

Original Article



Thoughts on Ageing

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Abstract:

Ageing is a process along the Time-Age axis that characterises the degree of wear and tear of the body. An eminent scholar of gerontology, F. Bourlier, has argued that “if in the future we wish to better understand the causes and effects of ageing at the molecular, cellular, organ, organism or population level, we must not use a single technique, but all those which, from biophysics to sociology, will enable us to approach the effects of Time on Life from several angles.” From a biological point of view, every living organism has a dual purpose: its own survival and the reproduction of the species. With age, the functionality of some analysers also decreases significantly. The process of ageing is thus included in the programme, without its beginning and end being clearly defined. It follows from this view, which is almost unanimously accepted by gerontological authors, that a person cannot die a natural death under present conditions, but that death is always caused by some disease process. Cross-linking prevents molecules from moving freely, and the molecules thus linked form inactive units, which disturb the physiological state of proteins and nucleic acids, resulting in a loss of function. From this we can draw an extremely important conclusion about the ageing process: all the movements that a person repeats constantly throughout their life can be easily reproduced in old age.

Key words: biophysics, human-time, gerontology

Introduction

Ageing is a process along the Time-Age axis that characterises the degree of wear and tear of the body.

As this definition shows, ageing is closely linked to the concept of time. Newton was the first great thinker to realise that the phenomena around him take place in space and time. He imagined space and time as absolute concepts. Later, in his philosophy, Kant sought to apply the Newtonian concept and assigned mathematical concepts to three-dimensional space and one-dimensional time, such as geometry and the set of numbers. It was a significant advance in his later philosophy that he conceived space and time as a form of existence of matter. He accepts matter in motion as an absolute given, and thus these two forms of existence of matter are brought into dialectical

unity with each other. Philosophy was nearly half a century ahead of the natural sciences in this respect, with Einstein being the first physicist to link space to time in 1905, followed by Minkowski in 1907.

Looking at the definition from another angle, we are faced with the phenomenon of life. Life can be said to be a fundamental concept in axiomatic biology, which is not defined, but it can be said to catalyse its own self-evolution through the motion-coupled transformations of various forms of matter, and in particular cases to produce the living state of matter. Thus, at different points in the Universe and at different moments in time, a fortunate combination of special circumstances has occurred which has made possible the emergence of a living state of matter. From that moment on, this living state runs its own program,

but its algorithm changes from time to time in response to external factors. The resulting living organisms have a finite lifespan, while the “lifeline” they concretise persists for several orders of magnitude longer, but has a beginning and an end.

Some interest

An eminent scholar of gerontology, F. Bourlier, has argued that “if in the future we wish to better understand the causes and effects of ageing at the molecular, cellular, organ, organism or population level, we must not use a single technique, but all those which, from biophysics to sociology, will enable us to approach the effects of Time on Life from several angles.” So gerontology (the discipline of ageing, or more specifically human ageing) is very young and its methods are diverse. [1] Of course, this is not to say that ageing – an intrinsic attribute of the living state of matter – has not been the subject of human thought for the past decades, but it is safe to say that the intellectual products of ageing have been almost shrouded in naivety, and that basic research has been going on for only a few decades. To date, gerontology has been dominated primarily by formal statistical surveys, rather than basic research on the subject. This claim is supported by the fact that life expectancy of around 100 years has not changed since the historical record. What has changed is the number of people who are approaching or reaching this apparent limit, but without human life being extended.

Having said these, without wishing to be exhaustive, the theoretical hypotheses on ageing are presented below.

1. Lorenzo Balthasar Gracian claimed in 1653 that stupidity is the shortener of life! In his work, he gives concrete suggestions on how to achieve a longer life. This claim is worth examining because it links ageing to human qualities that are not causally related either biologically or

philosophically. [2] Hundreds and thousands of such misconceptions and pseudo-scientific truths have littered the intellectual products of the past centuries and have decisively prevented a scientific approach to ageing.

2. From a biological point of view, every living organism has a dual purpose: its own survival and the reproduction of the species. Given that life expectancy at birth was generally below 40 years in all countries before 1900, the ageing period was usually closely linked to reproduction. On this basis, women were considered old after they stopped bleeding monthly, and men from the age of 40 upwards, when the frequency of penile erections decreases. [3] The same idea has been supported by the very many species in the animal kingdom that die out very quickly after a single or repeated act of reproduction, due to extremely strong selection.

