

To what extent can ageing be described as a disease?

Ageing is derived from the Latin word *aevum*, which means “lifetime.” In medical terms, ageing is the gradual deterioration of the physiological functions we require to survive and reproduce or, more simply, the process of becoming older. A disease, however, refers to *‘any harmful deviation from the normal structural or functional state of an organism, generally associated with certain signs and symptoms and differing in nature from physical injury.’* (Mellor, 2019). The result of vast advancements and various breakthroughs in medicine and drugs have contributed to life expectancy increasing to 79.2 years in males and 82 in females - double what it was during the 1840s (Border & Worsley, 2018). Despite this, the study of ageing is still awash with the need for more clarity on the root cause of ageing, which restricts scientists’ and researchers’ complete understanding of this process and, hence, the answer to whether or not it is a disease. From my standpoint, ageing is a disease to a partially large extent, but we still need to consider the opposing side to conclude. In light of this, the following essay evaluates whether we should consider ageing a disease from multiple perspectives and views. Nonetheless, we should first establish the importance of ageing and the different types of ageing.

Importance of understanding ageing

Whether or not ageing is a disease is a question asked by the NHS; who are spending on average seven times more on an 85-year-old than on a man in his late 30s, and more than two-fifths of the NHS budget is on people over the age of 65 (Robineau, 2016). We must also recognise the importance of understanding ageing as a significant risk factor for chronic diseases. For example, dementia cases in the UK are projected to rise from 850,000 to 2 million by 2051, according to Alzheimer’s Society (2014), as a direct result of the increasing life expectancy. It is also essential to understand ageing to maintain social inclusion and

independence and because it is a critical risk factor for various human pathologies (Avenue et al., 2012).

There are three different types of ageing

To understand the effects of ageing on the body, we should understand the different types of ageing used in research and discussion. The first term is chronologic age, which refers to the time that has passed since a person's birth date (Maltoni et al., 2022) in years. Although this type of ageing is a helpful indicator for many health problems - allowing for some legal and financial uses, it has limited significance in health research as a whole (Stefanacci et al., 2020). The second type is psychological ageing, which alludes to how people act, feel, and behave. Finally, and arguably the most crucial form of ageing is a person's physiological age, more commonly referred to as biological age, which encompasses all the accumulation of damage to various cells and organs in the body and is affected by many external factors such as lifestyle, habit, stress and smoking.

People have sought out cures and treatments for ageing since 1800 BC.

Human's tendency to find a cure for ageing links far back to the initial human recordings from the Babylonian poet Sîn-lēqi-unninni in the poem *'The Epic of Gilgamesh'* during 1800 BC. (Renstrom, 2020). This poem illustrates the antagonist trying to avoid death or, more seemingly, to cure it. Nevertheless, the poem emphasises that death is unavoidable and bound to happen, touching upon the idea that ageing is an irreversible phenomenon of life. This brings us to the question: What if we can cure ageing and it is not inevitable? When looking through a gerontological lens, one significant criterion for deciding if ageing is a pathological process is if it is treatable (Gladyshev & Gladyshev, 2016). Researchers discovered that implementing small molecules can decrease tissue-damaging senescent cells, allowing thirty per cent of healthy life to be regained as age-related illnesses are delayed. Clinical trials are being conducted, carving the path for using this with the general public (Jean-Marc Lemaître, 2022). Due to the following evidence, if we can reverse ageing or

maybe even cure it, it is a disease due to its potential to be cured, suppressed or treated. However, there are some inconsistencies in this argument. For example, Huntington's disease and the genetic disorders Edwards' syndrome and Patau's syndrome are all diseases that carry no potential for cure. There are currently only treatments to handle and suppress the effects of these diseases (Jones, 2020; Johns Hopkins Medicine, 2020; Morales-Brown, 2022). This highlights that not all diseases have a cure, hinting that ageing does not either, but it can still be considered a disease. Despite these promising advancements, the Food and Drug Administration does not govern any practice or drugs addressing ageing (Renstrom, 2020). Therefore, researchers still need to verify the claims that different treatments fight ageing, partly falsifying any comments on ageing being a disease since we have yet to learn whether it can be treated or cured.

