- **Most of the signs of ageing skin are caused by exposure to sunlight. UV wavelengths create bursts of destructive free radicals, which release the tissue-damaging MMP enzymes**
- **UV shields reduce the rate of ageing**
- **Add anti-oxidants to minimise the ageing impact of free radicals, and ...**
- **Blackcurrant and other flavonoids block the destructive MMP enzymes, and prevent glycosylation**
- **A good night really does make your skin look better – sleep, sex (and exercise) release a hormone which repairs body tissues**

Chapter 18

Saving your skin

The effects of gravity and slack facial muscles creep up on us so slowly, it can be hard sometimes to see just how much the face has been marked by the passage of time.

To find out what has happened, lie on your back on your bed, lower your head over the edge, and look at your face in a mirror. For anyone past the age of 35 or so, this can be a very disconcerting – and motivating – experience.

To exercise and tone the facial muscles, try to bring that upside-down face back into its normal shape. These muscles, if properly exercised, can help to rejuvenate the face once you're upright again. But they can't improve skin texture, and many people find the exercise programme hard to maintain. So what else can be done to slow the hands of time?

How to avoid cosmetic surgery

I'm not in favour of cosmetic surgery as a first line anti-ageing treatment, although it can be effective in removing some of the signs of ageing.

Before considering surgery, there are a number of strategies which can be used to block or slow down the ageing process. We should stay away from doctors – and especially surgeons – as long as we can, and only use them when they're really needed.

So, instead of saving up for a face-lift in five or ten years' time, reach for the supplements now. An anti-ageing programme begun today should mean you could delay surgery for many years.

What makes skin look old?

Much of the damage we think of as due to ageing – thinning skin, loss of elasticity, the appearance of lines and wrinkles – is nothing to do with age at all.

These changes typically appear in ageing persons, but ageing doesn't cause the changes. The fact that the skin changes as we get older is really no more than a coincidence. Even 70- and 80-year-olds generally have smooth, unlined skin on parts of their body. And this is the clue, because those are the parts which are not often exposed to the sun.

As much as 80 or even 90 per cent of skin ageing is extrinsic, caused by exposure to sunlight (known as 'photic ageing'), and other sources of free radicals. Intrinsic ageing, which occurs eventually even in sheltered skin, accounts for a mere 10-20 per cent.

Intrinsic ageing, as the skin gradually thins and becomes less robust, can be treated to some extent. Think of the well-documented effects of HRT in women: the oestrogen stimulates the fibroblast cells to produce more collagen and elastin, micro-fibres which give skin its strength and resilience, with a resulting improvement in skin texture. Growth hormone treatment and testosterone replacement therapy are reported to have similar effects in elderly men.

Extrinsic ageing too can be slowed, and perhaps stopped or even reversed. Here, free radicals are the key. Reducing exposure to sunlight and other sources of free radicals can have a dramatic age-retarding effect.

Boosting the exposure to free radicals has, as you might expect, exactly the opposite effect. This is why the face of the sun-worshipper is more lined than average for his or her age. The face of the smoker, too, is generally more heavily lined than the face of a non-smoker of the same age.

This is largely because of free radicals generated by sunlight, and tobacco smoke respectively.

Additional creases in the smoker are caused by squinting through the smoke, and there is also thought to be a 'curing' effect, rather like the smoking of a kipper. Crowsfeet round the

The sun is to blame!

Your skin doesn't age so much where the sun doesn't reach.

Sunlight causes up to 90 per cent of the thinning and wrinkling of the skin we think of as ageing. This is called 'photic ageing'.

Tanned skin is **not** healthy skin, but skin that is showing signs of UV damage.

A good UV filter is the first step to slowing ageing effects on the skin – and could slow skin ageing by up to 80 per cent.

However, there is no need to avoid the sun altogether. Sunlight on our skin produces Vitamin D – which many people are low in. Vitamin D reduces the risk of osteoporosis, various cancers and possibly rheumatoid arthritis.

