Skin Care for Cold Weather

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For Eva and Rory.

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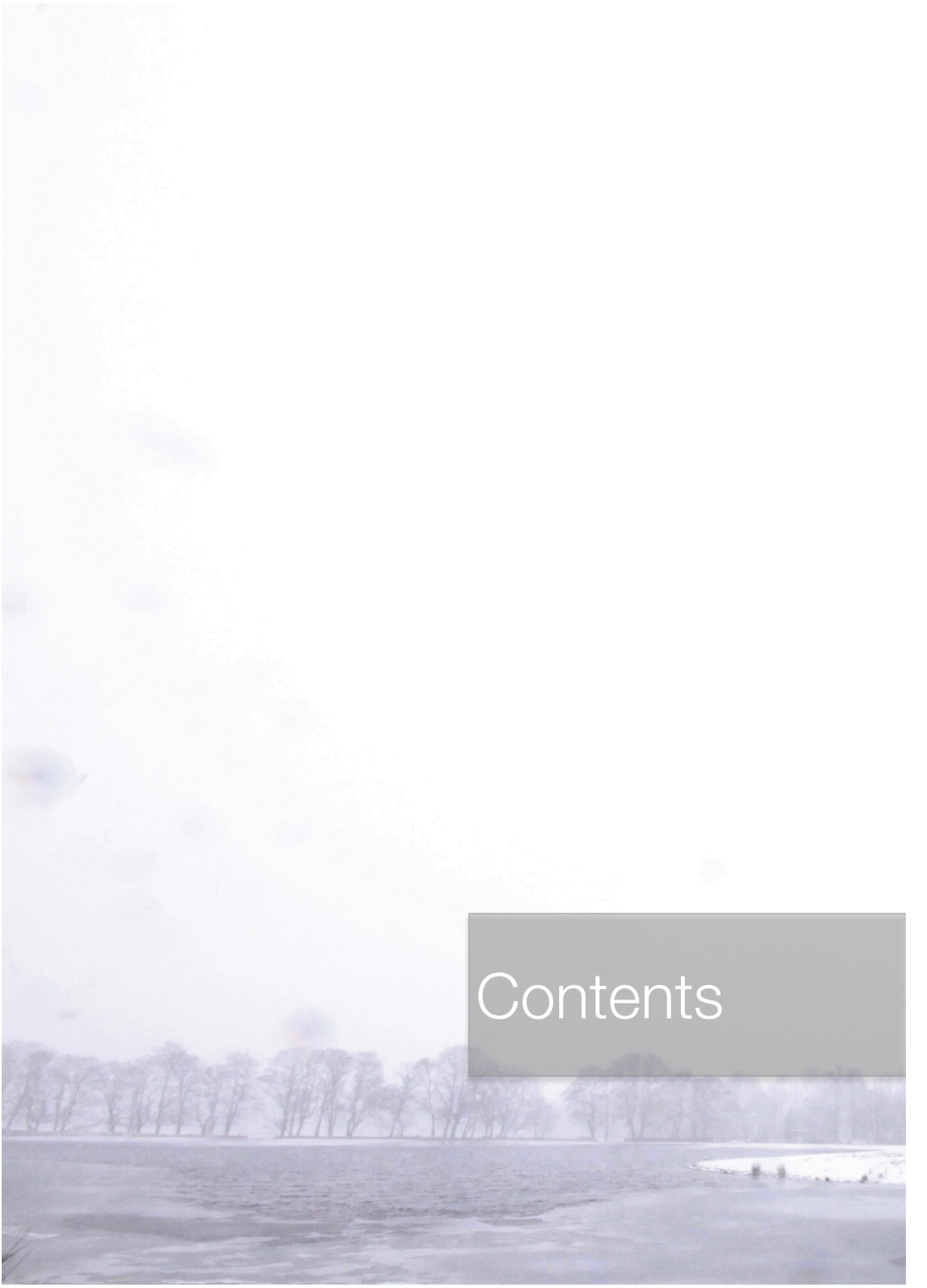
Photography

The very talented Catherine Davidson of Catherine Davidson Photography, Westhill, Aberdeen, kindly took the image for the front cover. Other images within the text are the author's own.



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Introduction

Aberdeen, Scotland 57.15° North, 2.09° West

Our skin is a complex, adaptable organ that responds to our health and the world around us including the climate and weather. Differences in the weather between summer and winter and winter and spring can bring about changes in the appearance and texture of our skin, leading to dryness, itch, irritation and even skin disease. We can anticipate and prevent this by being aware of our environment, at home or abroad, and being ready to vary how we care for our skin.

