Deep Science Publishing
https://doi.org/10.70593/978-93-49910-64-5_1

Chapter 1: Understanding the concept aging beyond the years

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Abstract

Aging is a complex, multifaceted process that encompasses biological, psychological, and social dimensions. It is commonly defined as the gradual decline in physiological function over time, resulting in increased vulnerability to disease and death. From a biological standpoint, aging is marked by cellular and molecular changes such as DNA damage, oxidative stress, and telomere shortening. Psychologically, it involves changes in cognition, emotional regulation, and self-perception. Socially, aging is influenced by cultural attitudes, social roles, and access to resources and support systems. The concept of aging is not solely a matter of chronological years, but also includes functional and perceived age. As populations worldwide continue to age, understanding the various dimensions of aging becomes increasingly important for developing effective healthcare, social policies, and support systems that promote healthy and active aging. This abstract aims to highlight the interdisciplinary nature of aging and the need for a holistic approach to address the challenges and opportunities associated with an aging society, especially for the aged people.

Keywords: Biological aging, Active aging, Social aging, Healthy aging, Lifespan, Senescence, Gerontology, Cellular changes, Telomere shortening, Oxidative stress,

1. Introduction

Living longer is a general desire of every creature including human being, although for some of the males like Antechinus, Australian Redback Spider, Boullanger Island Dibbler, Brazilian Slender Opossum, Dark Fishing Spider, Furcifer Labordi Chameleons, Octopus, Phascogale, Praying Mantis, Trans Volcanic Bunchgrass die sooner or later after one or two mating (Bebé, 2020). This everlasting desire of creatures is hampered by a process called as ageing. For many who have not biological background, the simple course of getting older means them as “ageing” or “ageing”.

The word “ageing” is usually applied to all animals’ including human being, plants, fungi etc., whereas some entities such as bacteria, perennial plants and some simple animals are biologically immortal i.e. they do not die but rather their body is converted into newer forms. In the wider sense, ageing can refer to a single cell in tissues, tissue in organ, or within an organism that has ceased to divide (cellular senescence) or to the whole population of a species (population ageing). So, a cell or, tissue, organism, whole population can age following different biological pathways.

1.1. Aging in Human

In humans, ageing is considered as the accumulation of the variations at physical, physiological psychological level in the body that lead to change in social interaction. Some age at a slower rate and therefore, live longer. While some experience a faster ageing process leading to die early. Many people exhibit a natural ageing process depending on the location they live in the planet, food habit they adopt, metabolic rate they come up with, stress level they can handle, life style they live etc. Depending on the average rate of death in a country, the life expectancy in calculated. Disease and ageing are intricately associated with each other.

Health consciousness and medical facility are found to be two major factors that control the life expectancy in different countries. Therefore, the human life expectancy is accelerating at a constant rate of increase from 47 years (estimated for the year 1955) to 73 years, estimated for the year 2020 (Fig. 1.1 Worldometers, 2020). As ageing can impose human body to disease(s) or a chronic disease(s) can also force the human body to age faster, it is estimated that about two thirds of 150,000 people die each day in the planet are closely found to suffer from age associated complications.

1.2. Theories on Aging

Many theories have been put forward to explain the exact causes of ageing. Therefore, the causes of ageing are explained in different ways. Experiments following cellular, biochemical, behavioral, physiological, social and other approaches are resulted in explaining ageing in different ways, finally, making the ageing theory a plausible one. Current theories on ageing are based on biological aspects, and are based on the rate and level of continues damage at bimolecular structure and function, cellular damage, organ dysfunction and finally misbalance in whole body level.

Accumulation of damage mainly at DNA level (example, DNA oxidation) leads to disturb the central dogma of protein synthesis and it may cause biological systems to fail partially or fully, or to initiate the programmed ageing associated events such as DNA methylation. Programmed ageing is a process which imposes the cells to follow

regular ageing associated events and therefore, it is different from the programmed cell death (apoptosis). However, as dissected earlier, contracting death in males of males after mating does not follow the normal process of ageing.