Skin cancer

The popularity of holidays in the sun and sunbeds at home is mirrored by the steady increase in skin cancer over the past 15 years.

It's now the third most common cancer in women aged 15-34 – and there are over 34,000 new cases of skin cancer a year in the UK.

Ozone hole

The hole in the ozone layer is thought to be responsible for the recent 10-15 per cent increase in skin cancer in children.

Sun-free tan

An alternative to sun-bathing is MSH, or Melanocyte Stimulating Hormone.

An Australian research group have produced a version of MSH that can be applied as a skin cream, and stimulates the melanocytes to produce a genuine, sun-free tan.

eyes, tiny wrinkles spreading around the upper and lower lips, and lines on the cheek and lower jaw are particularly noticeable. Tobacco induced changes to the blood supply to the skin make the matter worse, by giving the skin a greyish tinge.

The ageing effects of tobacco are clearly quite complex, but it is the free radicals formed by the interaction of smoke and biological tissue that cause the bulk of the damage; not just to the skin, but the lungs and other parts of the body too.

Reducing free radical damage in the skin by stopping smoking, and avoiding excessive exposure to sunlight, is important in slowing the ageing process. But to stop ageing, and reverse its effects, we must look under the skin.

Movement under a still surface

All biological tissues (skin, bone, muscle, arteries, etc) are in a state of constant flux. Their apparent constancy conceals the twin processes of tissue breakdown (catabolism), and repair (anabolism), both of which run constantly and in parallel throughout life. During childhood, tissue growth and regeneration generally predominate, and there are net tissue gains. In later life, and in certain disease states, breakdown predominates; leading eventually to ageing and loss of function.

This picture may seem depressing, but it is the key to skin and tissue rejuvenation. In adults, if the rate of tissue decay is ten units/day, the rate of tissue repair is typically nine units. This net change, the loss of one unit per day, is so small it cannot be seen; but if continued over years, it gradually brings on the signs of ageing – rather like the slow erosion of a landscape.

Slow the process of decay by a mere ten per cent, and increase the rate of tissue repair by ten per cent, and the net change shifts from minus one to plus one unit /day. The ageing process is now in reverse; from slow erosion to slow rejuvenation.

This general principle applies equally to the formation or removal of thrombus in an artery; the erosion or regeneration of bone and cartilage, the loss or stabilisation of brain cells; and the decay or the regeneration of the extra-cellular matrix which lies under the skin, supporting it and giving it firmness and elasticity.

How ageing happens

Now we can begin to understand how skin ages – and how to stop it. When ionising radiation (sunlight) strikes biological tissue such as the skin, it triggers a burst of free radicals. Free radicals may cause acute cell death, leading to sloughing of skin and the loss of generative cells in the lower dermis. They may cause DNA damage, leading to cellular dysfunction, loss of skin structure or cancer. They also damage cell membranes, releasing highly destructive enzymes called proteases and matrix metalloproteases (MMPs) (see Chapters 6, Flavonoids & isoflavones, and 10, Amino sugars).

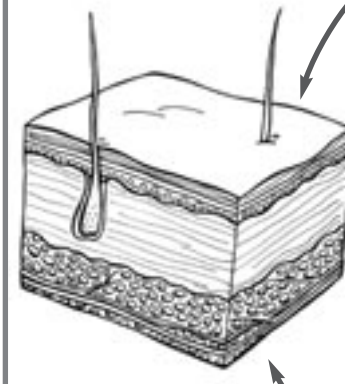
In the following inflammatory reaction, the proteases and MMPs break down the extra-cellular matrix, the mesh of microfibres which provides a 'soft skeleton' for the skin (and all soft tissues). This causes thinning and wrinkling of the skin, loss of firmness and elasticity, strength and moisture-holding capacity. In short, it causes most of the cosmetic elements of ageing skin[27, 28].

The micro-fibres which make up the matrix are the proteins collagen and elastin, and a range of amino-sugar polymers. They are constantly being broken down; and replaced by generative cells in the dermis such as the fibroblasts.

