NATIONAL RESEARCH PROGRAMME 'HEALTHY AGEING'
CHAPTER I
GENERAL PROVISIONS

1. The purpose of the National Research Programme 'Healthy ageing' (hereinafter – the Programme) is to obtain the new scientific knowledge required to extend the duration of a healthy and quality life in Lithuania. According to Statistics, at the beginning of 2014 there were 542,700 persons aged 65 and over living in Lithuania. Since 2010, the proportion of persons over 65 has increased from 17.3 % to 18.4 % of the total population (http://osp.stat.gov.lt/temines-lenteles19). The Statistical Office of the European Union (EUROSTAT) forecasts that unless the situation changes nearly one third (28.9%) of the Lithuanian population will be elderly persons by early 2030. Conventionally, people aged 60-75 are referred to as elderly, 75-90 as senior and those above 90 years as the oldest age group. For the purpose of the present Programme, the elderly are called people aged 60 and over, and persons aged 75 and over are referred to as senior.

2. The declaration 'Health for all in the 21st century" (1998) adopted by the World Health Organisation (hereinafter – the WHO) defined two major targets for the European region: 'Healthy ageing' and 'Research and knowledge for health'. It is projected that the number of people aged 65 and over will increase by 70 % by 2050, and that those over 80 will increase by 170 %. The White Paper of the European Commission 'Together for Health: A Strategic Approach for the EU 2008–2013', Brussels, 23.10.2007. COM (2007) 630 final) defined the general strategic measures and actions for the health policy of EU Member States and the healthcare of their citizens. The White Paper also formulated an important strategic objective – fostering good health in an ageing Europe. The projected demographic developments are believed to cause an accelerated increase in the demand for and changes to existing and new healthcare services.

3. According to EUROSTAT's demographic projections, people aged 64+ will account for about 17 % of the total population by 2020. The Lithuanian Health Programme for 2014-2025

implemented by Resolution No. XII-964 of 26 June 2014 of the Seimas of the Republic of Lithuania 'On the approval of the Lithuanian Health Programme for 2014-2025' provides that the target average life expectancy in 2020 is 76 years.

CHAPTER II
ANALYSIS OF THE CURRENT STATUS RESEARCH STATUS

4. Ageing is one of the unavoidable and irreversible phenomena of life caused by a number of genetic, epigenetic and environmental factors and their interaction. The multilateral ageing process is manifested by a decrease in physiological integrity, a weakening of the functions of the body's systems, and increased mortality rates. Such changes constitute the basis for most degenerative diseases (hereinafter – DD), e.g. cardiovascular system diseases, cancers, neurodegenerative diseases, type II diabetes, musculoskeletal diseases, and others. The research of the ageing biology of different organisms conducted in the course of the past decades has discovered tentative hallmarks which represent common denominators of ageing: genomic instability, telomere attrition, epigenetic alterations, the loss of proteostasis, deregulated nutrient-sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and altered intercellular communication (López-Otín, C., Blasco, M., Partridge, L., Serrano, M., Kroemer, G., 2013. The hallmarks of aging. Cell 153(6), 1194-1217). The interconnectedness between such processes, their overall impact upon ageing, and the occurrence of diseases has not yet been properly researched. New knowledge would facilitate the identification of methods to affect the ageing process and prevent the onset of diseases. Several fundamental molecular factors of ageing and their components (the GH-IGF-1 signal path and its components – mTOR, the sirtuin family proteins and their targets in a cell). The findings of this research constituted the basis for the development of strategies for the treatment of ageing-caused metabolism disorders based on the signal path suppressant rapamycin (aur J.A., Ungvari Z., Minor R.K., Le Couter D. G., de Cabo R. 2012. Are sirtuins viable targets for improving healthspan and lifespan? Nat Rev Drug Disc. 11(6) 443-461. Human trials of agents including metformin, rapalogs, PDGF, and IL-7 are being planned or have already started. The application of animal research models is in progress to determine the possibility of using the induced pluripotent cell technologies for the regeneration of cells, or stimulating the immune clearance of damaged or senescent cells causing inflammation.