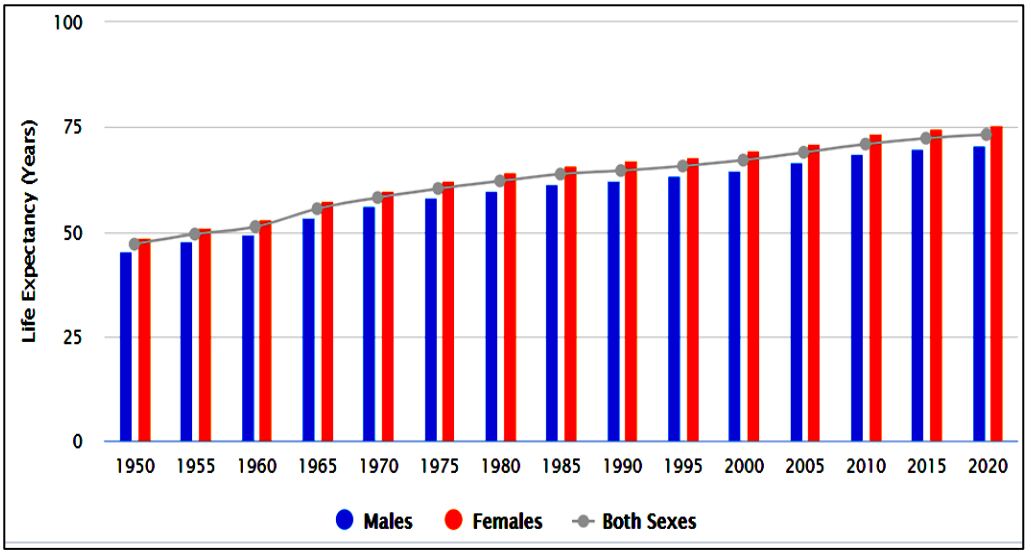

Figure 1.1. The trend of increase of avarge life expanctancy of human from 1995 to 2020 (source Worldometers, 2020)

In contrast to ageing that followed as a tendency by all most all craetures, some species are also considered as immortal. For example, bacteria fission to produce daughter cells, strawberry plant grows runners to produce clones of themselves, and animals in the genus Hydra have a regenerative ability by which they avoid dying of old age. All primitive single-celled organisms, for examples, prokaryotes, protozoans and, algae, multiply by fission into daughter cells; thus practically do not follow the ageing events and are considered as innately immortal. This process is important for such organisms to maiantin their race. On the other hand, aging followed by death was started with the evolution of sexual reproduction that intiated with the fungal/animal kingdoms approximately a billion years ago, and the evolution of seed-producing plants 320 million years ago. The sexually reproducing organisms were then tried to pass on thier genetic materials in the form seed or zygotes to maiantins their race. However, the process include variation to allow evotion, as a result, the offsrings become diferent than parents. Such examples are also seen in prokaryotes and such an event is in the bacterium *Eschechia coli* that divides into different daughter cells. It inidcates theoritically that "age classes" can be formed among mortal and immortal organsism. Within humans and other mortal species, stem cells are examples that show the charcatreistics of immortality.

1.3. The process og Aging

The process of ageing in animals is a trend and as per the ageing theory, few hallmarks that are conidered as markers of ageing. They are, genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, deregulated nutrient-sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and altered intercellular communication. So, based on the phiosiological or physcical apperanace, ageing cant be predcited. It is a set of celular events that lead to age the whole body. However, ceratin steps may be taken to slower the process of ageing. Modern research is also aimed to force stop ageing, albetit results are limited at few experimental set ups. Many day today events and life style including food habits can change or cotnrol the never ending ageing process. Therefore, life expentfcancy in different contores are dieffetnt (Table 1.1). All posiible aspects of aging and its associated evenst are discussed in subsequent chaptesr.

Table 1.1. Life expectancy of human in different countries.