3. It has been known for thousands of years that the most striking signs of ageing are both morphological and functional changes. We now know that all organs in the human body undergo minor changes as we age. Instead of listing them in their entirety, we will mention only some of them, which can be easily detected by external macroscopic examination, such as wrinkling, greying, balding, muscle atrophy, bending of the spinal column, skin pigmentation, etc.

4. The functional, physiological changes that occur during ageing have also long been recognised (Figure 1). It is a well-known phenomenon in sport that the winners of the fast-moving events come from the twenties. [4] With age, the functionality of some analysers also decreases significantly. One example of this is that the adaptability of the lens of the eye is significantly reduced after the age of 40, while the ability of the inner ear to conduct sound is significantly reduced after the age of 50.

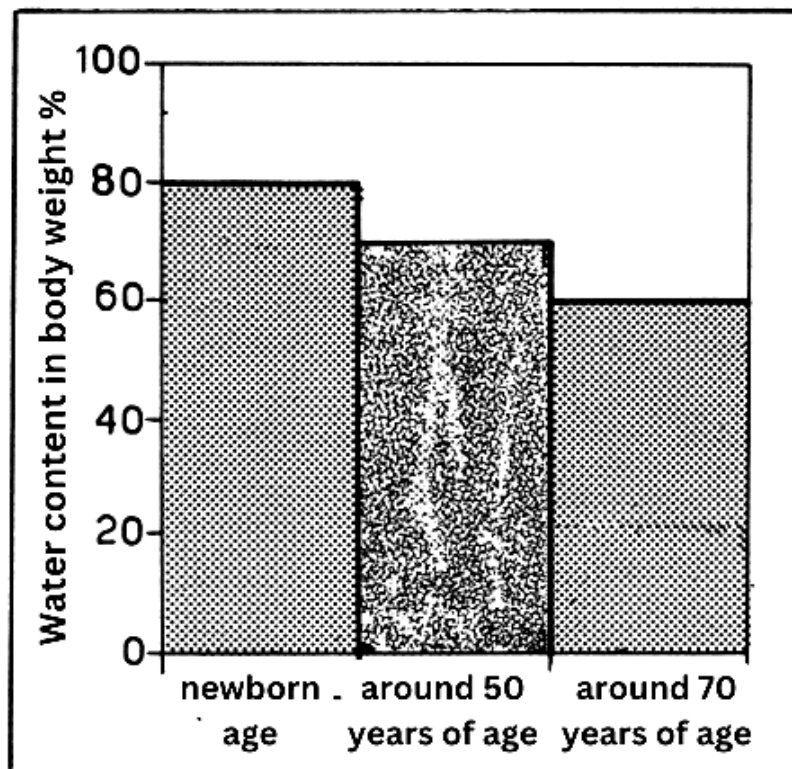


Figure 2: Changes in relative water content during different periods of ontogenesis

In older age, there are also significant changes in the water content of organs (Figure 2), which determine ageing on several levels, such as muscle fatigue, osteoporosis, changes in ion concentrations, decreased or increased enzyme activities, and many other physiological changes that are the result of changes in water balance. As the speed of response to stimuli also decreases with age, adaptability deteriorates. [5]

5. The ontogenetic development of an individual is nothing more than the playback of a “prewritten program”, spread out over time. This program is located in the chromosomes, the DNA molecule, and determines almost entirely the structure and function of the individual, leaving room for environmental influences. The process of ageing is thus included in the programme, without its beginning and end being clearly defined. In other words, this means that the individual lives for a finite period of time according to the program, but death is neither a fact nor a formality in this program, but a natural consequence of the finiteness of the program.

6. The period of ageing is very often accompanied by various pathological changes, in other words,

most diseases are much more likely to occur at an older age than before. As Professor Haranghy, a renowned pathologist, has shown in his autopsies of nearly a hundred very old people who died of “old age”, such people usually showed a number of pathological changes. [6] So, if they had not died at that time, their death would have been imminent anyway, from causes that had not been diagnosed before. It follows from this view, which is almost unanimously accepted by gerontological authors, that a person cannot die a natural death under present conditions, but that death is always caused by some disease process. Given that ageing is the last stage of post-embryonic development, it is likely to be dominated by minor or major pathological processes.