5. Biological processes in an ageing organism are interrelated and progress in parallel, and therefore system biology methods should be used for their integrated research (Clay, L., Barral, Y., 2013. New approaches to an age-old problem. Curr Opin Biotechnol 24(4), 784-789). It has been repeatedly stressed that for successful development in the research of biological ageing mechanisms it is necessary to develop new experimental research models (Kirkland, J.L, 2013. Translating advances from the basic biology of ageing into clinical application. Experimental Gerontology 48(1), 1-5). The past decades have witnessed a specifically rapid development of somatic cell reprogramming technologies enabling the pluripotent cells to be generated in laboratory conditions (hereinafter – iPL) (Yamanaka, S., 2012. Induced pluripotent stem cells: past, present, and future. Cell Stem Cell 10(6), 678-684). The technology is considered to be ethically acceptable as it uses somatic donor cells. The identified iPL of patients affected by different diseases may be used for modelling the different pathological conditions (research into pathophysiological mechanisms, the selection of medical substances, etc.), and the creation of new customised therapy methods. For instance, human neurons are necessary in order to achieve an adequate modelling of chronic neurodegenerative diseases under *in vitro* conditions (Qiang, L., Fujita, R., Abeliovich, A., 2013. Remodelling neurodegeneration: somatic cell reprogramming-based models of adult neurological disorders. Neuron 78(6), 957-969). With the help of modern technologies the somatic cells of a person affected by a neurodegenerative disease may be reprogrammed and differentiated into neurons of a preferred type. Researchers have even developed technologies for the 'accelerated ageing' of neurons (Miller, J.D., Ganat, Y.M., Kishinevsky, S., Bowman, R.L., Liu, B., Tu, E.Y., Mandal, P.K., Vera, E., Shim, J.W., Kriks, S., Taldone, T., Fusaki, N., Tomishima, M.J., Krainc, D., Milner, T.A., Rossi, D.J., Studer, L., 2013. Human iPSC-based modelling of late-onset disease via progerin-induced ageing. Cell Stem Cell 13(6), 691-705). The technological breakthroughs of the last few years have opened up new prospects for the creation of strategies for the prevention, diagnostics and treatment of ageing-related diseases.

6. Ageing-related pathologies are complex and dynamic processes, the understanding of which requires further research. Therefore, the application of new technologies is and will remain important in the foreseeable future for disclosing the ageing biology and the pathogenesis of ageing-related diseases, as well as the creation of new diagnostic and therapeutic means. For the purpose of disclosing the links between the ageing processes and ageing-related diseases, it is

necessary to develop the application of second generation nucleic acids sequences, while identifying genetic and epigenetic changes in specific organism cells and their dynamics, implement technological, system biology and bioinformatics methods in an integrated manner, use animal methods, develop molecular research on the interaction between individual immune response, the genome and the environment.

7. New diagnostics and treatment methods have extended the life expectancy of people with different diseases which have additional financial costs for healthcare and social security. Therefore, developed countries are seeking to extend the duration of high quality life, i.e. life without disability or diseases. Modern public health science analyses a number of different indicators used to assess the economic and social consequences of diseases. The research objects include the quality of life, the number of years lost due to disease or disability (DALY), the quality adjusted life years (QALY) and other indicators instrumental in evaluating the economic damage of diseases and demonstrating the importance of preventive treatment, early diagnostics and customised treatment means. The extension of a healthy life span would probably lead to a reduction in health care costs by providing protection against diseases for which aging is a risk factor. Aging--lost in translation? N Engl J Med 361(27), 2669-2670). Regretfully, there have been only a few key innovations that increase the quality of care and decrease the cost of care (Fuchs, V.R, 2010. New priorities for future biomedical innovations. N Engl J Med 363(8), 704-706).