Normally, the rate of breakdown exceeds the rate of renewal by a small margin, or a larger one if there is extensive exposure to sunlight. This deficit, if sustained over time, causes a growing loss of the microfibres in the matrix, and gradual skin ageing.

If the rate of tissue loss can be reduced by a small amount, and the rate of repair enhanced, it should allow repair to predominate, causing a net gain of micro-structural elements, and slowing or even reversing the ageing process.

The inside/outside skin care plan



CROSS SECTION OF SKIN

Fat-soluble anti-oxidants, like Vitamin E, can help to prevent damage to cell membranes, and the release of MMPs. These compounds, and some MMP blockers, can be applied topically.

Water-soluble micro-nutrients such as Vitamin C, which is an anti-oxidant and a matrix builder, can be taken orally. So can glucosamine, another key matrix builder (see Chapter 10, Amino sugars).

From loss to profit

This explains why some people have skin which ages less rapidly than others; the net rate of matrix loss in their skin has been slowed down, due to reduced exposure to sunlight, and enhanced nutrition.

Under the skin

Lose 10 units/day and gain 9 = -1 unit/day = -365 units/year = ageing

Lose 10 units/day and gain 10 = no change

Lose 9 units a day and gain 10 units = +1 unit/day = rejuvenation

Matrix breakdown and repair are both profoundly affected by the presence or absence of various micro-nutrients. Basically, the rate of repair is increased by one group of micro-nutrients; while the rate of decay is slowed by another group. Unfortunately, as we saw earlier, the vast majority of people suffer from multiple micro-nutrient depletion. The resulting slight slowing of repair, and equally slight acceleration of tissue breakdown, is enough to speed the ageing process unnecessarily[30].

By supplying the right micro-nutrients topically and orally (reaching the skin directly and via the sub-cutaneous blood vessels), healing can be enhanced and damage slowed – only slightly – but enough to move from a net loss to a net gain. If the regime is continued, long-term improvements in skin structure and appearance must ensue[14-17].

As the mechanism of ageing involves so many components, commercial products which rely on basic anti-oxidants can never be very effective.

Vitamin E – use with care!

For example, the one anti-oxidant in most skin care products is Vitamin E. Vitamin E is an anti-oxidant, it's lipid soluble so you can get it into the skin, and it's a moisturiser, so it seems a logical choice.

Liposome care

If you're buying a sun lotion with Vitamin E, flavonoids or alpha lipoic acid, make sure it's a liposome or phytosome formula which will give better skin penetration.

But it isn't that simple, because when a molecule of Vitamin E is oxidised it becomes a free radical itself, and can cause great damage by oxidising lipids (fats) in the cell membranes. Oxidised Vitamin E must be recycled to make it safe again, and in the body, oxidised Vitamin E is recycled by Vitamin C plus carotenoids[13]. This is known as the Vitamin E cycle (see page 63).

Vitamin C is an important anti-oxidant in skin, particularly in the fluid between the cells. One of its key roles there is to refresh

oxidised Vitamin E. If you take too much Vitamin E and not enough Vitamin C and carotenoids, you could end up worse off than if you hadn't taken E at all, because the skin may be full of oxidised Vitamin E, which would accelerate skin ageing.

Vitamin C has at least two other roles in preventing skin ageing, which are distinct from its anti-oxidant properties. It helps build the extra-cellular matrix by stimulating collagen synthesis, and blocking aryl sulfatase B, an enzyme that would otherwise damage it[22].

This underlines the importance of a co-ordinated micro-nutritional approach.

The nutraceutical approach outlined below is designed to modify nearly every significant component of the ageing process; and to tip the balance away from ageing, towards regeneration.

Your Vitamin E regime – is Vitamin C included?

Most anti-oxidant nutrients work in tandem. An approach which singles out only one or two anti-oxidants is simplistic, and may be counter-productive[13].

Taking Vitamin E to protect the skin without taking Vitamin C could cause more damage than taking no vitamins at all[31].