7. Ageing is therefore a process that takes place over time, which is true in the sense that ageing starts at the moment of birth. In fact, this can easily be supported by the fact that the younger the individual, the more intense its relative ageing. This means that a 70-year-old person ages by 1.4% in a year, a 10-year-old child ages by 10%, while a 1-year-old child ages by 100% in 1 year. Depending on relative ageing, the ageing process slows down with age. This is also well illustrated

in a biological sense, because young individuals go through more significant developmental stages than older individuals. [7]

There are two main stages of human development: intrauterine development, which usually lasts 9 months, and extrauterine development, which has a biological upper limit of 120 years, as we know it today.

Gerontology

One of the most important experimental proofs of the hypothesis about the molecular genetic mechanism of ageing is the formation of cross-links in DNA. Cross-links are the result of the action of cross-linking agents that are always present in the body. Such cross-linking agents include aldehydes, free radicals, dibasic acids, etc. Cross-linkages may be present in the body at a younger age, but their number increases with age. This is the most significant specific structural physicochemical difference that has been detected in nucleic acids as a function of age. [8] This approach also makes it possible to clarify why macromolecules, and thus indirectly cells, age under the influence of the time factor, thus resolving the apparent antinomy between the macroscopic features of ageing.

Cross-links can also form in protein molecules. Cross-linking prevents molecules from moving freely, and the molecules thus linked form inactive units (inactive complexes), which disturb the physiological state of proteins and nucleic acids, resulting in a loss of function. The age-related increase in the number of cross-links slows down and makes the macromolecule – and indirectly the cell – less precise. At the molecular level, the increase in the number of cross-links is the most fundamental evidence of the ageing process. Disruption of cellular function leads to functional perturbation of the body. [9] The body defends itself against this by breaking down these

protein molecules and making new ones to replace them. There will no longer be any cross-links in the new molecule, so the new molecule will be functional again. However, this mechanism only provides partial protection, because if too many cross-links are formed, or if cross-links are formed where the defence mechanism does not work, the cross-links formed will interfere with cell function. However, the defence mechanism can be helped by external interventions (e.g. root-control drugs).

Observations at the molecular level have provided another key piece of experimental evidence on the ageing process, showing an age-related decline in immune function. Many researchers suggest that the period of adulthood can be significantly prolonged by immunological manipulation (when the immune system is treated to maintain its normal function). [10]

The dual nature of the ageing process – both in its internal logic and in its general context – is easy for the layperson to understand, because a number of structural and functional changes occur in the body of older individuals that are observable to the naked eye and that differ significantly from the average characteristics of middle-aged people. The aging process, as the motto implies, does not clearly imply a decline in target activities, i.e. an older biological organism may achieve higher positive scores for certain traits than younger individuals (Figures 3.).

Biomechanical processes are present or absent in the vast majority of human traits that shift in a positive direction in older age, and in a smaller proportion of negative lags. The experience accumulated in older age means nothing more than that the target activities carried out by the living organism have developed their own dynamic stereotypes, which are orders of magnitude greater in number than in younger age.

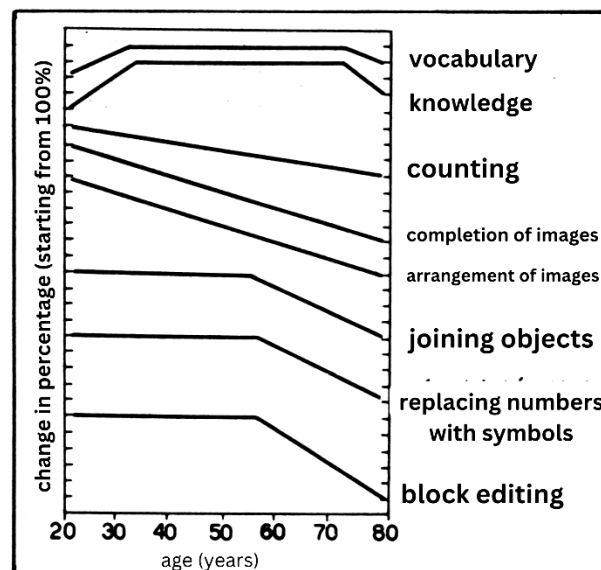


Figure 3: Some changes in intellectual performance depending on age (1 unit = 5%)

Tens of thousands of repetitions of the same sequence of movements in the same order and intensity over decades of time were required. So, for an old person, to develop a certain form of activity required a greater and more vigorous “total effort”, but the amount of effort at any one time was less than for a young person. [11] An excellent pianist, violinist or instrument maker over the age of 80 can play the piano, violin or hold a screwdriver with more confidence than a 20-year-old.

