**Fountain of youth**

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The ‘Fountain of Youth’, a mythical spring that keeps you young forever if you drink water from it, has been the subject of many a tale for centuries.

Mark Twain once contemplated about the reversal of the ageing process and stated that "life would be infinitely happier if we could only be born at the age of 80 and gradually approach 18." Now with a growing understanding of the complex scientific processes underlying the ageing phenomenon, there is light at the end of the tunnel.

There have been stunning developments in the field of science related to ageing and longevity in the last two decades. As a result, it is believed that children being born today could well have average ages of 120 years plus. This is not necessarily good news for humanity as it could create huge social problems with large ageing populations and limited job opportunities, especially for the young and less experienced.

David Sinclair, professor of genetics at the Harvard Medical School, had identified genes that allow yeast to extend their life spans by about 30 per cent if the level of nutrition available was curtailed. Later the same group discovered a chemical NAD (Nicotinamide Adenine Dinucleotide) that was shown to actually reverse the ageing process! The levels of NAD in our cells are reduced by as much as 50 per cent as we grow older. The presence of NAD is important for energy metabolism. Mitochondria serve as the energy engines in our body. The diminishing of the levels of NAD lead to the deterioration of mitochondria which in turn leads to ageing. Its replenishment may therefore have a strong rejuvenating effect.

Another compound ‘resveratrol’, discovered by the same research group in grapes and cocoa, was also found to reverse the ageing process in animals. Other compounds discovered that have been found to slow down the ageing process, or even reverse it include Nicotinamide Mononucleotide (NMN), and a drug metformin, currently in use for treating diabetes.

The genes responsible for the ageing process have also been the subject of intensive studies. "We've discovered genes that control how the body fights against ageing and these genes, if you turn them on just the right way, they can have very powerful effects, even reversing ageing - at least in mice so far," said David Sinclair in an interview (http://www.abc.net.au/news/2014-11-04/scientists-reverse-ageing-process-in-mice/5865714)

Both the amount and nature of the food that we consume is important in the ageing process. It has been known that restricting the diet of worms, flies and mice results in a significant increase in their life spans. Richard Weindruch and co-workers at the University of Wisconsin-Madison in the US were able to show that when monkeys are fed a low-calorie diet their life spans are increased significantly. In another study in humans by Charles Mobbs and co-workers at the Mount Sinai School of Medicine in New York, they established the linkage between reduction in food intake and longer life spans in humans. The reduction of life spans is due to ‘oxidative stress’ on living systems caused by the metabolism of glucose. If we consume less calories, the reduction in glucose metabolism leads to the prolonging of lives in humans.

An important reason for ageing is the damage caused to our biological system by oxidative processes. The villain in this case is a reactive form of oxygen – oxygen radicals. The oxygen radicals attack our DNA as well as some proteins, thereby accelerating the process of aging. There are inbuilt search and repair mechanisms to detect the damage caused and repair it, but these mechanisms also become less effective as we grow older, resulting in wear and tear to our systems. Antioxidants such as vitamin C are therefore widely used for healthy living.

A high-calorie diet, however, accelerates the ageing process due to the greater oxidative stress. The process of ageing is accelerated by consuming overcooked brown meat and other foods. Research has established that this occurs because of the production of certain chemicals, ‘Advanced Glycation End Products’ (AGEs) in the brain and other parts of the body that can lead to Alzheimer’s Disease and tissue degeneration.

One important aspect of ageing is the ‘ageing clock’ which is located in a region of DNA at the end of the chromosome. It is a protective cap, known as a ‘telomere’, which protects DNA from oxidative damage. As we age, this protective cap erodes away, and our DNA molecules begin to experience wear and tear. Scientists have therefore been working on ways to restore the eroded cap and a compound code named TA-65 has been discovered that helps to repair the telomere.

Recently it was found that sea squirts that are commonly eaten in Japan and Korea can significantly slow down and reverse the ageing process. The active compounds identified are called ‘plasmalogens’. A plasmalogen-rich diet given to rats led to positive changes in their body features including the restoration of thick black hair on the skin.

Clues to what actually goes on in the ageing process have come from a study on mole rats. Mole rats live about 10 times longer (30 years longer) than mice and some other rodents. A study by Prof Buffenstein and colleagues at the University of Texas Health Science Center in San Antonio demonstrated that the level of oxidative damage caused to proteins in mole rats was much lower, and that the repair mechanisms in their biological systems were much more effective than in normal mice. If we could somehow reproduce the biological behaviour of mole rats in humans to prevent the damage to our cells by the oxidative processes, and repair the damages caused, we would have an average age of 700 years plus. It is interesting that the fountain of youth may eventually be discovered from a better understanding of the longevity of mole rats.

For the present, the best advice that science can provide is to eat less, avoid overcooked meats and maintain a healthy balanced diet with sufficient regular exercise to live longer.

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