Dual anti-ageing approach

The strategy consists of two basic components. The first reduces the destructive effects of sunlight on skin; the second speeds the renewal of the extra-cellular matrix – a dual brake/accelerator strategy.

The approach likewise consists of two delivery systems, including a topical cream to apply actives which can easily enter the skin; and an oral form which delivers the water-soluble actives.

There are a number of links in the chain of events from sunlight to skin damage, and as many of these as possible must be blocked to achieve maximum inhibition of the catabolic processes. The anti-catabolic (anti-breakdown) formulation should, therefore, include a UV filter, lipid-soluble anti-oxidants to protect cell membranes; water-soluble anti-oxidants including Vitamin C to support the lipid-soluble anti-oxidants; MMP-blockers and other anti-inflammatory agents.

The pro-anabolic (pro-repair) formulation should include zinc, copper and Vitamins C and B6 to accelerate collagen and elastin synthesis; and glucosamine, manganese and betaine to boost the amino-sugar polymers which form the other main constituents of the matrix.

Complete sun protection and anti-ageing formula

Anti-catabolic = UV filter, Vitamin E, Vitamin C, mixed carotenoids, OPC flavonoids

Pro-anabolic = Vitamins C and B6, copper, zinc, glucosamine, manganese and betaine.

A nutraceutical formulation based on this approach is on trial at a major UK clinical research centre.

INSIDE/OUTSIDE SKINCARE

Co-enzyme Q10 is another prime anti-ageing candidate. Like melanin, Q10 is a dual purpose compound. It is a potent anti-oxidant which supports Vitamin E, and it also boosts the function of the mitochondria, improving the energy balance of the cells and acting as a general stimulant. Like Vitamin E, Q10 is fat soluble, so it can also be applied topically.

Water soluble micro-nutrients, on the other hand, including Vitamin C, glucosamine, the B group of vitamins and the anti-oxidant minerals, are more logically taken orally.

This forms the basis of a thorough anti-ageing skin care strategy. It's effectively an inside/outside strategy. The outside half of the skin care strategy comprises lipid-soluble anti-oxidants and matrix stabilisers delivered through the skin. The inside half consists of water-soluble micro-nutrients arriving at the skin via the bloodstream after oral ingestion. This micro-nutrient pincer movement significantly reduces photic ageing[14-17].

Plants to block ageing

Blackcurrant (Ribes nigrum), the perennial herb, Lady's Mantle (Alchemilla vulgaris) and elderberry contain flavonoids which block most of the destructive MMP enzymes [4-6].

Bilberry, ginkgo, pycnogenol and red wine or green tea extract contain flavonoids with similar MMP blocking properties[7-11].

Some citrus flavonoids (ie tangeritin) may be equally effective[29].

Finally, soybeans – lightly cooked they contain the Bowman Birk Protease Inhibitor, which, as its name suggests, is very good at blocking the tissue-destructive (and ageing) protease enzymes.

MMP and protease blockade

Two garden plants are rich sources of flavonoids which block MMPs. These are blackcurrant (Ribes nigrum), and the perennial herb Lady's Mantle (Alchemilla vulgaris). Both contain flavonoids which are potent inhibitors of just about all of the metallo-protease enzymes, including the elastases, hyaluronidases and collagenases[4-6, 21]. Commercially available alternatives include ginkgo, pycnogenol, and red wine or grapeseed extract. These preparations are not identical to blackcurrant and Lady's Mantle, but contain related flavonoids which are very good at stabilising collagen and elastin fibres in the extra-cellular matrix, and protecting them from enzymic attack[7-11].

Soybeans are a rich source of BBI (the Bowman Birk Inhibitor), which blocks the equally destructive protease enzymes

Matrix protection is best combined with enhanced matrix regeneration, see previous page for details.

CROSS-LINKS

There is one more key aspect of skin ageing which can be blocked; namely, the cross-linking of collagen and elastin. When these micro-fibres are cross-linked together, usually by sugar molecules (a process called glycosylation), they lose their strength and elasticity[18] .

