



***Ageing, Anti-Ageing, and Longevity: A Medical Perspective*.**

by **Dr. R.G. Wiseman Pinto**

Ageing is a natural, inevitable, and progressive journey—one that begins the day we are born and continues until our final breath. It is a process that every living being must go through, dictated by time, biology, environment, and individual choices. Although it is often viewed through the lens of wrinkles and physical decline, ageing is far more than skin deep. It is a complex transformation that affects the body on the cellular, tissue, and organ levels.

From a medical standpoint, age itself is not a singular concept. Rather, it encompasses various dimensions. Chronological age refers simply to the number of years one has lived, based on the date of birth. But biological age can differ greatly, depending on factors like lifestyle, nutrition, and exercise. Some individuals may be 60 years old chronologically but possess the physical health of someone 45, thanks to better habits. Psychological age is all about perception—how old or young a person feels internally. Then there is social age, which is defined by one's roles, responsibilities, relationships, and participation in the social fabric, including stages like employment, retirement, or community involvement.

Centuries ago, William Shakespeare captured the phases of human life in a poetic framework that still resonates today. From the crying infant to the schoolchild, the lover, the brave soldier, the fair judge, and eventually the aged man leaning on a cane—his depiction from 1616 serves as a timeless reflection on the stages of life. Yet today, we explore these transitions not just through art, but through science.

Modern medicine now understands that the process of ageing begins at the cellular level. As we grow older, cells experience a decline in function and resilience. This leads to decreased cellular viability and an increased risk of genetic abnormalities. A major contributor to this is damage to DNA, which occurs due to both external and internal causes. Externally, physical, chemical, and biological agents play a role, while internally, reactive oxygen species (ROS) produced by metabolic processes can harm both nuclear and mitochondrial DNA.

Fortunately, our bodies have repair mechanisms to fix DNA damage through specialized enzymes. But even these biological fixes have their limitations. Of particular importance in the discussion of ageing are structures called telomeres. These are protective caps found at the ends of chromosomes, which safeguard our genetic information during cell division. They function much like the tips of shoelaces, keeping chromosomes from unravelling or sticking to each other.

Each time a cell divides, telomeres become slightly shorter. Over time, this shortening leads to cellular ageing. Eventually, when telomeres reach a critically short length, the cells stop dividing, enter a state of senescence, or die through a programmed process known as apoptosis. Telomere shortening is linked to numerous age-related conditions, including various types of cancer, cardiovascular disease, and neurodegeneration.

An enzyme known as telomerase is capable of partially rebuilding and extending telomeres. However, telomerase activity tends to decline with age. Lifestyle and environmental factors also greatly influence telomere length. Studies have shown that individuals with healthier lifestyles tend to have longer telomeres. Plant-based diets, rich in legumes, leafy greens, red and orange fruits, nuts, dairy, and even moderate amounts of coffee, help preserve telomere length. The Mediterranean diet, which includes omega-3 fatty acids from olive oil and fish, is particularly beneficial.

In contrast, high consumption of alcohol, red meat, and processed foods has been associated with accelerated telomere shortening. Physical activity plays a powerful role in slowing biological ageing. Athletes, for example, typically exhibit longer telomeres than their sedentary counterparts. Adequate levels of micronutrients such as folate and vitamin D also support healthy telomere maintenance.

One of the silent killers of cellular health is stress. Chronic stress releases cortisol, a hormone that increases oxidative damage to cells, hastening the shortening of telomeres. Proper stress management, along with regular, restful sleep, plays a critical role in promoting longevity. In fact, telomere length is now regarded as an important biomarker of health and biological age. It can be measured through a laboratory technique called Southern blotting. Additional supporting biomarkers include blood levels of vitamin D, folate, and cortisol.

In recent years, research has shown that intermittent fasting and caloric restriction may increase both telomere length and activity. Human cells typically divide between 50 to 70 times in a lifespan, depending on the type. Some cells—like skin and those in the gastrointestinal tract—are constantly regenerating. Others, such as liver cells, have a moderate ability to divide. Permanent cells in the brain and heart rarely divide at all, making damage to them more permanent.

Caloric restriction has also been linked to increased lifespan due to its effect on nutrient-sensing pathways. These effects are mediated through insulin and IGF-1 (Insulin-like Growth Factor-1), both of which play key roles in metabolism and cellular growth. Another fascinating discovery in longevity research is the role of sirtuins, a family of proteins that regulate genes related to stress resistance, inflammation, and metabolism. Consuming red wine in moderation is thought to activate sirtuins, thanks to its content of resveratrol.

A relatively new gene under study is FOXO3, located on chromosome 6. This gene helps regulate a range of vital functions, including cell metabolism, telomere maintenance, DNA repair, stress resistance, and stem cell activity. Variations in the FOXO3 gene have been observed in centenarians—those who live past 90 or even 100—making it a key area of research in the field of anti-ageing and longevity. As a tumour suppressor gene, FOXO3 also plays a role in preventing diseases such as cancer, stroke, and Alzheimer's.

While science is continually exploring anti-ageing interventions, many currently available methods remain unregulated or lack sufficient evidence for approval. Nevertheless, there are a number of proven and safe lifestyle practices that contribute to a long and healthy life. These include maintaining a balanced diet, regular physical activity, sufficient sleep and rest,

staying hydrated, exposure to morning sunlight, and avoiding harmful substances such as tobacco, alcohol, and recreational drugs.

Equally important are psychological and social factors. A strong support system comprising family, friends, and a sense of community promotes mental wellbeing. Engaging in hobbies, entertainment, and emotional bonding with a partner contributes to overall health. Limiting sugar intake, avoiding confrontations, staying calm, and cultivating joy and gratitude can have lasting effects on both mental and physical wellbeing.

Despite the growing popularity of anti-ageing treatments such as vitamin drips, glutathione injections, collagen powders, NAD+ infusions, and other supplements, many of these are not approved by the FDA. In fact, some of these methods may be dangerous if administered without proper medical oversight. Tragic incidents, such as the recent death of actor Shefali Jariwala during anti-ageing therapy, highlight the need for extreme caution. Many of these therapies are self-administered or provided by unlicensed clinics lacking emergency medical preparedness.

Approved methods that have shown some benefit include Platelet-Rich Plasma (PRP) treatments that stimulate collagen production, High-Intensity Focused Ultrasound (HIFU), and Botox or dermal filler injections. However, even these must be performed by qualified medical professionals in regulated settings.

In conclusion, while the march of time is unstoppable, the quality of that journey lies in our own hands. A commitment to healthy living, consistent habits, and a positive outlook can go a long way in adding not just years to life, but life to years.

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