Country	**Both sex**	♀	♂	**Country**	**Both sex**	♀	♂	**Country**	**Both sex**	♀	♂
Hong Kong	**85.29**	88.17	82.38	Ecuador	**77.71**	80.45	75.05	Philippines	**71.66**	75.92	67.67
Japan	**85.03**	88.09	81.91	Sri Lanka	**77.56**	80.74	74.25	Tonga	**71.32**	73.38	69.28
Macao	**84.68**	87.62	81.73	Algeria	**77.5**	78.76	76.3	Western Sahara	**71.08**	73.19	69.36
Switzerland	**84.25**	86.02	82.42	Antigua, Barbuda	**77.47**	78.58	76.26	Iraq	**71.08**	73.21	68.96
Singapore	**84.07**	86.15	82.06	China	**77.47**	79.73	75.36	Sao Tome, Principe	**71.01**	73.5	68.54
Italy	**84.01**	85.97	81.9	Peru	**77.44**	80.15	74.87	Vanuatu	**70.99**	72.75	69.4
Spain	**83.99**	86.68	81.27	Morocco	**77.43**	78.66	76.17	Cambodia	**70.54**	72.69	68.2
Australia	**83.94**	85.8	82.08	Montenegro	**77.39**	79.77	74.99	Mongolia	**70.53**	74.79	66.43
Channel Islands	**83.6**	85.31	81.82	Tunisia	**77.36**	79.34	75.37	India	**70.42**	71.8	69.16
Iceland	**83.52**	84.9	82.15	Hungary	**77.31**	80.66	73.78	Guyana	**70.26**	73.53	67.22
South Korea	**83.5**	86.42	80.46	Argentina	**77.17**	80.42	73.82	Timor-Leste	**70.18**	72.36	68.14
Israel	**83.49**	84.91	81.98	Aruba	**76.79**	79.1	74.26	Rwanda	**70**	72.16	67.75
Sweden	**83.33**	84.97	81.69	Saint Lucia	**76.67**	78.06	75.27	Botswana	**69.86**	72.69	66.72
Martinique	**83.13**	86.1	79.85	Malaysia	**76.65**	78.78	74.71	Kiribati	**69.17**	73.12	65
France	**83.13**	85.82	80.32	Brazil	**76.57**	80.14	73.01	Laos	**68.89**	70.79	67.04
Malta	**83.06**	84.68	81.37	Romania	**76.5**	79.91	73.13	Senegal	**68.87**	70.88	66.64
Canada	**82.96**	84.74	81.15	Serbia	**76.47**	79.05	73.89	Turkmenistan	**68.63**	72.19	65.1
Norway	**82.94**	84.78	81.11	Lithuania	**76.41**	81.7	70.97	Madagascar	**68.21**	69.92	66.53
Ireland	**82.81**	84.32	81.29	Brunei	**76.35**	77.64	75.17	Fiji	**67.91**	69.97	66
New Zealand	**82.8**	84.38	81.2	North Macedonia	**76.26**	78.32	74.26	Djibouti	**67.87**	70.16	65.84
Greece	**82.8**	85.08	80.52	Syria	**76.06**	79.11	73.13	Ethiopia	**67.81**	69.8	65.86