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Our skin is a complex, adaptable organ that responds to our health and the world around us
❖

We often turn to the weather when describing the place we call home because it affects almost everything we do, in what we choose to wear, the food we eat, our willingness to go outdoors and ultimately whether or not we can survive. In the UK, we live on an island in the Northern Hemisphere with a temperate maritime climate. The angle of the sun and tilt of the Earth mean that we receive less warmth from sunshine, while westerly winds from the Atlantic bring depressions with bands of cloud and rain, to which Scotland is particularly vulnerable[1,2,3]. Our combination of latitude and climate mean that nothing stands still - we are always passing through seasons, creating a rich variety of colours and things to do in the landscape around us.

Cold weather, which we see a reasonable amount of in the UK, can make even the happiest of skins become dry, red and cracked. Wind, the cold and use of central heating all encourage our skin to dry out and partly as a result, eczema seems to be more common in colder, wetter, less sunny areas of the world[43]. The impact of cold weather extends to what we eat, as the warming snacks and comfort foods encouraged by long, dark winters may affect the balance of nutrients in our skin barrier and our antioxidant defence systems. Our pattern of occasional, unreliable sunlight at northern latitudes has an impact on our vitamin D levels and our risks of sun damage and skin cancer, and weeks of cloud, wind, rain and sleet can be draining for the body and mind.

❖
Good skincare repairs and prevents the damage caused by our environment
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But cold weather can be fresh and invigorating. Ice and frost bring sparkle to dull streets, and smoking log fires and cosy knits warm us from the inside out. Such a feeling of contentment can be gained from watching rain battering against a window from inside beside a roaring fire, or snuggling under a blanket while a frustrated wind howls around the rafters.

The lifestyle terms hygge and coorie, used to describe cosily comfortable recharging self-care, do not originate from cold, northern areas of the world by accident. The ideas behind these terms have probably been part of human resilience in the face of cold,

harsh conditions for thousands of years. Skincare has a natural place in this, as good skincare repairs and prevents the damage caused by our environment, but also has relaxing, stress-relieving, emotional benefits and can be a useful habit to hoard away to stay feeling healthy in the cold.

This book explores how our skin responds to cold weather and the climate variables associated with northern latitudes. It discusses lifestyle habits that we adopt and the impact these have on our skin, and considers things we can do to stay looking and feeling our best in the cold. I hope it helps you to shine brightly on the dullest of days.

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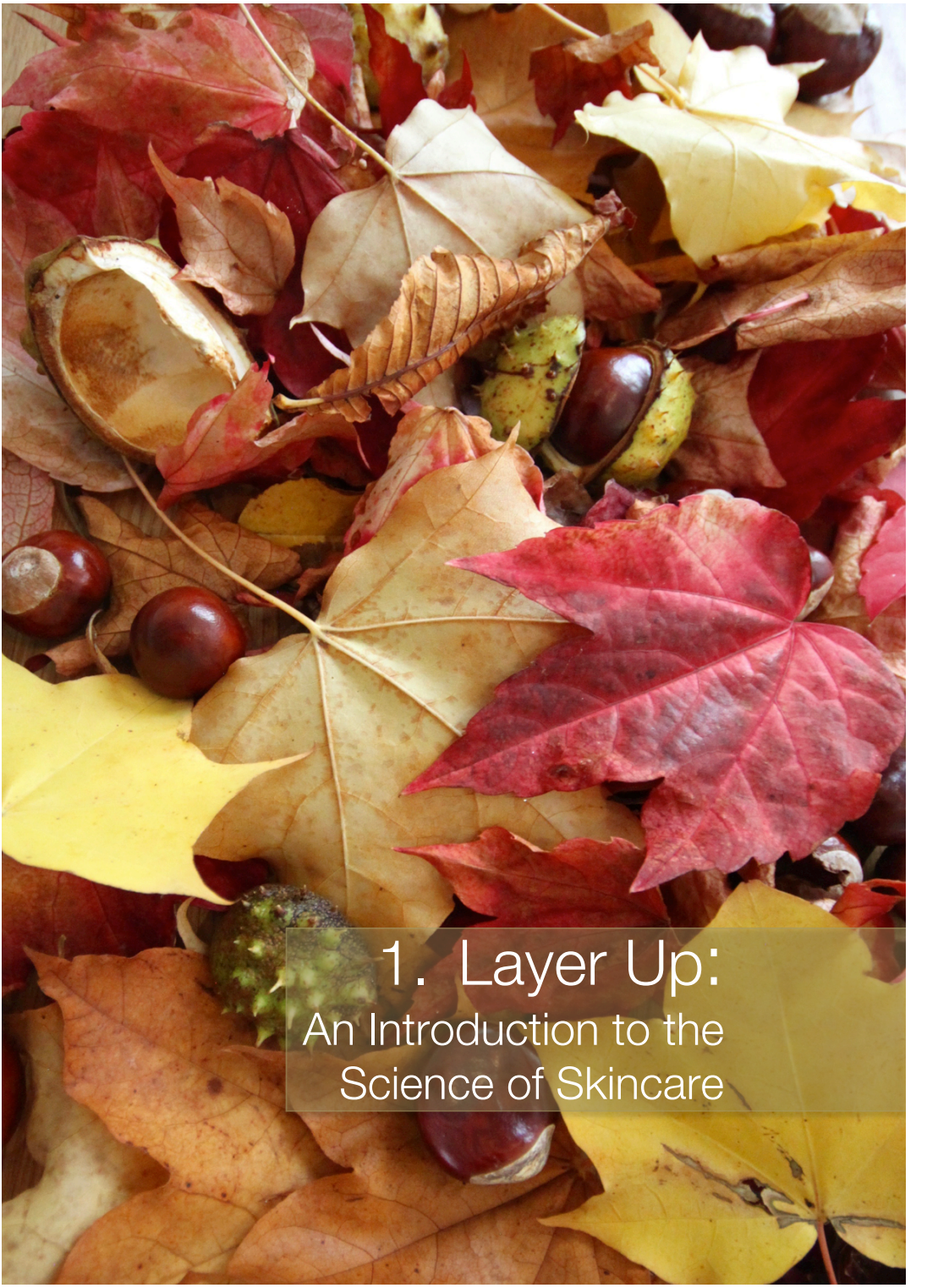