8. When addressing the problem of healthy ageing increasing focus is placed upon the development of personalised molecular medicine (Hoffman, E.P., 2007. Skipping toward Personalised Molecular Medicine. New England Journal of Medicine 357(26), 2719-2722). There is broad agreement that the personalised application of primary preventive and treatment methods, including regenerative medicine, are overly important from the viewpoint of healthy ageing and the quality of life (Jamison, D.T., Summers, L.H., Alleyne, G., Arrow, K.J., Berkley, S., Binagwaho, A., Bustreo, F., Evans, D., Feachem, R.G., Frenk, J., Ghosh, G., Goldie, S.J., Guo, Y., Gupta, S., Horton, R., Kruk, M.E., Mahmoud, A., Mohohlo, L.K., Ncube, M., Pablos-Mendez, A., Reddy, K.S., Saxenian, H., Soucat, A., Ulltveit-Moe, K.H., Yamey, G., 2013. Global health 2035: a world converging within a generation. Lancet 382(9908), 1898-1955).

9. According to data from the WHO, diagnostic and treatment measures for modern cardiovascular diseases, cancer, neurodegenerative diseases and diabetes are still inefficient

(World Health Organisation, 2008–2013). Early detection based on the use of sensitive and specific biomarkers, a speedy and targeted treatment, and the activation of the internal healing mechanisms of the organism are currently the essential tasks in fighting the most common diseases. The strategic 'Medical imaging" plan included in the EU Framework Programme for Research and Innovation Horizon 2020, approved by the Regulation of the European Parliament and of the Council No. COM (2011) 809 of 30 November 2011, noted the current need for new diagnostic and therapeutic methods which would lead to the development and implementation of personalised theranostic systems in clinics'.

10. Ordinarily *in vivo* theranostics is associated with integrated imaging and therapeutic methods. Modern diagnostic methods apply progressive, non-invasive optical imaging safe for the organism and the cell, using marked particles, magnetic resonance, ultrasound, X-rays (ETP Roadmaps in nanomedicine towards 2020. Joint European Commission / ETP Nanomedicine Expert Report, 2009): marked nanoparticles, contrast agents or stem cells are injected into the organism where they accumulate, marking the localisation of the damage caused by the disease. The targeted transfer area integrates the artificial biologically active transfer systems composed of at least two components, of which one is active. The creation of a molecular image requires specifically sensitive and reliable measures which may facilitate the diagnosing and monitoring of the course of a disease and the efficiency of the treatment. Find, fight and follow – that's the concept of theranostic measures.

11. An integrated addressing of any ageing-related issues requires the early detection of diseases caused by ageing, which is not possible without cutting-edge imaging technologies and the creation and improvement of signal analysis. An important strategic objective for Lithuania is to develop, improve and implement innovative cutting edge early diagnostic methods for diseases which shorten a healthy and high quality life in clinical practice as this would ensure not only the general needs of the patient, but also individualised treatments. This on-going research may become the basis for several principal imaging and diagnostic directions – early diagnostics, non-invasion diagnostics, combined diagnostics and functional diagnostics, which would facilitate an efficient addressing of complex ageing-related problems and support the development of new methods and methodologies.

12. Elderly people suffer from chronic diseases, reduced physical capacity, cognitive, hearing, vision, voice, and other disorders more frequently. In view of the overall ageing populations the

number of individuals suffering from dementias and other neurodegenerative diseases will undoubtedly increase. Therefore, the further improvement of imaging and functional research technologies which would contribute to an improvement of the early detection of neurodegenerative diseases and facilitate the application of individualised and innovative prevention and treatment methods is of the utmost importance. For instance, one of the methods of diagnosing the early stages of Parkinson's disease is an ultrasound which enables the detection of subcortical changes in the brain in their early stages. Currently researchers are also trying to identify molecular markers for the early diagnosis of neurodegeneric diseases. Another method used for the detection of early Alzheimer's disease is magnetic resonance spectroscopy (indicative in view of memory disorders). The early detection methods for the disease also include an examination of amyloid sediments and other proteins in the cerebrospinal fluid.