Luxembourg	**82.79**	84.76	80.83	Honduras	**75.87**	78.14	73.57	Pakistan	**67.79**	68.9	66.77
Netherlands	**82.78**	84.35	81.2	Kuwait	**75.85**	77.06	75.09	Myanmar	**67.78**	70.81	64.65
Guadeloupe	**82.74**	85.94	79.16	Vietnam	**75.77**	79.85	71.73	Eritrea	**67.48**	69.75	65.26
Portugal	**82.65**	85.28	79.79	Latvia	**75.73**	80.37	70.81	Kenya	**67.47**	69.87	65.04
Finland	**82.48**	85.14	79.82	Saudi Arabia	**75.69**	77.37	74.47	Gabon	**67.03**	69.27	64.93
Belgium	**82.17**	84.31	80	Armenia	**75.55**	78.9	71.82	Yemen	**66.44**	68.16	64.72
Austria	**82.05**	84.19	79.88	Mauritius	**75.51**	78.92	72.21	Tanzania	**66.39**	68.25	64.52
Germany	**81.88**	84.14	79.62	Bulgaria	**75.49**	79.06	72.05	Sudan	**66.09**	68.03	64.18
Slovenia	**81.85**	84.44	79.26	Mexico	**75.41**	78.17	72.62	Afghanistan	**65.98**	67.59	64.47
UK	**81.77**	83.28	80.22	Nicaragua	**75.23**	78.65	71.75	Malawi	**65.62**	68.77	62.45
Réunion	**81.55**	84.45	78.52	Belarus	**75.2**	79.9	70.15	Mauritania	**65.57**	67.24	63.88
Cyprus	**81.51**	83.45	79.55	Belize	**75.09**	78.25	72.14	Papua New Guinea	**65.22**	66.62	63.92
Denmark	**81.4**	83.27	79.54	Guatemala	**75.05**	77.89	72.14	Congo	**65.21**	66.73	63.67
Virgin Islands	**81.17**	83.52	78.64	Jordan	**75.01**	76.82	73.28	Comoros	**65.03**	66.88	63.24
Taiwan	**81.04**	83.64	78.49	Jamaica	**74.88**	76.6	73.17	Liberia	**65**	66.48	63.54
Costa Rica	**80.94**	83.39	78.53	Dominican Republic	**74.65**	77.9	71.58	Haiti	**64.99**	67.21	62.77
Guam	**80.74**	83.98	77.63	State of Palestine	**74.62**	76.38	72.92	Ghana	**64.94**	66.13	63.78
Chile	**80.74**	82.8	78.54	Paraguay	**74.59**	76.78	72.55	South Africa	**64.88**	68.42	61.46
Qatar	**80.73**	82.49	79.78	Bahamas	**74.28**	76.51	71.95	Namibia	**64.86**	67.67	61.83
Puerto Rico	**80.69**	83.92	77.27	Georgia	**74.24**	78.54	69.85	Zambia	**64.7**	67.71	61.66
French Guiana	**80.53**	83.38	77.8	El Salvador	**74.06**	78.48	69.27	Uganda	**64.38**	66.67	61.99
Maldives	**79.89**	81.58	78.53	Trinidad and Tobago	**73.91**	76.66	71.24	Niger	**63.62**	64.89	62.41
Mayotte	**79.85**	83.24	76.62	Kazakhstan	**73.9**	77.97	69.55	Gambia	**63.26**	64.73	61.8
Czechia	**79.85**	82.35	77.33	Samoa	**73.75**	75.97	71.69	Burkina Faso	**62.98**	63.78	62.06
Barbados	**79.64**	80.85	78.36	Seychelles	**73.74**	77.71	70.26	Benin	**62.84**	64.45	61.23
Curaçao	**79.41**	82.08	76.42	Cabo Verde	**73.58**	76.83	70.15	Burundi	**62.71**	64.56	60.85
Poland	**79.27**	82.98	75.51	Bangladesh	**73.57**	75.6	71.8	Guinea	**62.64**	63.25	61.79
Lebanon	**79.27**	81.17	77.53	Libya	**73.44**	76.46	70.61	Angola	**62.22**	65.12	59.46
Cuba	**79.18**	81.12	77.25	Solomon Islands	**73.38**	75.31	71.6	Zimbabwe	**62.16**	63.66	60.39
Estonia	**79.18**	83.06	74.98	Azerbaijan	**73.33**	75.87	70.76	Togo	**62.13**	63.08	61.16
United States	**79.11**	81.65	76.61	Russia	**72.99**	78.15	67.62	Mozambique	**62.13**	64.95	59.05
Panama	**79.1**	82.2	76.14	North Korea	**72.89**	76.37	69.26	DR Congo	**61.6**	63.21	60.01
Croatia	**79.02**	82.02	75.95	Bhutan	**72.77**	73.33	72.27	Eswatini	**61.05**	65.67	56.98
Albania	**78.96**	80.48	77.48	Grenada	**72.59**	75.16	70.24	Mali	**60.54**	61.39	59.69
Oman	**78.58**	80.94	76.9	Egypt	**72.54**	74.95	70.23	Cameroon	**60.32**	61.66	58.99

