

COMENIUS UNIVERSITY IN BRATISLAVA
FACULTY OF MEDICINE

Mechanism and Biomarkers of Ageing
DIPLOMA THESIS

Study programme: General Medicine

Field of study: 7.1.1. General Medicine

Training work place: Institute of Medical Chemistry, Biochemistry and Clinical
Biochemistry

Supervisor: RNDr. Zuzana Országhová, PhD.

Bratislava 2019

Buchta Peter Leopold

ABSTRACT

BUCHTA Peter Leopold: *Mechanism and Biomarkers of Ageing*. [Diploma thesis] – Comenius University in Bratislava, Faculty of Medicine; Institute of Medical Chemistry, Biochemistry and Clinical Biochemistry. - Supervisor: RNDr. Zuzana Országhová, PhD., Bratislava, 2019, pp.: 65

Aging is a universal and multifactorial process characterized by a gradual decline of physiological functions, occurring at the molecular, cellular, and tissue levels, which involve a series of mechanisms such as deregulated autophagy, mitochondrial dysfunction, telomere shortening, oxidative stress, systemic inflammation, and metabolism dysfunction. The deregulation of these pathways leads the cell to a senescent state, which contributes to aging phenotype and, eventually, driving towards age-related diseases.

Due to the growing population in the world and the increase of the ratio of elder people it gets more and more interesting to sustain healthy aging. Over the past decades several theories of aging have been proposed which included on the one hand the mistake accumulation theories like the wear and tear theory, rate of living, free radicals, crosslinking and somatic mutations and on the other hand the theories about programmed aging like replicative senescence and the role of telomeres. Due to these theories the hunt for biomarkers to track the course of healthy biological aging began.

The diploma thesis provides the basic theoretical knowledge of ageing, the mechanisms that lead the cell to senescence and how this process can contribute to aging and age related diseases as well as the biomarkers of aging and its monitoring.

Keywords: ageing, senescence, biomarkers of aging, genomics, epigenomic, glycomics, sarcopenia

ABSTRAKT

BUCHTA Peter Leopold: *Mechanizmus a biomarkery starnutia*. [Diplomová práca]. - Univerzita Komenského v Bratislave, Lekárska fakulta; Ústav lekárskej chémie, biochémie a klinickej biochémie. – Vedúci práce: RNDr. Zuzana Országhová, PhD., Bratislava, 2019, počet strán: 65

Starnutie je univerzálny a multifaktoriálny proces charakterizovaný postupným poklesom fyziologických funkcií, prebiehajúcich na molekulárnej, bunkovej a tkanivovej úrovni a ktoré zahŕňajú celý rad mechanizmov, ako sú deregulovaná autofágia, mitochondriálna dysfunkcia, skracovanie telomér, oxidačný stres, systémové zápalý. a porucha metabolizmu. Deregulácia týchto dráh vedie bunku k starnutiu, čo prispieva k starnutiu fenotypu a nakoniec vedie ku chorobám súvisiacim s vekom.

Vzhľadom na rastúcu populáciu na svete a zvyšovanie podielu starších ľudí je stále viac a viac zaujímavé udržiavať zdravé starnutie. V posledných desaťročiach bolo navrhnutých niekoľko teórií starnutia, ktoré na jednej strane zahŕňajú teórie akumulácie chýb, ako je teória opotrebovania, životné tempo, voľné radikály, zosieťovanie a somatické mutácie a na druhej strane teórie programovaného starnutia, ako sú replikatívna senescencia a úloha telomér. Vďaka týmto teóriám sa začalo hľadanie biomarkerov na sledovanie priebehu zdravého biologického starnutia.

Diplomová práca poskytuje základné teoretické vedomosti o starnutí, mechanizmoch, ktoré vedú bunku k senescencii, o biomarkeroch starnutia a jeho monitorovania, ako aj o ochoreniach spojených s vekom.

Kľúčové slová: starnutie, senescencia, biomarkery starnutia, genomika, epigenomika, glykomika, sarkopénia

5. Conclusion

The process of aging and its rate cannot be measured uniformly because of genetics and environmental factors differing from person to person. Age-related changes in body function or composition that could serve as a measure of “biological” age and predict the onset of age-related diseases and/or residual lifetime are termed “biomarkers of ageing”. A lot of candidate biomarkers have been discovered so far but in all cases their variability in cross-sectional studies is considerable. No single biomarker has yet been proven to be suitable for solely describing the aging of a group or an individual. This might be caused due to the multi-casual and multi-system involving process of aging. Therefore it must be considered that several biomarkers have to be put together to create useful measuring parameters for healthy aging. Despite of all the efforts undertaken until now the topic of biomarkers of aging is still requiring a lot of time- and cost-intensive research, which in the future maybe leads to better understand aging and a reduction of age related diseases.

With respect to mentioned above the diploma thesis provides the summary of theoretical, experimental and clinical knowledge of the aging process with emphasis on the mechanism and theories of aging, biomarkers of aging and possibilities of its monitoring as well as age-associated diseases.

Diploma thesis was supported by the project „Nutrition and Healthy Aging“ (NutriAging), Interreg V-A V-014, realized under the Cross-border Cooperation Program of the Slovak Republic – Austria.