast cancer.

When small amounts of soy are fed to animals, their rate of breast cancer falls by nearly 50 per cent<sup>(279)</sup>, as does the incidence of prostate cancer<sup>(280)</sup>. In this last case, the isoflavones appear to be acting as testosterone blockers; not altogether surprising, as the molecules of oestrogen and testosterone are very similar.

Men who think that soy is just for women should think again; considering the high rate of prostate cancer in the West, it seems that men have just as much to gain from adding soy to their diet.

Prostate cancer, like breast cancer, is usually hormone-dependent. But whereas breast cancer is encouraged by oestrogen, prostate cancer is often driven by testosterone. Isoflavones which block testosterone reduce the tendency for prostate cancers to grow. (See also Lycopene in Chapter 13, Cancer.)

#### Bad genes

There are known genetic risk factors for breast and prostate cancer. But they are not nearly common enough to account for the epidemic of both these diseases.

#### International evidence

In soy-eating countries like Korea, the rate of breast cancer is between a sixth and a tenth of the rate in the West. The rate of prostate cancer is about 1/15th<sup>(278)</sup>.

In the developed Western nations, where the rate of cancer has risen 10 per cent in the last decade, soy is still a relatively minor item in the diet.

#### A key anti-cancer ingredient

An isoflavone called genistein not only inhibits cancer cells – it can force them to turn back into normal cells<sup>(281-283)</sup>.

## THE DEFENCE BOOSTERS : Flavonoids & isoflavones



### LOOK FOR

...

a supplement that includes genistein (and other isoflavones).

40mg of a genistein/daidzein/glycitin combination would be my recommendation.

It gets you to approximately the daily isoflavone intake of the Koreans – where the rate of breast and

### Prostate Cancer

Japanese men have just as many prostate cancers in situ (small and localised) as do American men – but they have fewer cases of clinical cancer. If they emigrate and switch to an American diet their prostate cancers rapidly emerge.

This is probably because they are no longer being held in check by the protective elements in the Japanese diet, such as the anti-cancer compounds in soy.

### REDUCING BREAST CANCER

Because of their ability to mimic and block the effects of oestrogen, isoflavones are often called phyto-estrogens. A major risk factor for breast cancer is thought to be the amount of oestrogen a woman is exposed to over her lifetime, which is related to the number of menstrual cycles she has experienced.

Anything that reduces the number of cycles, such as late start of menstruation, early menopause or multiple pregnancies, lowers the risk of breast cancer. The phyto-estrogens in soy slow down the menstrual cycle, lengthening it by up to six days, and so reduce the total number of cycles.

## Amazing genistein

King of the isoflavones, and subject of well over 300 research papers to date, is genistein. Genistein has little effect on normal cells – but it is a powerful inhibitor of nearly every cancer cell type examined so far<sup>(281)</sup>.

Its anti-cancer effects are wide because its mode of action is so profound: it inhibits several of the products of oncogenes, genes which cause cancer<sup>(282)</sup>.

**But genistein doesn't just inhibit and kill cancer cells. Remarkably, it also causes cancer cells to revert to normal cells<sup>(283)</sup>. This is an absolutely crucial anti-cancer property, and a very unusual one: called 'redifferentiation'.**

If that were all that genistein did, it would be a miracle in itself. But genistein has another amazing trick up its sleeve. It inhibits the growth of new blood vessels, as shark cartilage extract does<sup>(284)</sup> and should therefore be able to starve cancers even after they have begun to grow (see also Chapter 13, Cancer).

### CHOKING OFF CANCER

Growing cancers are dependent on new blood vessels to supply oxygen and nutrients and take away waste products. These new blood vessels are fragile, break down and need to be constantly replaced. Any substance that prevents the growth of new blood vessels should theoretically leave a tumour without a blood supply, choking it to death.

This is a relatively new area of research, but there is good evidence from various trials that angiostats, as they are called, can work. The main side effect is interruption of the menstrual cycle, which is quite logical when you think what angiostats do.

## Soy and the heart

Soy protects against heart disease as well.

One of the most insidious aspects of coronary artery disease (CAD) is that it is a hidden disease. For most people, the first sign that anything is wrong is the first heart attack. The great majority of survivors are left with a permanently damaged heart and a long-term risk of complications.

Even advanced cases of CAD are often not diagnosed in time. An American investigation called the Sudden Death Study, discovered that an astonishing one in four people who died suddenly of a heart attack had seen their doctor in the week before they died. But they had not been diagnosed accurately, and had not been hospitalised<sup>(294)</sup>.