1. Layer Up:
An Introduction to the Science of Skincare

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An Introduction to the Science of Skincare

Our skin is one of the largest organs in our body. Most of our organs are protected, nestled under layers of tissue and bone, but our skin covers us like a shell or wrapping and is exposed to attacks from wind, water, sun and snow, bugs, beasties and whatever else it comes into contact with. Our skin protects us, warns us if we are near anything hot, cold or sharp, bends and stretches any way we fancy, stops us from losing water, generates enough vitamin D to give our bones strength and heals itself as and when required.

The reasons for and solutions to skin problems are deeply rooted in science. This chapter is an introduction to the structure and function of our skin, its resources for defending itself and its processes for repairing damage.

❖
The reasons for and solutions to skin problems are deeply rooted in science.
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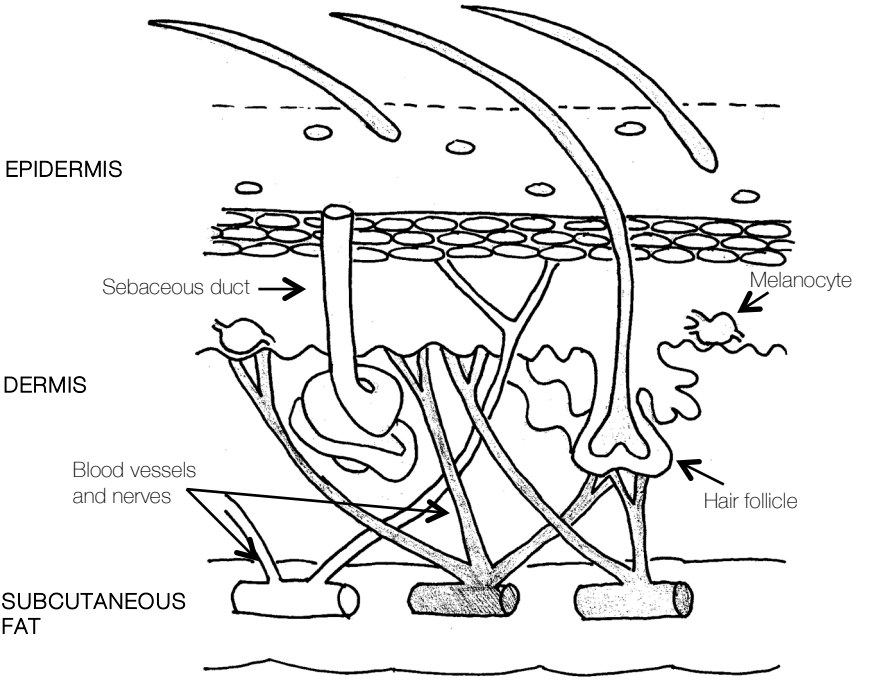
Skin Structure

Looking down at our skin we just see a flat expanse of tissue, but if skin is cut into and looked at under a microscope it has three main layers, a bit like a cake or sandwich, as shown in the illustration below. The top, outermost layer is called the epidermis, beneath that is the dermis and then the deepest layer is the subcutaneous fat.