UAE	**78.46**	79.8	77.79	Ukraine	**72.5**	77.27	67.56	Equatorial Guinea	**59.82**	61.08	58.76
Turkey	**78.45**	81.21	75.57	Bolivia	**72.35**	75.35	69.5	Guinea-Bissau	**59.38**	61.33	57.31
Uruguay	**78.43**	81.88	74.75	Venezuela	**72.34**	76.25	68.59	Côte d'Ivoire	**58.75**	60.13	57.5
French Polynesia	**78.23**	80.41	76.23	Indonesia	**72.32**	74.64	70.12	South Sudan	**58.74**	60.31	57.21
New Caledonia	**78.16**	80.89	75.61	Moldova	**72.3**	76.53	68.02	Somalia	**58.34**	60.11	56.62
Slovakia	**78**	81.35	74.59	Suriname	**72.13**	75.55	68.88	Sierra Leone	**55.92**	56.78	55.01
Bosnia and Herzegovina	**77.93**	80.32	75.48	Uzbekistan	**72.04**	74.26	69.8	Nigeria	**55.75**	56.75	54.8
Colombia	**77.87**	80.54	75.18	Kyrgyzstan	**71.95**	76.03	67.85	Lesotho	**55.65**	58.9	52.52
Thailand	**77.74**	81.34	74.16	Tajikistan	**71.76**	74.11	69.5	Chad	**55.17**	56.65	53.73
Bahrain	**77.73**	78.88	76.87	Nepal	**71.74**	73.23	70.13	Central African Republic	**54.36**	56.58	52.16

All coutnries are mentioned from top to botton as per the rant in life expectancy, ♂-male, ♀ - female (source, Worldometers, 2020).

1.4. Care for the aged population

The world is experiencing an unparalleled demographic shift toward older populations, because global life expectancy increases and fertility rates weakening. Since change is the law of life, this change has significant and profound implications for individuals, families and societies. It also impacts social security systems, inter-generational solidarity and social infrastructure. In today's busy world, ‘ageing’, often seen as a process of decline, also provides a rich arena for social and philosophical reflection. The transformation of the ageing body over time is not just a site of biological change, but a vehicle for accumulated wisdom, much life experience and existential depth. This paper examines the multifaceted nature of ageing from social, psychological, philosophical and ethical perspectives. This study critiques current socially dominant life care structures, analyzes ethical approaches to care, social security, and future challenges and proposes a culturally based framework for promoting longevity, well-being, and intergenerational social harmony.

1.5. Conclusion

Aging is the natural and progressive decline in biological functions and the ability of an organism to adapt to metabolic stress and environmental challenges over time. It affects all living organisms and ultimately leads to increased vulnerability, disease, and death. Gradual deterioration of physiological functions, cellular and molecular damage that accumulates over time, reduced regenerative capacity of tissues and organs, higher susceptibility to diseases, like cancer, cardiovascular conditions, neurodegenerative disorders, and immune decline are the indicators of aging. Programmed Theory, Damage or Error Theory, Free Radical Theory and Epigenetic Theory are few that explain the concept of aging.

Author Contributions: "Conceptualization, methodology, software, validation, for-mal analysis, investigation, resources, data curation, writing—original draft preparation, writing—review and editing: BRP. The author has read and agreed to the published version of the manuscript.

Funding: This work was funded by DBT Star College Scheme, 12th batch, Granted to College of Basic Science and Humanities under the cordinatorship of Dr Biswaranjan Paital (HRD-11011/33/2022-HRD-DBT)" and "The APC was not funded by anyone".

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data are published in this article. The authro declares that this manuscript is an original work, prepared with the consent and contribution of all listed authors. It has not been submitted to, nor published in, any other journal or platform. All figures and tables are drawn using appropriate Creative Commons platforms with proper attribution. We as authors declare that there are no conflicts of interest related to this work.

Acknowledgments: Encouragement by my mentor Prof. GBN Chainy, former Head, Department of Zoology and Department of Biotechnology, Utkal University, Bhubaneswar, India is duly acknowledged.

Conflicts of Interest: "The author declares no conflict of interest." "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results".

Citation: Paital B (2025) Understanding the concept aging beyond the years. *In*: Paital B (ed) *Defy the Clock with Slow Aging*, 1st edn. Deep Science Publishing, USA, pp. 1-7, doi: https://doi.org/10.70593/978-93-49910-64-5_1