The overlap of the physiological processes and hallmarks of ageing and disease

The origin of this side of the ancient dichotomy appeared during 400 BC in the book coined as the Hippocratic Corpus, where numerous writers perceived ageing as a disease and concluded that ageing results in weakness, incapacity, and demise (Faragher & Calimport, 2019). This is quite similar to how a disease affects the body physiologically, but people knew very little about ageing and disease processes then. However, more recently, we have pinned down further similarities in the physiological processes through scientific approaches and in-depth research. For example, as specified by Gibson & Allen (2023), both dementia and ageing are associated with the occurrence of beta-amyloid plaques (a key factor of cell death and tissue loss in the brain) and neurofibrillary tangles - which impede the transport system of the neurone, impairing synaptic transmission between neurones (National Institute of Ageing, 2024). As a result, this causes the disturbance of neuronal function and cell death - both common in each. This reflects how closely dementia and ageing are linked biologically. On the other hand, in ageing, minimal amounts of both beta-amyloid plaques and neurofibrillary tangles occur and are distributed more widely than disease pathology. Moreover, a study by the pathology group at Barts and The London Hospital School of

Medicine and Dentistry (Martin & Sheaff, 2007) identified the natural changes in the body due to ageing, for example, alterations in the immunological, cardiovascular, and endocrine system, coincide with diseases processes, like those brought on by musculoskeletal and skin “wear and tear”, or cardiovascular diseases.

Further evidence highlights the relation between ageing and pathological processes as both foster the accumulation of cellular damage, leading to organ dysfunction (**Izaks & Westendorp, 2003**). Physiological changes form the primary basis of all processes inherent to ageing, and this is the same for diseases. So, this argument is vital as what happens to the organs during ageing is the same or very similar to that for a disease, which will help make an informed decision if ageing is a disease. Despite this, the argument has some limitations, as the physiological changes of ageing may bring on chronic diseases, whereas the physiological changes of chronic diseases will not cause ageing. Also, the physiological changes of disease are mainly concentrated in one organ system; for example, cardiovascular diseases will only affect the heart. Whilst the physiological changes of ageing affect most organ systems in the body

If we look deeper into what causes these physiological changes, we will discover the hallmarks of ageing known as the progressive loss of physiological integrity (López-Otín et al., 2013). For ageing, there are nine hallmarks presented in the following list: (1) genomic instability, (2) telomere shortening, (3) epigenetic alterations, (4) loss of proteostasis, (5) dysregulated nutrient sensing, (6) mitochondrial dysfunction, (7) cellular senescence, (8) stem cell exhaustion and (9) altered intercellular communication. All the hallmarks increase the risk of age-related diseases and lead to a decline in biological and physiological organ function. More specifically, they lead to the progressive accumulation of misfolded or unstable proteins (Lemoine, 2021). The importance is that they play a causative role in the process of ageing (Rumiana Tenchov et al., 2023). For example, the primary hallmarks contribute to the damage of cellular functions.

In contrast, the following hallmarks lead to antagonistic responses to the previous damage, and the integrative hallmarks contribute to the clinical effects of ageing, for instance, diminished function, organ deterioration and physiological loss of reserve (Aunan et al., 2016). Even though these hallmarks are essential to ageing, researchers have observed them in many chronic conditions and age-related diseases. By way of example, chronic obstructive pulmonary disease (COPD) and idiopathic pulmonary fibrosis demonstrate all hallmarks of ageing (Barnes, 2019). Likewise, diseases such as osteoarthritis, cancer, atherosclerosis, Alzheimer's disease and frailty all feature the presence of senescent cells. However, each condition displays different cells undergoing senescence instead of a single cell type, whereas, in the ageing body, it is the stem cells undergoing senescence (Mylonas & O'Loghlen, 2022). This could cause counterarguments pointing out the difference in cell types. However, this is a strong argument at a cellular level, as the underlying cause (the hallmarks of ageing) of the physiological changes in ageing and disease are, to a degree, the same.