The Epidermis and the Skin Barrier

The epidermis itself consists of four microscopic layers: the stratum corneum at the surface, the stratum granulosum below, the stratum spinosum below that and the stratum basale at the bottom, neighbouring the dermis. The epidermis, particularly its top layer, the stratum corneum, is a barrier between the outside world and the inside of our bodies. It prevents harmful substances from entering, controls how much water passes out of our skin into the air and protects us from the effects of the sun's radiation.

Like other organs, skin is built from a variety of different cells. The epidermis contains several cell types, including keratinocyte cells, filled with keratin filaments, which act like bricks to give structure to the epidermis; melanocyte cells, which produce a brown pigment called melanin to provide protection from sunlight; Merkel cells, which are associated with nerves and the sensation of touch; and Langerhans cells, which communicate with the immune system to protect us from infection.

Keratins are the most important family of proteins in the epidermis. Keratin filaments form a structural network spanning the epidermis, both inside keratinocytes and outside in the space between cells. They attach to desmosomes (joins between cells) anchoring cells in place.

The epidermis varies in thickness depending on the area of the body. It is much thicker on the soles of our

feet than it is on our eyelids, but on average it is 0.1mm thick, roughly as thick as a sheet of paper.

The Brick Wall

Many dermatologists describe the epidermal skin barrier as being like a brick wall[1]. Keratin filled keratinocyte cells in the stratum corneum act like bricks in the wall, giving it structure. The keratinocyte cell bricks are embedded in a lipid enriched matrix substance, which acts like mortar between the bricks, controlling the entry and exit of water. The lipid molecules here include ceramides, cholesterol and fatty acids arranged in an organised formation called the lipid bilayer. This lipid bilayer is our main defence against evaporation[1].

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Healthy skin is like a new brick wall
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Healthy skin is like a new brick wall with no cracks for water or bugs to leak out of or slip through. But if skin is irritated, broken or eczematous then it is as if the brick wall is crumbling, gaps are appearing and skin can dry out or become infected more easily.

Moisturisers can help repair damage to the skin barrier by providing a protective coating over the cracks and replacing, or encouraging the skin to produce, important molecules that allow the barrier to regain its strength.

Waterproofing

Our bodies need to be able to retain water or we will simply evaporate, and the epidermis itself needs to contain just the right amount of water in order to stay soft, supple and free from scaling.

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The skin barrier controls the balance of water in the skin
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The structure and components of the skin barrier in the stratum corneum control the balance of water in the skin[2]. Keratin, keratinocytes and the lipid bilayer are key players in this, as is a substance called natural moisturising factor (NMF), which is a collection of molecules that help to attract water into the epidermis and keep it there. Aquaporin water channels are involved in the transport of water and moisturizing molecules through the epidermis[3]. Problems with the skin barrier can be related to the structure and function of the lipid bilayer, to low levels of supporting substances like NMF or to problems with supporting structures like aquaporins.

Lipids

The volume of lipids in the skin seems to drop in winter, which will contribute to skin drying out[1]. In contrast, ultraviolet (UV) light in sunlight seems to increase levels of lipids in the epidermis[1]. Ceramides

make up about half of the lipids in the stratum corneum, cholesterol makes up about a quarter and fatty acids make up about a sixth[3]. Ceramides are often mentioned in skincare articles and product adverts in relation to the ingredients of moisturisers. Ceramides prevent loss of water from the epidermis and the skin barrier performs its functions better when it contains higher levels of them[3]. Lips have a thin stratum corneum with lower levels of ceramides, which will contribute to a higher rate of water loss and skin that can easily become dry and cracked[4,5].

Natural Moisturising Factor

Natural moisturising factor (NMF) is a collection of water attracting substances. Half of it is amino acids, including pyrrolidone carboxylic acid (PCA). The other half includes lactate, urea and electrolytes[2,3]. These molecules attract water into the stratum corneum from the atmosphere and the deeper skin layers. Keratinocytes that contain most natural moisturizing factor hold on to more water, while lower levels are linked to skin dryness, scaling, flaking and cracking[3,6]. Our levels of PCA reduce as we get older and can also be lost from the skin by washing with soap[3].

Aquaporins

Aquaporin channels transport water and moisturizing molecules like glycerin between cells. Aquaporin-3 is the most common aquaporin in the epidermis and lives in the cell membrane of keratinocytes. The number of aquaporin-3 channels in skin reduces with age and with years of excessive sun exposure[5].