13. In view of the accelerating pace of life and the improvement in treatment methods there is a growing need for early express diagnostics. Early diagnostics is closely related to fast, simple and painlessly performed procedures; however, there is still a shortage of sensitive non-invasive methods while the spectrum of their application remains overly narrow. Express diagnostics also includes methods which might be applied in relation to surgical procedures for the purpose of the specification of damage localisation. The combination of the most advanced technologies opens up new opportunities to develop new diagnostic methods. The application of multifunctional diagnostic particles (markers) for diagnosing diseases allows different research and examination methods which were previously considered incompatible to be combined – namely molecular analysis, and structural and functional imaging methods. Combined diagnostics will allow the accurate identification of a disease and its localisation.

14. Modern research efforts focus mostly upon non-invasive imaging and diagnostic methods. This is especially important for elderly persons as these new methods alleviate the adverse effect of a diagnosis on the organism and the experience for patients is less stressful. One of the priorities in the modern bionanomedical imaging and diagnostic methods is functional diagnostics, which is closely related with individualised diagnostics and treatment. Functional diagnostics is an entirety of methods and methodologies intended to detect functional disorders which affect the function of the organism. The advantage of such diagnostics is its ability to detect not only structural changes of tissues, but also to image metabolic processes with regard to the specifics of each individual.

15. Diagnostic and prognostic means based on molecular markers, minimal invasive technological-engineering solutions, achievements in nanotechnologies, innovative imaging, signal analysis methods through the use of information technologies for image processing and analysis, new biologically compatible substances used for diagnostics – these are the measures capable of improving the quality of healthcare and reducing the cost of providing protection against diseases in which ageing is a risk factor.

CHAPTER III
OBJECTIVE AND TASKS OF THE PROGRAMME, IMPLEMENTATION MEASURES

16. The objective of the Programme is an integrated analysis of and the finding of solutions regarding issues in the healthy ageing biomedicine and social medicine of Lithuanian society through the development of science and technologies, as well as the results of fundamental and applied research.

17. Tasks of the Programme:

17.1. to develop new methods for the evaluation and prevention of disease risk factors; to research and evaluate their impact upon the duration of a healthy, good quality life;

17.2. to develop methods for the early detection and forecasting of the progress of diseases which shorten a healthy and productive life through the use of biotechnologies, nanotechnologies, information and communications technologies;

17.3. to develop, improve and research methods for the treatment of health conditions affecting the duration of a healthy and productive life, patient rehabilitation methods, and long-term monitoring methods, as well as technologies which reduce the social exclusion of the elderly in Lithuania.

18. The assignments under the Programme, their content and the necessary measures are defined for each task under the Programme individually.

19. Four measures have been envisaged for addressing the task referred to in sub-item 17.1 of the Programme:

19.1. Measure 1 – to assess the epidemiological situation of ageing-related diseases and its changes with a view to scientifically substantiating strategies for the preventive treatment of such diseases through reference to life-style, biological and genetic factors.

It is of the utmost importance to assess the epidemiological situation of ageing-related diseases and its changes with a view to scientifically substantiating strategies for the prevention of such diseases through reference to life-style, biological and genetic factors.

19.2. Measure 2 – to assess the development of the risk factors of ageing-related degenerative diseases in different periods of life, and forecast the risk factors.

It is important to study susceptibility to oncological diseases and the genetic factors predisposing diseases, cardiac insufficiency prevention measures, cardiovascular diseases continuum concept, the reasons for progressing changes in the musculoskeletal system, as well as conducting research in age-related macular degeneration, sensory impairment, anxiety, appearance of depression and the disorders of the cognitive functions.

19.3. Measure 3 – to develop an individual-specific preventive treatment methodology with reference to genetic, life-style, metabolism, nutrition, and psychosocial factors.

This will involve research into which genetic, life-style or psychological factors contribute to the ability to remain healthy and independent. An integrated survey of such factors and the assessment of their interaction would be instrumental in developing preventive methods designed to maintain physical and cognitive functions, as well as the quality of life and independence of the elderly.

19.4. Measure 4 – to assess the physical and psychological well-being of the elderly and its determinants.

The integrated research of the reasons for psychological health disorders (life-style, socio-economic, environment and genetic factors) as well as research into the pathophysiological mechanism would facilitate the creation of models for efficient integrated preventive treatments which could be implemented by different institutions. In addressing the issue special attention is devoted to cohort studies (long-term observation) which dispose of biobanks and an efficient outcome (new cases of the disease, complications, disability, deaths) registration system.

