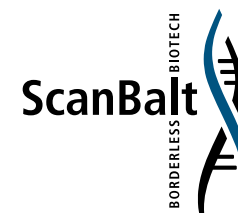


ScanBalt Position Paper: Healthy Ageing: From Biological Fundamentals to Clinical Solutions

ScanBalt BioRegion February 2011



1. Introduction

Healthy Ageing: From Biological Fundamentals to Clinical Solutions

Ageing is one of the grand societal challenges for the forthcoming decades. Due to the post-war baby boom, the ever-increasing life expectancy and dropping birth rates, the proportion of elderly people is steadily increasing. Although healthier than previous generations, tomorrow's elderly will ultimately require (complex) care for chronic disorders and multi-morbid states.

For this reason, the emphasis of the ScanBalt Health Region for the coming years will be on Healthy Ageing: growing older in a healthy and active way. Healthy ageing already begins at conception. Parents pass along their genes, accompanied by opportunities and risks that can lead to a healthy life course or the development of illnesses later in life. Lifestyle, nutrition, the amount of exercise, the use of medication and environmental factors such as synthetic and natural toxins in the environment or diet, UV and ionizing radiation that may accumulate over time, are all factors that affect the evolution of health. The influence of these factors and the way they relate to each other is not yet clear. New knowledge is needed, particularly for the design of effective preventive strategies to combat the epidemic of metabolic diseases related to (childhood) obesity. The partners in the Baltic Sea Region are able to contribute by generating this type of fundamental new knowledge and its translation to improve health status in our ageing society. The strength lies in the rapid exchange and application of knowledge and experience within the chain of scientific research, preventive strategies, patient care, and education.

2. Basic Research on the Biology of Ageing

In order to develop evidence-based recommendations for healthy ageing it is of crucial importance to understand the mechanisms that result in aberrant functioning of ageing cells and tissues. Research activities that will be covered by this theme range from e.g. Chromosome Biology, Regenerative Medicine, Protein Folding, Energy Metabolism, Oncology, Immunity to Transcriptional Regulation. There are competent resources in the ScanBalt BioRegion to cover research into the fundamentals of ageing and age-related disorders, like the European Research Institute on the Biology of Ageing (ERIBA, Groningen) and the Center for Healthy Aging (Copenhagen). A wide array of technological platforms is required and will be available for ScanBalt BioRegion researchers. These platforms include high-speed cell sorters, animal facilities, advanced microscopy, deep sequencers and mass spectrometric equipments for metabolomics, proteomics etc.

Therefore, ScanBalt™ fmba (hereinafter ScanBalt) recommends the following issues for future strategies on ageing research:

- ▶ Fundamental approaches on cellular senescence, mitochondrial (dys)function and (epi)genetics;
- ▶ Systems Biology approaches for metabolic diseases, including type II diabetes;
- ▶ Development of novel animal models, including mouse models for rapid ageing.

3. Population Research: Life Course Epidemiology

Participants in ScanBalt Health Region and members of ScanBalt have already broad experience in research concerning cohort studies, ranging from population based cohort studies to cohorts of various patient populations (like organ transplant receivers, persons cured from cancer, asthma patients). These cohort studies include assessments of both genetic information (including GWA in selected samples), as well as clinical and life style factors. The combination of scientific experience and data management skills has put the ScanBalt Health Region in an expert position on life course epidemiology.

The number of participants in a single cohort study is not sufficient for studying combination and interaction of risk factors. This is usually crucial for the understanding of multifactorial chronic diseases. International and cross-sectoral collaboration is needed to create sufficiently large research databases by combining cohort studies from different countries. The Baltic Sea region can provide additional value because the health care infrastructure is largely similar. This results in comparable data collections notably on clinical endpoints, which facilitate merging of datasets. ScanBalt Health Region, ScanBalt BioRegion and ScanBalt afford unique opportunities to set up collaborative projects.

In the Baltic Sea Region there are many centers with cohort studies, as well as companies (biotech, pharmaceuticals, food) that are interested in collaborative projects on life course epidemiology. The results will be tools to individually tailor

prevention and treatment of chronic diseases. Potential topics of interest might include diabetes/overweight, mobile phone use, fish consumption, and many more.

Therefore, ScanBalt recommends the following issues for future strategies on biobanking:

- ▶ To support initiatives to facilitate the communication and interconnectivity between bio-banks;
- ▶ Develop applications for subtracting high quality phenotype/clinical data from existing patient records research files;
- ▶ To encourage harmonisation of the ethical, legal, and societal (ELSI) framework;
- ▶ To implement sustainable funding mechanisms for long-term maintenance of and access to bio-banks;
- ▶ Public private partnerships: transnational access for SME and multinationals to bio banks and cohort studies.

4. Care & Cure

4.1 Ageing Brain

Ageing Brain research addresses the translation of basic neuroscience and neurological and psychiatric research to better care and prevention. Research on the Ageing Brain focuses on: (1) neurodegenerative diseases, including dementia and Alzheimer's disease, and (2) the development and consequences of – common – mental disorders throughout life.