From this we can draw an extremely important conclusion about the ageing process: all the movements that a person repeats constantly throughout their life can be easily reproduced in old age. Thus, the ageing process typically becomes dominant in non-repetitive or sporadically applied movement sequences. This brings us to the core of our conclusion, in which we claim that the more movements a person practices into a dynamic stereotype, the less they age!

So the person who delays the onset of old age best is the one who develops and uses all their muscle groups harmoniously and purposefully: walking, running, gymnastics, weight lifting, swimming, football, typing, hiking, driving, chopping wood, in other words, repeating the most varied “movement sequences” on a regular basis, and intellectual activities such as reading and speaking foreign languages. This repetition is well known

among elite athletes, where it is called a workout. Exercise needs to be woven into our lives in a metaphorical sense, in a broader sense and for a lifetime. It follows from what has been said that the number one, most decisive and fundamental antidote to ageing is movement! For all those who want to delay their ageing process, we recommend that they fetishise their own movement!

From sports medicine data, it is clear that individuals who exercise regularly on a daily basis have, at the age of 50, typical biological parameters that are on average those of 25-year-olds who do not exercise. In some countries, such as the United States, advocates of the “run for your life” movement share the same principle. Statistical studies in gerontology also show that individuals over 100 years of age were characterised by a lifetime of active physical activity. Numerous observations show that intense exercise, as an effective human need, ensures normal metabolism in the body over a long period of time, regardless of diet and habit, and contributes significantly not only to increasing the life span of middle age, but also to extending the life span of individuals.

Unfortunately, this scientific discovery was not followed by adequate social education, i.e. the mass media were far from convincing the masses of the importance of physical activity in order to preserve health and delay ageing. In this context, we can speak of a lag in social education, and we

must also mention the lack of environmental conditions. Unfortunately, there is no single place where everyone can play mass sports at the same time. There are no sports complexes available to the population that would allow a lifetime of varied physical activity. Given these circumstances, it is up to each individual to decide how many times a week they kick the ball, how many times a week they lift weights at home, how many kilometres a day they walk to keep their muscles flexible, which then acts as a rebound ball for their mental state, helping to create mental balance and more effective mental activity.

Regardless of one's age, but even more so in old age, people carry within themselves all the conditions, opportunities and capacities that they have been given by their history and present as a bondage and freedom of choice, which then they shape through their actions and desires.

The teleological view of ageing has a tradition going back to the beginning of science. All thinkers directly or indirectly involved in gerontology have had to face the question: do ageing processes follow a trajectory that can be read as the embodiment or fulfilment of a predetermined goal? The question is obvious to the everyday naive mind. Ageing should be considered primarily in terms of process (function) rather than structure.

For accuracy, the internal state of ageing must be distinguished from its external state. That is why there is a biological age and a calendar age, with one or the other in a hurry in relation to the other. The ability of the older organism to adapt to changes in the external and internal environment is reduced. The extent to which an old person can functionally compensate for these influences is very significant. The psychological safety of an elderly person depends primarily on the accuracy of the data on endogenous factors that are relatively easier to work out and exogenous factors that are more difficult to obtain, and on their relative proportions in terms of quantity and quality. The difficulty of the task is to establish the relationship between outcome measures and factor measures, to extrapolate existing trends and tendencies in a realistic way, and finally to assess the changes in the main structural parameters of the phenomenon under study – the ageing process – on the basis of appropriate information.

Imperfections in the registering and feedback mechanisms explain the increased vulnerability of the body in old age. This explains the introduction of the dynamic concept of “relative health” in this age group.