20. Three measures have been envisaged to address the task referred to in sub-item 17.2 of the Programme:

20.1. Measure 1 – to search and study the molecular factors inhibiting or suppressing the ageing of human cells, as well as differentiation and disorders of the regenerative potential, and study the diagnostic and applied value of such factors.

For the purpose of studying the biological processes of ageing it is important to engage highly efficient study technologies, studies of comparative genomics and genetic associative studies, bioinformation and system biology methods. The application of technologies for the determination of second generation nucleic acid sequences, transcriptome, proteome, metabolome, interactome, metagenome and bioinformation analysis, and integrated analysis methods, by combining multiple technologies enabling the analysis of biological analysis of different classes and/or their interactions will provide abundant information about the ageing processes at the molecular, genetic and epigenetic levels, as well as about the new relevant biomarkers of ageing.

It is necessary to study the molecular and functional characteristics of stem cells, differentiation and migration peculiarities. This would create the preconditions for using stem cells for an efficient regeneration of tissues, and would contribute to the creation and application of the treatment methods of circulatory system, cancer, neurodegenerative and other diseases in clinical practice;

20.2. Measure 2 – to consider new molecular markers and based on those develop new generation methods for diagnosing and forecasting diseases shortening the duration of a healthy and productive life through biotechnologies, postgenomic and bioinformation technologies.

It is important to establish (develop) sensitive, effective and economically substantiated methods for the early detection of degenerative diseases and other cancer-related diseases of the elderly (breast, cervical or colorectal cancer) by implementing diagnostics and prognostic measures based on molecular markers. It is necessary to further develop methods for the diagnostics of chronic and acute syndromes and the modern treatment of ischaemic heart disease. An identification of the molecular and cellular factors of valve degeneration disease pathogenesis would facilitate the creation of new treatment methods; such factors would be instrumental in stratifying the patient risk and development of patient-specific measures for the prevention of the progression of diseases.

20.3. Measure 3 – to develop new tools and measures for diagnosing diseases shortening a healthy and productive life, the planning of diagnostic procedures and the passing of clinical diagnostic solutions through the use of imaging, info-tele- and nano-technologies.

It is important to develop organism-saving and little invasive diagnostic and theranostic tools on the basis of multi-functional imaging markers. The diagnostic imaging capacities of modern

imaging systems – computer tomographs, organism imaging devices developed on the basis of nuclear magnetic resonance, x-rays, gama-rays, and ultrasound all depend on contrast agents and the incorporation of imaging biomarkers into the cycle of the image formation to a large extent. A task of special importance is the development of new contrast imaging agents, radiopharmaceutical preparations, nano-particles and diagnostic and theranostic nanoplatforms instrumental in imaging the functional and metabolic processes caused by a disease, or highlighting disease damaged locations.

Sensitive and informative early diagnostic methods using optical technologies, optoacoustic synergies and non-invasive implementation technologies would facilitate the creation of new optical biopsy, non-invasive ultrasound transcranial sonography methods for the active diagnosis of neurodegenerative diseases, address the issue of the sonography resolution and would create suitable preconditions for the preparation and development of nanotechnology, biophone and laser application methodologies suitable to be used for diagnostics.

The diagnostic tools developed on the basis of nanotechnologies and cell technologies are expected to be more sensitive, accurate and more reliable, able to apply simultaneously the different measurement systems or several integrated analytical systems – from regular diagnostics or the imaging of the disease source to the management of a sophisticated diagnostic mechanism.

Models of medical signals and images based on information communication technologies, concepts of enhancement of resolution and informative and parametrisation methods realised by means of software, the search for segmentation, classifications, and internal patterns, knowledge obtaining methods adapted for clinical research would facilitate the creation of new signal, image and data flow processing methods, and software modules designed for stationary and embedded systems.