Ageing is not a disease of the body but a disease of the spirit

This view has been fostered by many due to the psychosocial effects - they are the mental, emotional, social, and spiritual effects of a disease National Cancer Institute (2019) - that accompany ageing, providing various challenges and adaptations. Due to ageing, older people face a decline in physical abilities, separation, changing social roles, and multiple losses and, as a result, hurting their sense of purpose and well-being, bringing about everyday issues like social isolation, loneliness, anxiety, and social exclusion. Studies have also depicted that the issues stated above trigger higher risks of high blood pressure, heart disease, obesity, anxiety, depression, Alzheimer's disease and sometimes death (National Institute on Aging, 2019). This clearly shows that ageing can be considered a disease of the spirit due to the psychosocial effects of ageing; these effects cause negative physiological changes in ageing and an increase in the prevalence of chronic conditions akin to disease

processes, showing how mental state and well-being contribute vastly to how ageing affects the body/

However, in 300 BC, Plato stated that maintaining mental and spiritual harmony is essential to preventing the physical decline of ageing. Ageing can also be viewed as a spiritualising process that offers wisdom and inner growth despite challenges like loss, physical deterioration, and mortality.

Ageing is a natural and inevitable process inherent to all life

During 100 AD, the first proper establishment of the opposing side of the argument, in which ageing is considered not a disease, was by arguably the ‘greatest classical writer on medical matters’ Claudius Galen, expressing ageing as a ‘natural condition’, which was obliging to a natural process (Faragher, 2015). The idea of ageing being a ‘natural’ process is the precursor of this side of the ancient dichotomy. Because ageing doesn’t recognise race, gender or country, we consider ageing to be a ‘universal’ or ‘natural’ process. Moreover, we also consider it inevitable - meaning the breakdown of the organs and other bodily functions will happen to everyone. The idea of ageing being ‘universal’ touches upon the concept that all experience it - one cannot avoid it - whereas disease is something that only a portion experience (The Lancet Healthy Longevity, 2022). Russell Swerdlowk, director of the Alzheimer’s Disease Research Center, states, “one could argue that ageing can then be a disease if it impairs function, but you run into this issue of — that’s everyone.” Some people have even compared ageing to adolescence purely because the latter also cannot be avoided and involves a change in our body (Belshe, 2024). Many researchers (Amarya et al., 2018; Rysz et al., 2021; Samuel, 2015) also agree with this idea, fortifying the idea of ageing being natural and inevitable. This argument is essential, but a few things could be more consistent. For instance, when ageing is compared to adolescence, it is done because it involves changes in our body. However, adolescence doesn’t cause any harmful physiological changes in the context of a disease. In contrast, ageing does, so this comparison isn’t robust. However, the

idea that ageing happens to everyone, whereas ageing doesn't, is simple but powerful as it is a critical disparity between the two processes.

Modern-day arguments

As the world develops, more modern factors must be considered when arguing whether ageing is a disease. Namely, we need to build our understanding of what influences cancer, the use of animal models about human ageing, and the effects of ageing on the risk of other diseases.

Public perception and societal attitudes contribute substantially towards perceiving ageing as not a disease. A study conducted by Tikkinen et al. (2012) in Finland gathered data from 6200 people from varying professions were asked to rank 60 "states of being" according to how they saw different sicknesses. Ageing was ranked #58 out of 60, indicating that it isn't a disease. In another study by Zhavoronkov et al. (2014), the employees of an insurance company, the International Employee Benefits Association, were asked to answer 27 questions. The results showed that 88% of respondents felt that ageing was a disease. Clearly, in the eyes of society, it is not a disease, consequently leading to the perception of ageing as not a disease and contributing to the idea that ageing is different from a disease as most of the population perceives it that way.

Hypothetically, if we look at ageing as a disease, we already know that genes influence ageing, like cancer. As we know, those with genes that increase the risk of cancer (such as the mutation of the BRCA1 gene for breast cancer) are more prone to getting cancer. Similarly, if different people have different genes, some will experience the effects of ageing more heavily than others, and some may start experiencing the effects of ageing after others. This may suggest that it is a disease as some experience ageing worse or decades later than others due

to their increased chance of getting it. Interestingly, however, the father of cancer genetics, Aldred Warthin, recognised ageing as a distinct process to disease (Faragher, 2015).

Observing the ageing characteristics of naked-mole rats can provide insights into the features of human ageing. Naked-mole rats exhibit negligible senescence (Stenvinkel & Shiels, 2019), decreasing senescent cell production. This prevents the release of harmful molecules and the impairment of organ function, thus preventing the decline in reproductive capability or physiological function and allowing the naked-mole rat to live about nine times longer than a similar-sized rodent and show little signs of physiological ageing (Buffenstein, 2008).

