"Therefore we do not lose heart. Though outwardly we are wasting away, yet inwardly we are being renewed day by day."

Maintaining the status quo with stem cells

Run out, worn out, tired out: that sums up the fate of most things in life. Our shoes wear out, the toothpaste runs out and our bodies get worn out. We can buy new provisions to replace the old but how do we keep our body tissues from falling into a state of disrepair? Thankfully the human body has store-cupboards of stem cells in depositories as diverse as the intestine, skin, bone marrow and brain. These 'master cells' have an amazing ability to divide and produce new cells to replace the old: for example, stem cells in the blood system make 100,000 million new blood cells each day to keep us topped up.

One problem with tissue stem cells, however, is that they don't divide forever: there is growing evidence that adult stem cells age, slow down and even divide incorrectly, resulting in wrinkles, slower healing, cancer and death.

Learning from the plant world

When it comes to ageing of the skin specifically, scientists have turned their attention to the forests. Some trees live for hundreds of years: the bristlecone pines of North America are several thousand years old, and it's thought to be down to their almost immortal stem cells.

Plant stem cells (found, coincidentally, in their stems) are also superior to adult stem cells because they are able to turn into all parts of the plant throughout the plant's lifespan. Whilst embryonic stem cells can produce the entire spectrum of cell types found in the human, adult tissue stem cells can form only the cell type found in the tissue they belong to (for example, muscle stem cells can only make muscle cells).

The longevity and versatility of plant stem cells makes them attractive in cosmetic science: could their application to human skin regenerate it?

Current applications of stem cell therapy in regenerative medicine

When a starfish loses an arm or a lizard loses its tail, it can grow a new one thanks to its stem cells. In clinical medicine, transfer of stem cells underlies bone marrow transplants for treatment of leukaemia, and doctors are investigating transplant of brain stem cells in the treatment of Parkinson's disease, and heart muscle cells to repair damaged hearts. In cosmetic surgery, stem cells from adipose tissue are often injected into the face to reduce the signs of ageing – could plant cells offer similar promise?

Anti-ageing apples in regenerative medicine?

Combining plant stem cells with human stem cells might at first seem akin to comparing 'apples and oranges' but the results from experiments are so far proving fruitful. Initial studies have concentrated on a very interesting Swiss apple, the Uttweiler Spätlauber: in experiments, human stem cells multiplied very rapidly in a weak solution of stem cells from this apple, whilst skin creams containing the apple extract reduced depth of wrinkles by 15% after 4 weeks of application.

Some scientists are trying to upset the apple cart by denying these observed effects. As we learn more about stem cells, however, it is becoming clear that elaborate hormone and protein communication systems exist between stem cells and surrounding cells, driving their multiplication – and there might even be some commonality in the messengers used in plants and animals.

Dr Detlef Weigel from the Max Planck Institute and writing in Nature in 2002, remarks how "some of the molecules required for stem cell survival, such as *PIWI* in flies and *ZWILLE/PINHEAD* in plants, are closely related". Granted humans are not flies, but if this finding extended to humans, could an apple a day (applied as a cream) really keep crow's feet away?

Stem cells are not the only sought-after part of a plant in beauty products

Antioxidants are big news in the world of health and beauty and plants are rich in them. Their magical effects are best seen if you compare for a moment the leathery, etched, weather-beaten skin on the faces of the Himalayan Sherpas and the iridescent, smooth petals of the famous Himalayan blue poppy. The youthful look of the poppy is attributed both to its stem cells and to the antioxidant activity in its petals: this prevents sunlight from triggering harmful production of toxic free radical molecules which kill cells.

Human skin does possess antioxidant activity in its keratinocytes: these cells also form a helpful barrier against infection, heat and dehydration. In extremes of weather, however, skin damage is plain to see and harnessing the antioxidant and stem cell properties of plants in a skin cream becomes an attractive option.