This is why with coronary artery disease, as in so many other diseases, prevention is better than cure.

Diet is the key. A diet rich in animal fats and low in anti-oxidants and fish oil is a fast route to a heart attack, as is smoking. And so is high blood cholesterol.

Most of us have a cholesterol level that is higher than 'normal'. According to Drs Brown and Goldstein, who won a Nobel Prize for their work on cholesterol, the normal level is between 100 and 150 mg/dl<sup>(286)</sup>. This is the level found in people who eat a low fat, high fibre diet, and who have a low risk of heart disease.

But there is more than one form of cholesterol. LDL cholesterol is potentially harmful, as it is the form of cholesterol which is released by the liver, and distributed to all the cells in the body, including the cells in the artery walls.

HDL cholesterol, on the other hand, is a good thing. HDL particles remove cholesterol from the body cells, and take it back to the liver. They remove cholesterol from artery walls, which is one reason why high levels of HDL are cardio-protective.

This is where we come back to soy. Soy should be a part of any cardio-protective diet, because it reduces cholesterol absorption from the gut, and increases cholesterol excretion<sup>(309-311)</sup>. The overall effect is a lowering of LDL cholesterol by up to 30 per cent, and a simultaneous increase in HDL cholesterol by up to 15 per cent<sup>(290)</sup>.

301-308)



### WARNING

Our arteries don't just start clogging in later years – in the West the earliest signs of atheroma have been found in young adults and even children, thanks to a diet high in animal fats and low in anti-oxidants and fish oil. However ...

In most Western countries, heart disease is the major killer, responsible for approximately 50 in every 100 deaths.

Coronary artery disease is insignificant in Crete, Iceland and Japan, even in the elderly.

In China, a mere six deaths in a hundred are caused by heart disease<sup>(285)</sup>.

The difference is diet.

### LDL cholesterol is not all bad

LDL cholesterol is essential for transporting lipid-soluble anti-oxidants in the bloodstream. It only becomes dangerous if there are insufficient anti-oxidants in the diet.

## Soy's effect on the heart

Soy even helps in cases where blood cholesterol is way above normal. Italian doctors examined the cholesterol-lowering effects of soy in patients with hypercholesterolaemia – a genetic condition associated with extremely high blood levels of cholesterol and a very high risk of heart disease.

They found that adding soy to a low-fat diet dropped cholesterol levels by an impressive 26 per cent<sup>(292)</sup>. Because of these excellent results, the Italian National Health Service now provides soy in the form of textured vegetable protein free to all patients with hypercholesterolaemia.

Before we leave soy, we have to return once more to genistein. This compound, you'll remember, has a number of powerful anti-cancer effects. One of them, the ability to inhibit the growth of certain cell types, is also cardio-protective. As oxidised cholesterol begins to accumulate in the artery walls, and an atheroma forms, the artery responds by growing more smooth muscle cells in the affected areas.

As they grow, they contribute, along with the growing mass of cholesterol, to the gradual blocking of the vessel. Genistein blocks this smooth muscle response<sup>(293)</sup>. This presumably plays a role, together with the soy's cholesterol-lowering effect and anti-oxidant content, in reducing heart disease in those Far Eastern countries where soy is so widely eaten, and where coronary artery disease is so uncommon.

What should you drink with soy? We've already covered red wine, so I'll briefly review the benefits of tea – with, believe it or not, chocolate for dessert.

## More tea, vicar?

Although some health food pundits say tea isn't such a good idea, they're wrong<sup>(321, 322)</sup>.

The cup that cheers is a rich source of flavonoid anti-oxidants. Green tea contains up to 30 per cent by weight of flavonoids, and black tea is nearly as good.

### How much soy?

Adding soy to the diet has cut levels of those with ultra-high cholesterol by a quarter. And the good news is you don't have to eat soy at every meal to achieve the desired effect.

A mere 50g of soy protein (approximately one 2 oz serving) daily will do the trick<sup>(291)</sup>.

Or eat a 4 oz serving every two days.

Textured vegetable protein (soy) is a good source for cholesterol lowering. However, this form of soy has no anti-cancer properties.

Quorn has similar cholesterol-lowering effects<sup>(295-297)</sup>.

### More HDL benefits

HDL has anti-oxidant properties, and can protect the 'bad' LDL cholesterol from oxidation – another reason to aim for high HDL cholesterol levels.