The flavonoids in blackcurrant and the other plants mentioned inhibit cross-link formation[19]. This is another way in which they protect the micro-fibres, and another crucial anti-ageing property. High doses of Vitamins C and E have a similar effect[20] as does turmeric[2], or half an aspirin per day.

Looking for skin savers

There are a number of pharmaceutical approaches to the problem of skin ageing.

Dr Young, a photobiologist at the Dermatology Centre at St Thomas's Hospital in London, has been working with compounds found in the bergamot orange (used to flavour Earl Grey tea). This stimulates the tanning process, and offers fair-skinned people the same protection against the sun that dark-skinned people have. In other words, it increases your natural SPF rating, and may double it or even better.

Other scientists are looking at agents that enhance the rate of skin regeneration. Among these are the retinoids (Vitamin A and its close relatives), which have well-known growth promoting effects. The first of these was RetinA.

Unfortunately RetinA often irritates the skin before improving it, and leaves it extremely sensitive to sunlight. Currently awaiting FDA approval is Renova, the same drug in a more soothing base. Perhaps more excitingly, a licence application has also been made by Hoffman LaRoche for topical isotretinoin, a close chemical cousin to RetinA.

Isotretinoin is well known as an oral treatment for acne, and it's now being screened in clinical trials for topical use for repairing sun-damaged skin. Experimenters say that it improves skin colour and texture, with less reddening and scaling than RetinA.

But the best member of the Vitamin A group so far appears to be retinyl palmitate, a compound initially dismissed because it could not penetrate the skin. Researchers have now succeeded in making a formulation of retinyl palmitate which does penetrate.

Initial studies show that this compound can promote skin cell renewal, help wound healing, reverse sun-induced damage, increase skin elasticity and thicken age-thinned skin, without the side effects associated with the other retinoids.

Coral relief

Researchers at the Scripps Institute in La Jolla, California, have found that certain soft corals produce compounds which, like the flavonoids in blackcurrant and the other plants, inhibit the skin-damaging enzymes elastase and collagenase.

These are probably defence compounds. Corals need to defend themselves against predators just as plants do and it's not

A new and unexpected area of research which may pay big dividends in skin care is soft coral.

surprising that some defence substances in coral are very similar to those which occur in plants. Others, however, are found nowhere else in the plant or animal kingdom.

This latter group includes cell division inhibitors, which may find a role in anti-cancer treatments, neuromuscular toxins and anti-inflammatory agents.

The Scripps scientists have identified a whole host of novel compounds in soft corals, including some which are interesting because they have the ability to remove excess iron from the tissues. They also bind to a wide range of enzyme active sites. Two of these, the cembrenes and the pseudopterosins, are powerful anti-inflammatory agents[2], which is why Estée Lauder is currently investigating their suitability for inclusion in their skin care range for sensitive, easily inflamed skin.

The anti-inflammatory properties of the coral compounds, if they help to stabilise the micro-fibres in the skin, should exert a marked anti-ageing effect.

Silicon and skin

Skin cells called fibroblasts are important in building the extra-cellular matrix. They may often be below par, slowed down by aluminium intoxication[25, 26].

Silicic acid removes the aluminium 'brake' and can boost fibroblast activity[23, 24].

CAROTENOIDS

Carotenoids have much to offer. Drs Kune and Bannerman at the University of Melbourne recently showed that a high intake of fish and vegetables, plus foods containing beta carotene and Vitamin A, offered a degree of protection against basal cell carcinoma and squamous cell carcinoma[1]. These are two skin cancers caused by over-exposure to sunlight.

Carotenoids on their own reduce inflammation of the skin (sunburn) after exposure to UV, but are unlikely to help much if you seriously overdo the sunbathing[9, 12], or are depleted in Vitamin C.

Beauty sleep

From the deep to deep sleep, otherwise known as core sleep or more technically sleep stages 3 and 4.