Moreover, we can consider the ageing mechanism in humans a disease due to the presence of senescence, as the lack of senescence in naked-mole rats is linked directly to increased lifespan. It also further emphasises that when one ages, the human body experiences an increase in senescence (National Institute of Ageing, 2021).

As the final argument, we must also consider ageing as a risk factor for comorbidities. Comorbidity is the presence of more than one disorder in a person over a defined period (Wittchen, 1996). Obesity is a prominent risk factor for several comorbidities, such as type 2 diabetes, cardiovascular diseases, osteoarthritis, gallstones, hypertension, and some cancers (Webber, 2001). Due to this, the World Health Organization (2024) proclaim obesity as a disease. Furthermore, ageing also has many comorbidities, increasing the risk of neurodegenerative diseases (such as Alzheimer's, Dementia and Parkinson's Disease), osteoarthritis, diabetes, cerebrovascular disease, depression and COPD. To give an idea, between the ages of 50 and 80, the prevalence of Parkinson's disease rises dramatically by a factor of about ten (Pringsheim et al., 2014). However, as we know, ageing is not considered a disease, even though, like obesity, ageing defies the conventional criteria used to characterise an illness (Bulterijs et al., 2015). In my opinion, this argument is somewhat strong because there is a direct correlation between obesity and ageing, increasing the chance of further illnesses.

Moreover, just like obesity, medicalising ageing can bring considerable benefits to ageing research due to the increased focus. However, this argument can be weak due to the

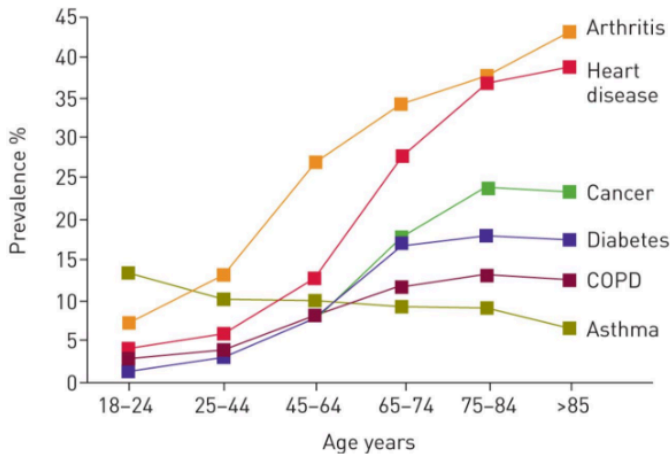


Figure 1 shows the incidence of chronic diseases concerning increasing age. Harris, R. E. (2019). *Epidemiology of Chronic Disease: Global Perspectives*. In *Google Books*. Jones & Bartlett Learning. <https://books.google.co.uk/books?hl=en&dr=&id=qKKODwAAQBAJ&oi=fnd&pg=PP1&dq=>

argument that, for example, smoking has many comorbidities, such as COPD, lung cancer and hypertension, but this doesn't mean that smoking is a disease. Similarly, the sun leads to skin cancers due to the UV rays emitted, but we don't consider the sun a disease. Finally, as seen in

Figure 1, the chronic condition asthma decreases in prevalence as we age, contradicting the increased risk of chronic diseases due to ageing. Hence, this argument allows us to consider ageing, to a small extent, a disease due to the similarities it shares with obesity and the beneficial implications of doing so.

Through the multifaceted argument above, although the 'ageing is universal and inevitable' provides a strong argument from a broader and omnipresent perspective, the physical and mental burden that ageing places on our bodies, the similarities in hallmarks, and modern perspectives are evidence to say that it is a disease. This resonates with my viewpoint; in my opinion, ageing should definitely be considered a disease. However, we must look at the implications of making these assumptions. At what age would you conclude that someone has a disease? For instance, if 65 was the threshold, everyone above that age is ill. Perhaps the most necessary point is that denoting ageing as a disease exacerbates ageism and age-related discrimination (The Lancet Healthy Longevity, 2022). Instead, we should put greater emphasis on and revolutionise the treatment for the effects of ageing efficiently

rather than trying to reverse the process. By doing so, we can significantly reduce the costs of ageing and increase mortality, allowing people to live longer and better lives.

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