By engaging methods for the processing, merging and parametrisation of medical 2D and 3D images, multimodal synchronous signals and data flows, for computation of the parameters relevant for diagnostics and therapy, as well as knowledge of engineering and cloud computing, new computerised workstations could be created for doctors which would enable the intense processing of images and signals, parametrisation, the obtaining of the required information, the planning of diagnostic procedures, and the passing of well-reasoned clinical diagnostic decisions.

21. Three measures have been envisaged in order to address the task referred to in sub-item 17.3 of the Programme:

21.1. Measure 1 – to develop new and improve the existing methods for the treatment of diseases affecting the duration of a healthy and productive life on the basis of research into the molecular biology of systems and cells.

In order to develop new, secure and efficient strategies for the treatment of damaged tissues and organs by means of cell therapy and tissue engineering, it is necessary to investigate transitions of transplanted cells, their differentiation, contact with adjacent cells and the angiogenesis.

An especially acute scientific and practical problem is the identification, early detection and treatment of the factors of cardiovascular diseases caused by atherosclerosis, as well as research into the outcomes of periooperational myocardial infarction in elderly patients.

It is important to clarify the impact of adjuvant treatment upon tumoral cells (e.g. changes in the expression of adaptive and cytoprotective proteins, changes in the epigenetic regulation, etc.), the development of the clones of cells resistant to treatment, and an optimal treatment duration and schemes. An important task is to develop technologies for the characterisation of cancerous stem cells, study the molecular mechanisms of drug resistance of such cells, and further develop selective therapy measures.

It is necessary to further study the molecular mechanisms of ageing-related degenerative diseases. Therefore, it is necessary to develop and implement experimental models to study neurodegenerative diseases and customised treatment strategies.

21.2 Measure 2 – to develop and improve the measures and technologies intended to strengthen the abilities and ambitions of the elderly to seek good health, safety, fully-fledged participation in public life, and productiveness well into old age.

Further studies are required on the impact of physical activity, obesity, degenerative diseases of joints, osteoporosis, infectious diseases, mouth health and other factors upon healthy ageing. To that end it is necessary to create measures which would, in view of the appearance of new diagnostic and treatment methods, appropriately inform the public about the available possibilities, benefits and shortcomings of long-term palliative care. For the promotion of physical activity it is necessary to develop a set of scientifically grounded activities (assessments of risk factors, education, consultations with professionals, and the support of self-help groups). The newly developed health-strengthening technologies will incorporate a variety of methods

and measures (education, legal, financial and organisational measures, inclusion of society), and be based on the empowerment of communities.

It is necessary to develop science-based nutrition models to be followed and used by food producers and consumers. Clear and explicit guidelines are required to protect consumers from misleading information about products.

Therefore, it is necessary to develop and implement experimental models for studying neurodegenerative diseases and customised treatment strategies. New solutions covering social and legal issues, as well as new treatment and rehabilitation methods, are required in the geriatric psychiatry.

New information technology based techniques have to be implemented to reduce the social exclusion of the elderly and improve their quality of life. One of the most perspective technologies is non-contact technologies able to assess the biometric and disability characteristics, as well as management and augmented reality technologies. At the same time it is necessary to develop alternative (simplified, based on biosignals) electronic interfaces for the disabled and the elderly.

21.3. Measure 3 – to develop and improve customised treatment, rehabilitation, long-term monitoring and nursing methods for ageing-related diseases.

To develop customised medicine adopted for personal needs by carrying out the search for new prognostic biomarkers. Such biomarkers would be instrumental in assessing the effectiveness of the current (or intended to be applied) therapy. This would prevent the administering of unsuitable medicines or doses and would eventually lead to significant financial savings. Breakthroughs in the area of the modern biotechnology, and primarily in the area of '-omics' of the total technologies create the suitable preconditions to address these tasks.