Core sleep triggers the release, from the pituitary gland located just below the brain, of Growth Hormone. Growth Hormone (GH) is one of the great restoratives. It increases the amount of

nutrients taken up by the cells, encourages the growth and repair of muscle and bone, and stimulates the immune system.

Unfortunately, as we age, the pituitary's ability to synthesise GH falters. The resulting fall in GH levels is associated with loss of lean tissue, and an increased risk of heart disease. (GH therapy is increasingly being used to reverse some of the symptoms of ageing.)

The rate of tissue growth and repair is greatest at night because, under the influence of GH, this is the time when our body cells are most active, and when they are most actively dividing (which they must do in order to multiply). This is why lack of sleep shows in the skin, and why the old idea that lack of sleep stunts growth may have something in it.

The skin cells are constantly being replaced, which keeps the skin clean and healthy. A large part of the renewal takes place at night, during core sleep. If we don't get enough of this restorative sleep the pituitary gland produces less GH, the rate of skin cell replacement slows down, and our skin loses its clarity and bloom.

When the need for growth is greatest (such as during pregnancy, adolescence, or recovery from anorexia), the duration of core sleep, and the amount of GH released, increase.

A similar response occurs when daily energy expenditure increases, either through exercise, or in some medical conditions such as hyperthyroidism. But when we use less energy, the amount of core sleep, and GH release, is reduced.

This is why a rewarding and stimulating day, especially when exercise takes place, leads to improved sleep and more GH. This means that a happy and well-balanced lifestyle will improve your looks, your physique and your immune system – another example of modern science rediscovering the classical idea of a healthy mind in a healthy body.

Finally, sex causes a burst of GH release. This is not only good for the skin (unless it keeps you up all night) but could also explain why a good sex life is associated with slower ageing.

Beauty sleep

The notion of 'beauty sleep' is not just an old wives' tale.

Growth hormone released while we sleep repairs tissues. This is why a string of late nights resulting in reduced growth hormone synthesis shows in the skin.