The Acid Mantle

The pH level of our skin is important in maintaining normal levels of healthy bacteria (the normal microflora), the function of the skin barrier, the creation and organization of epidermal lipids and the loss of cells from the stratum corneum through desquamation[7,8]. Skin should have a fairly acidic pH of 4-6, sustained by a thin film on our skin surface known as the acid mantle[7,8]. This film is created from a mixture of skin moisture, sebum and lactic acid from sweat and is influenced by the area of the body it covers, our age, genetics and ethnicity[8]. Alkaline skincare products, which can increase the skin's pH to above the normal range, have more potential to irritate and affect the skin barrier than pH neutral ones[8,9]. Soap is one of the most common alkaline skin products.

Desquamation

Desquamation is the process by which old cells are sloughed off from the top of the stratum corneum. This is necessary in order to prevent the build up of scale on the skin surface and the function of the skin barrier is affected if it goes wrong. Desquamation is

dependent on water balance in the stratum corneum, as the enzymes needed to break the joins (desmosomes) between cells need water in order to function properly[2].

Responses to Sunlight

Dermatologists have a bit of a paradoxical approach towards sunlight and the UVA and UVB radiation it contains. We advise against too much sun exposure because of the risks of sun damage and skin cancer, but we also use UV light to treat many skin conditions.

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Everyone should try and avoid sunburn, which is associated with skin cancer as a result of DNA damage
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UVB, and to a lesser extent UVA rays cause damage to cell DNA through the creation of pyrimidine dimers – lesions in DNA that can lead to problems in its function and accuracy of replication if they are not repaired or bypassed[10,11]. Inflammation and oxidative damage occur as UVB and UVA rays trigger keratinocytes to release cytokine messenger molecules and other inflammatory mediators, resulting in the production of reactive oxygen species (ROS) and free radicals like singlet oxygen and hydrogen peroxide, which damage cells and DNA[10,12,13]. Everyone should try and avoid sunburn, which is associated with substantially greater risk of skin cancer as a result of this DNA damage[10].

Sunlight can have good effects on the epidermis, for example it increases the volume of epidermal lipids; it triggers adaptations within the skin such as thickening of the epidermis and production of melanin production that protect its cells from sunlight (known as photoadaptation); it triggers production of vitamin D; it reduces the activity of the immune system in the skin, which can have unwanted effects but allows it to be used in treatment of some skin diseases; and it raises levels of a hormone called beta-endorphin in our bodies, creating a feeling of wellbeing[1,10,13,14].

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Intermittent sun exposure has implications for the health of our skin and for our health in general
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Not getting enough sun exposure (without burning) has been related to health risks including risks of several cancers, high blood pressure and diseases of the heart, lungs and blood vessels, diabetes, the metabolic syndrome, obesity, Alzheimer's disease, multiple sclerosis, rheumatoid arthritis, psoriasis, non-alcoholic liver disease and eye problems[10]. Some benefits of sun exposure can be related to the vitamin D produced in response to UVB rays but many others are thought to be independent of this, so taking a vitamin D supplement is not an entirely adequate substitute for natural sunlight[10]. The key of course is balance between sun exposure and sun protection, but where the balance lies will vary between each of us depending on characteristics like our skin colour, our age, our ability to go outdoors and where in the world we live.

Living at northern latitude means that we spend much of our lives with our skin covered in layers of clothing, living indoors out of the sun, or buried in dark winter months with no exposure to UVB, which is only present in sunlight between late spring and early autumn[15,16]. Because of this, our skin can be surprised and unprepared when it is eventually exposed to natural sunlight, which often comes in short sharp bursts during a few weeks of local good weather or during a sunny holiday abroad, in contrast to the constant exposure of people living in sunnier climates. This intermittent pattern of sun exposure has implications for the health of our skin and for our health in general.

Defences Against UV Damage

Protection against sunburn and skin cancer within our skin is thought to come partly from photoadaptation (the greater production of melanin and thickening of the epidermis that occurs in response to sunlight) and possibly the creation of higher levels of the active form of vitamin D[10]. Also, the inflammation and oxidative damage caused by UV light alerts damage response pathways in the skin, including processes for repairing DNA, processes to stop damaged cells from growing or producing new versions of themselves, processes encouraging damaged cells to die rather than linger and cause problems, and processes to reduce inflammation[10,13].

Melanin is a pigment that can absorb UV rays, helping to prevent damage to cell DNA. It is produced by melanocytes in the stratum basale (the bottom layer of the epidermis) and packaged into