CHAPTER IV
PROJECTED OUTCOMES, THEIR ASSESSMENT CRIERIA AND THE USAGE POSSIBILITIES

22. The most important outcomes of the Programme will be the new knowledge, theoretical and applied foundations required for the development of an advanced strategy of a quality ageing in the Lithuanian health care system. The results of the evaluation of the effectiveness, accessibility and quality of diagnostics, forecasting, treatment and rehabilitation of ageing-related diseases

will be used for a scientific substantiation of new efficient methodologies for the prevention, diagnosis, and treatment of ageing-related diseases and the assessment of their effectiveness. The scientific results will be published in peer-reviewed international science magazines. The results obtained will be presented at scientific conferences and disseminated through the website. Not less than 80 scientific publications will be published on subject matters related to the Programme, in addition to the annual Programme conferences and the creation of the NRP website.

23. The solving of the tasks defined for the purpose of the Programme will lead to the identification of factors affecting healthy ageing and the significance of their interrelation to longevity, possibilities to maintain physical and cognitive functions and ensure the quality of life. Having evaluated the relevant genetic, life-style, social and environmental factors an outcome of the Programme will be models adapted for the elderly population. The results of the studies will create suitable preconditions for the development of targeted preventive treatment methods based on risk assessments, the application whereof will contribute to the prolongation of a healthy life, help to postpone physical and mental disability, and help the elderly remain active and independent longer.

24. The studies will help to identify molecular factors which stimulate or inhibit the ageing of human cells, differentiation and potential regenerative disorders, and to study their diagnostic and applied values. The implementation of the present Programme will enable the creation and further improvement of a variety of methods, tools and measures for diagnosing and projecting age-related diseases through the use of the modern imaging, bio-, nano-, tele- and information technologies.

25. Studies in molecular, cell, and system biology's will constitute the basis for the creation of new methods for the treatment of acute and chronic diseases and conditions affecting the duration of a healthy and productive life and the improvement of existing methods.

26. Further outcomes and results of the Programme will include the creation and development of geronthotechnologies enabling the elderly suffering from cognitive and daily activity functioning disorders to reside safely in their homes and participate in community life, as well as the creation of technological measures to assist informal nurses to take care of the elderly members of their families.   The theory of the dynamic self-regulatory systems will constitute the basis for the

development and a further improvement of health promotion methods specifically designed for the elderly and optimising the operation of the organism's systems and their analysis.

27. In addition, the Programme will create customised treatments and rehabilitation programmes for the elderly. The customised treatment models developed within the framework of the Programme will help to reduce the number of persons subjected to inappropriate medicinal treatment, as well as the number of persons affected by side effects. A targeted treatment method, i.e. carried out on the basis of objective indicators able to describe the effectiveness of the response of a specific individual to a projected treatment would lead to a more efficient treatment and eventually savings of the national budget allocated for pharmaceuticals. The clinically significant biomarkers identified will facilitate the selection of the correct doses of drugs administered to the elderly.

28. The data from the study of risk factors and their interface will be used to assess the individual disease risk and to create customised preventive treatment methods through the application of information technologies. The proper assessment of risk will allow the earlier detection of disorders. A customised individualised approach will encourage people to follow the recommendations and treatments will become more efficient. Information technologies will facilitate the maintenance of feedback and a more efficient management of the process. The studies carried out within the framework of the Programme will help to identify the most efficient measures and methods to enable people to remain healthy and independent for longer.

29. More than 100 young (up to 34 years of age) researchers (doctoral students, residents and master's degree students) will be trained to ensure the continuity of research in the area;

30. The most important qualitative criteria for the assessment of the results of the Programme are its relevance, substantiation and reliability, the innovativeness and novelty of the results, the coherence of the results of the survey with the research objectives and the implementation measures of the Programme, the dissemination of the results of the research to the public, public authorities, and society. The results of the research carried out within the framework of the Programme will be evaluated by experts.

31. The results of the Programme will be evaluated according to the following criteria:

31.1. the number of peer-reviewed publications and publications which have a citation index in the Thomson Reuters Web of Science database (not less than 40). Publications of research results will include an acronym and the number of the Programme project.

31.2. the number of innovative ageing monitoring methods, measures for the diagnostic, preventive prognostic and the treatment of chronic degenerative diseases and the number of patents obtained within the implementation of the Programme (not less than 5);

31.3. the number of scientific monographs on the subject matter of the Programme (not less than 3), and their international significance;

31.4. the number of young (up to 34 years of age) researchers participating in the Programme (not less than 100), of which 40 are doctoral students;

31.5. the dissemination of the results of the Programme: the number of presentations at scientific conferences, information articles for specialists and society (not less than 40).