… and Arginine

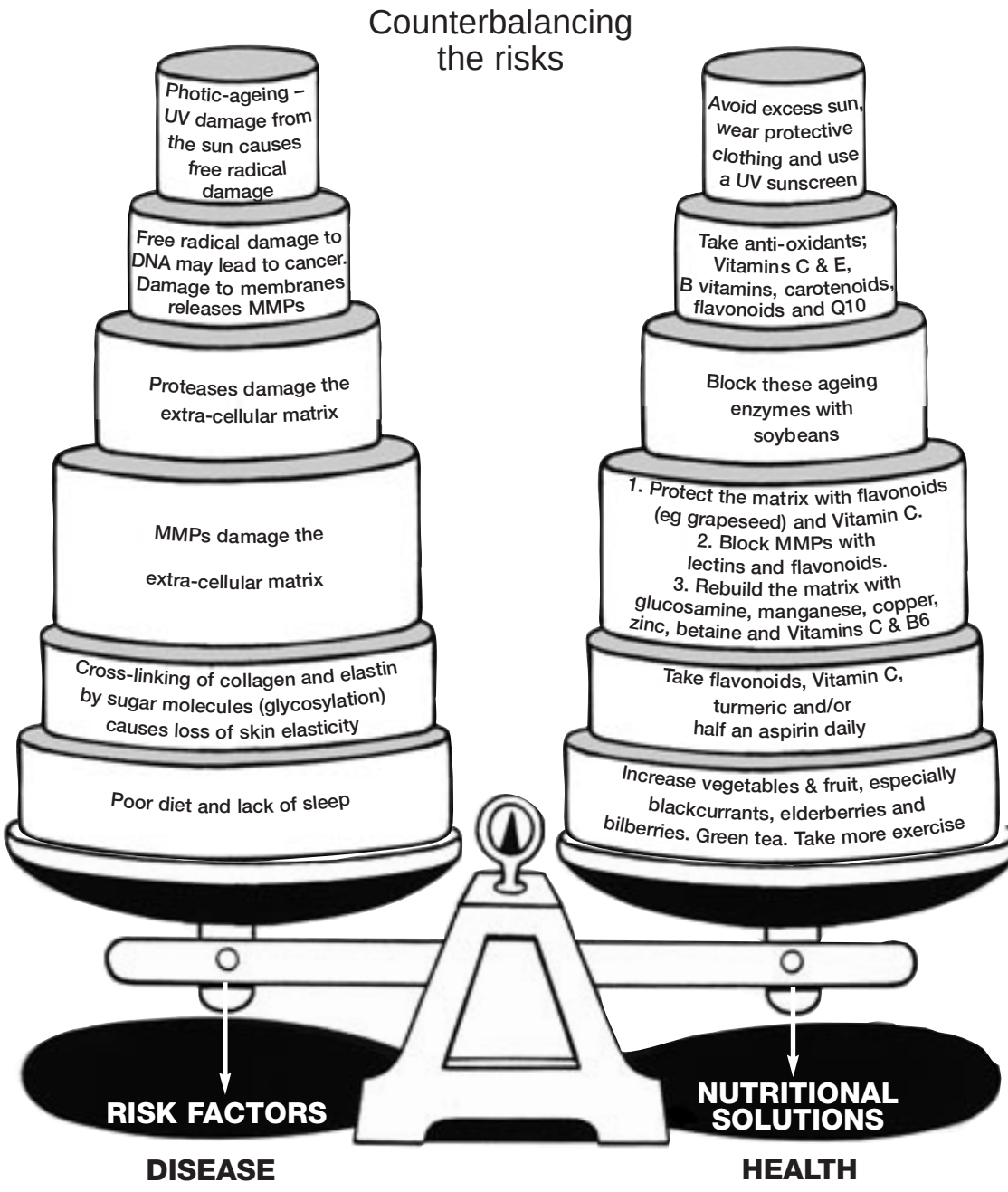
Why do fit people look healthier? Exercise triggers deeper, longer sleep, which produces more Growth Hormone, which repairs the body better. Sex does the same.

If you can't change your lifestyle to incorporate more sleep, sex or exercise, try an arginine supplement.

This amino acid stimulates the synthesis and release of Growth Hormone, and has a place in serious skin rejuvenation programmes.

Many athletes and bodybuilders use GH boosters. Most of these are based on the amino acids arginine and ornithine.

Preventing skin ageing



SUMMARY

Keep young and beautiful ...

Avoiding UV

- Even in temperate countries such as the UK, there are many cases of skin cancer in people who have never been abroad.

So during the summer months:

- Keep children out of the sun between 10.30 am and 2.30 pm (this also applies, to a lesser extent, to adults, especially those with fair skin).
- Stay in the shade.
- Wear loose, cool clothing which doesn't leave vulnerable areas like the shoulders exposed.
- Wear a hat with a broad brim to protect the face.
- Use a sunscreen, minimum SPF 15, with UVA and UVB filters.
- Sunglasses (or contacts) with UV filters should be used.
- Don't forget UV protection for your hair.

Skin savers

- Stop smoking.
- Stock up on anti-oxidants C, E, Q10, mixed carotenoids and flavonoids.
- Eat lots of blackcurrants, blueberries or elderberries, which contain matrix stabilising flavonoids. Combine with glucosamine, manganese and betaine.
- If you don't like fruit products, take half an aspirin daily. The salicylate it contains slows the cross-linking in collagen, as well as reducing the risk of heart attacks.
- Take more exercise.
- Get a good night's sleep.
- Look for skin care products that contain a well-balanced range of anti-oxidants and matrix stabilisers in liposome or phytosome form to ensure penetration into the skin. The best include a good sun block.
- Drink plenty of water.
- Take a tablespoonful of silicic acid (sold in Europe as Silicol) daily. Found in foods such as watercress, it is claimed to reduce fine lines in ageing skin.

  It may work by protecting the fibroblasts that help to build the extra-cellular matrix from aluminium poisoning.