## THE DEFENCE BOOSTERS : Flavonoids & isoflavones

The most important flavonoids in tea are a group of extremely potent anti-oxidants based on the catechin molecule; catechin itself, epicatechin, epigallocatechin, and epigallocatechingallate (EGCG)<sup>(323)</sup>.

EGCG is among the best of this lot and Nestlé researchers have already developed methods of increasing and standardising levels of EGCG in a new range of teas, which may be launched as the first products in what could eventually be a whole range of 'functional foods'<sup>(324, 325)</sup>.

Where will tea be in this brave new world of functional foods? It's early days, but there is increasing experimental evidence that tea (especially green tea) may have a role in preventing some cancers, especially skin, gastric and bladder cancer<sup>(326-328, 335)</sup>.

Japan has a far higher rate of gastric cancer than the UK, probably due to their high intake of pickled foods, but there is one area, Shizuoka, where gastric cancer is rare. The inhabitants of Shizuoka are famous for their tea drinking, and this is thought to be the key protective dietary factor.

Cardiologists have discovered that EGCG in tea has other beneficial effects, including lowering blood cholesterol<sup>(329, 330)</sup>, and possibly reducing blood pressure<sup>(334)</sup>, and the tendency for platelets to form clots. This suggests that tea may reduce the risk of coronary artery disease, and heart attacks.

Intriguingly, chocolate contains flavonoids (known as 'cocoa red') which are similar to those found in red wine<sup>(344, 345)</sup> and is also therefore likely to be cardio-protective<sup>(341, 342, 346, 348)</sup>.

### THE BRITISH PARADOX

Tea has only a third of red wine's anti-oxidant capacity, but because its anti-oxidant molecules are smaller than those in red wine, they are more quickly absorbed and cause a larger increase in plasma anti-oxidant levels than does wine.

The good effects fade within an hour or so<sup>(120, 172, 173, 183)</sup>, but both green and black tea are thought to protect against heart attacks<sup>(213, 214)</sup>.

Do drink your tea black; milk neutralises the flavonoids<sup>(231)</sup>, which may explain why there is no British paradox.

### More tea, dentist?

There is evidence that tea may help prevent tooth decay!

Tea leaves are a good source of fluoride and one British study went so far as to suggest that heavy tea drinking would supply enough fluoride to reduce the risk of dental decay in children<sup>(331)</sup> if you could get them to drink it ...

The flavonoids in tea appear to amplify the protective effects of fluoride<sup>(332)</sup>, and reduce the build-up of plaque<sup>(333)</sup>.

The Japanese already use green-tea-enhanced toothpaste and chewing gum to fight dental decay.

### Chocs Away!

Chocolate eaters, like wine drinkers, live longer<sup>(346)</sup> – almost certainly because dark chocolate is a rich source of flavonoids<sup>(345)</sup>.

A recent study of over 10,000 men and women showed that those who ate a diet high in flavonoids were significantly less likely to die of heart disease, stroke, lung cancer, prostate cancer, asthma and Type 2 diabetes<sup>(347)</sup>.

## **SUMMARY**

### **Flavonoids**

- Get more flavonoid-rich foods into your diet – prunes, strawberries, bilberries, apples, citrus fruits, raisins, raspberries, blackberries and particularly red and yellow onions and shallots; walnuts; pecan nuts and tomatoes.
- Switch from beer, spirits or white wine to red wine.
- An anti-cancer diet should include onions, walnuts, pecans, tomatoes, tea, coffee, rosemary, turmeric, and garlic. Also ...
- Increase your intake of legumes (beans) and soya bean products. They may not only protect against cancer, but also help slow its spread.
- The flavonoids in (dark) chocolate are also protective.
- Tea and especially green tea contains flavonoids called catechins that are cancer and cardio-protective.
- Consider flavonoid-rich supplements – especially grapeseed, bilberry, ginkgo, pycnogenol, yarrow, hawthorn or hazel.

### **Isoflavones**

- Soy contains six of the most powerful anti-cancer ingredients that we know of.
- Most powerful of all is genistein – which you can now take as a supplement.  
  
40-50mg a day gives you a level roughly equivalent to the daily intake in countries like Korea, where levels of breast and prostate cancer are a fraction of Western Europe.
- Soy products also have a role to play in preventing heart disease, because they can lower LDL cholesterol and increase HDL cholesterol.