We find different historical lifestyle models across the historically changing spectrum of human lifestyles. They have been greatly influenced by the sense of material existence as an organiser of life, and by the value orientations and requirements of life. The activity of the elderly is a historically changing process, determined by specific conditions, nourished by natural and social resources, in constant interaction with production, with constantly changing content, constantly reborn and reproduced at a higher level of satisfaction, satisfying needs. These are objective needs, the consciousness of which, as an inner ideal, must be realised both in the individual and in society. So old age is an essential condition of life, an inalienable part of life. Then, and in this respect, humans are not forced to grow old by the alien, blind forces of society; their compulsion is a natural and not a social compulsion. Humans seek to break free from the constraints of nature, to alleviate their blind subordination to nature by recognizing the laws of nature.

The elderly are alienated from themselves and their environment. The main condition for the elimination of alienation is the environmental impact, which is the backbone of the process, but the resolution of the brackets in the formula – the complete elimination of alienation – is a long and complex process. This state is significantly characterized by contradictions, but there is no absolute contradiction between the facts. Conscious ageing is no longer an inevitable acknowledgement, but a recognition, a necessity absorbed into the human consciousness.

Ageing is nothing to fear. Those who have been preparing for old age for sixty-five years live rightly. One should prepare for it as a “great holiday” that ends with one's death, when one can indulge in the pleasures that life has denied them while at work, and we are ultimately responsible for the way our old age unfolds. We ourselves must create a peaceful, harmonious old age.

These ideas reflect the tasks of applied gerontology, which can be summarised as follows:

1. To extend productive life and prepare for retirement;
2. The possibility of maintaining activity (employment) and overcoming loneliness;
3. To maintain independent living for as long as possible and to ensure appropriate social support;
4. The optimum provision of the various types of temporary or permanent institutional care desired, including respect for the individual's personality and the balance between their physical and mental state;
5. Creating hospital wards that meet the needs of the elderly;
6. Ensuring the availability of suitably trained and sufficient staff to deal with these complex tasks.

The “internal logic” of gerontology is not independent of the human goals to be achieved and the needs of the future, but is in many ways related to them. Thus, if new discoveries, procedures, knowledge – that are currently only to be found in the workshops of science, but are likely to be expected in future developments –, as well as the “chain reactions” that can realistically be derived from these, are considered in the context of new needs and new goals, then gerontological predictions can be based on a relatively secure foundation, which is possible at this time. [12]

From a biophysical point of view, ageing can be expected to occur when the balance between the building and breaking down functions in the body is upset in favour of the breaking down functions. Cooperation between organ systems becomes loose and adaptability is weakened. In terms of shape, a disharmonious appearance is created: a disproportionate reduction or increase in weight. In the nervous system, nerve cells shrink and sclerose, the body's water-retaining capacity decreases, the skin becomes dry, flaky and thinning, hair loss and greying begin, teeth fall out. Sensory function is reduced, light thresholds rise, hearing is impaired, and touch, pain and heat sensation are also reduced. In the intellect, judgement declines, the horizon narrows, it is difficult to see through thought-contexts, the capacity for flexibility of thought is slowly lost, but the rehearsed dynamic stereotypes remain

intact, and a slow, shambling gait prevails in movement.

The bio-psycho-physical unity of development is established by adolescence, neurotic foci seek compensation, a relatively stable phase follows. The particular individual traits that have made the individual individual and unique in the course of development, remain strikingly specific to the individual. These individual traits remain strong and firmly anchored even in old age. So the general traits become blurred and unified at the physical and mental level, while the individual attitude, reaction, gesture, remains permanent in the character portrait.

In a future positive space society, future humans will live very long lives, because both society and individuals will strive to maintain their health from birth.

They will strive to eliminate accidents at work and at home. Traffic accidents will disappear as a result of automated driving. They will not use drugs, tobacco or alcohol in any form. They will eat only fresh organic produce without preservatives. They will live normal heterosexual lives, eliminating left-handedness and obesity as factors that reduce longevity.

Medical activity, instead of curing, shifts to a form of health-preserving activity. The issue of time will be addressed flexibly, because the 15–30 minute accuracy of human metabolism will be adopted as the moral standard and thus, everyday stressful situations will be greatly reduced.

So their life expectancy will likely be 180–200 years.

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