32. Expected results:

32.1. new methods of treatment, rehabilitation and the long-term monitoring of ageing-related diseases based on scientific research which will create the preconditions for reducing the morbidity of the population with diseases and the related mortality rate will improve the quality of life of the elderly;

32.2. the identification of clinically significant biomarkers substantiating the selection and the dosage of medicines for the elderly, and development of the fundamentals for the customised treatment and rehabilitation of the elderly;

32.3. the application of customised treatment models will reduce the number of persons who are administered unsuitable drug treatments and who suffer from side effects. A targeted treatment method, i.e. carried out on the basis of objective indicators able to describe the effectiveness of the response of a specific individual to a projected treatment would lead to a more efficient treatment and eventually lead to savings in the national budget allocated for pharmaceuticals, and a more efficient treatment;

32.4. the creation of models for forecasting of the risks of ageing-related diseases, a study of social and geographical inequalities will be instrumental in identifying the most vulnerable groups within society and a more efficient allocation of funds for the diagnosing and treatment of diseases affecting these groups. A scientific analysis of economic and social consequences will facilitate a more objective assessment of problems related to relevant diseases and the economic efficiency of treatment, rehabilitation and monitoring programmes;

32.5. the fundamental knowledge about the molecular and cellular mechanisms of ageing and its relation to the diseases characteristic of ageing will enable the development of new preventive, diagnostic, and therapeutic measures;

32.6. new generation diagnostic and prognostic measures will be developed and improved through the use of knowledge about the mechanisms of the pathogenesis of chronic degenerative diseases and new molecular markers, and the application of the modern biotechnologies, postgenomic and bioinformation technologies.

32.7. the imaging, info-, tele- and nanotechnologies will facilitate the creation of new tools and measures for the early detection of ageing-related diseases (express diagnostics), the planning of diagnostic procedures and the passing of clinical diagnostic solutions.

CHAPTER V
IMPLEMENTATION OF THE PROGRAMME, MONITORING AND REPORTING

33. The Programme shall be administered by the Research Council of Lithuania (hereinafter – the Council), in accordance with the Regulations of the National Research Programmes approved by the Government of the Republic of Lithuania, and the Description of the procedure for the preparation and the implementation of the National Research Programmes approved by the Council and agreed with the Ministry of Education and Science.

34. The Council will carry out the monitoring of the implementation of the Programme; while performing this function the Council will review the results of the Programme on an annual basis, and draw up an interim and final report of the Programme, publish the reports on the Programme's website, organise the evaluation and public discussion of the reports.

35. For the purpose of an interim evaluation of the Programme, the Council shall evaluate an interim report submitted by the Programme implementation group; such interim report shall be submitted four years after the Programme's implementation. Having evaluated the report on the Programme, the Council may propose to specify the Programme, or, in the case that the Programme is implemented unsatisfactorily, or insufficient funding has been allocated for the implementation of the Programme, or propose that the implementation of the Programme be terminated earlier than initially anticipated.

36. The reports of the Programme specifying the results of the projects implemented under the Programme, as well as the conclusions obtained and the recommendations submitted to ministries concerned and other institutions which will be published at events, in relation to publishing the results in the media and other means of information.

CHAPTER VI
FINAL PROVISIONS

37. The Programme shall be funded subject to the financial capacities of the State by appropriations from the budget of the Republic of Lithuania committed for the Council and other legitimate funding sources. The projected period for addressing the tasks and the implementation of the measures within the Programme is 2015-2021. A preliminary funding demand for the tasks and the measures in 2015-2018 is specified in the Annex to the Programme. Having examined and evaluated the results of the interim report of the Programme, the Minister of Education and Science provides for the funding requirement for the implementation of the Programme in 2019-2021.

38. The implementation of the Programme is completed after the Research Council has approved the final report of the Programme.

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