ScanBalt BioRegion has excellent groups working on this topic and we anticipate to start networks on glia research, neural stem cell research and neuroimaging technology. There are also possibilities for collaboration on clinical studies addressing ageing of the brain and to combine valuable patient cohorts and related databases for clinical/epidemiological studies on brain ageing. The latter will be interesting for clinical innovation and economic valorization.

ScanBalt members are aware of the Joint Programming Initiative on Neurodegenerative diseases. In this light, ScanBalt recommends the following issues for future strategies on ageing brain research:


- ▶ Establishing a cohort study of people with early onset dementia;
- ▶ Executing a pan-European intervention study in lifestyle factors involved in neurodegeneration;
- ▶ Establishing very early markers for Alzheimer's disease and dementia pathology;
- ▶ Employing rapidly emerging novel (molecular) imaging techniques;
- ▶ Understanding the multifactorial road of cumulative damage in mixed dementia.

4.2 Healthy Food and Nutrition

People are exposed to complex mixtures of food components throughout their life that deliver energy but also nutrients and other components that enable proper growth and functioning of the body, the latter for instance by modulating the activities of genes ("Nutrigenomics"). Consequently, design of proper diets is not just about avoiding deficiencies but more and more about optimal health and the avoidance of age-related metabolic diseases. It has become clear that the benefits of some dietary choices are not the same for everyone: new technologies now allow for detailed analyses of underlying mechanisms. Obesity and the Metabolic Syndrome are both considered as life style illnesses that are increasingly becoming a threat to children and adolescents across Europe. Overweight and obesity are major risk factors for chronic diseases, including diabetes, cardiovascular diseases and cancer. Excessive dietary calories, the lack of physical activity, but also genetic susceptibility, social environment, and use of medication play a role in the obesity epidemic.

In collaboration with the private sector research groups can work on defining optimal nutrition for specific age groups, e.g., newborns and elderly, as well as for specific populations in the workforce, e.g. shift workers. In addition, clinical nutrition for specific patient groups and for optimal feeding during peri-surgical periods constitutes an important area of research.

Partners in ScanBalt Health Region are particularly excellent in the fields of nutrition and metabolic diseases. Universities and industries can together work on defining the role of diet and specific food components in prevention of age-related diseases.



ScanBalt members are aware of the Joint Programming Initiative on a Healthy Diet for a Healthy Life. In this light, ScanBalt recommends the following topics for future strategies on food and nutrition research:

- ▶ A large concerted programme to unravel the pathophysiology of obesity and its metabolic and cardiovascular consequences as well as its biological origin;
- ▶ This initiative needs to include basic, translational and clinical research using a systems biology approach;
- ▶ An international cohort study with intensive phenotyping to enable comparison of relevant factors across North European cultures;
- ▶ Identification of biomarkers to discover those individuals at greatest risk;
- ▶ Development of models (in silico, in vitro and in vivo);
- ▶ Development of targeted prevention and treatment strategies for subjects at risk;
- ▶ Platforms for cooperation between academia and industry in order to work on preventive healthcare.

4.3 Technologies for Ageing People

When human cognitive capabilities and mobility capacities are impaired, people will lose their independent functioning and will require an increasing amount of medical care and help. To prevent this, new intelligent mobility devices are needed that prevent deterioration or restore mobility. ScanBalt Health Region focus on three stages of mobility support, prevention, treatment and rehabilitation:

- ▶ Prevention: intelligent balance and physical condition training devices for elderly;
- ▶ Treatment: intelligent prostheses, orthoses and wheelchairs;
- ▶ Optimize the rehabilitation process with the device, home training protocols that place individual patients and their needs at the focal point.

In addition to these novel approaches aimed at reducing immobility and tissue degeneration, new concepts for curative medicine are urgently needed. Regenerative Medicine is a relatively new field of research that requires an integrated approach. Knowledge and expertise in this field is largely spread over the European countries, and several supporting technologies need to be developed, preferably in a joint effort to reduce the costs. Regenerative medicine is applicable to several diseases and is a very broad scientific discipline. For instance, fibrotic phenomena are studied to understand the pathological accumulation of collagen, thus providing intervention points to improve tissue repair as well as tissue engineering. The aim is to develop treatment modalities to combat fibrosis, as fibrosis is prominent in many chronic diseases and therefore leading to an enormous health burden in the ageing population (about 40% of deaths are related to fibrosing disorders).

ScanBalt recommends the following issues for the EU research agenda on technologies for ageing people and regenerative medicine:

- ▶ Basic research on stem cells, biomaterials and their interactions to understand regeneration of complexity of tissues;
- ▶ Developing in vivo and in vitro (2D and 3D) model systems available to obtain basic knowledge on controlled propagation and differentiation in normal and pathogenic organs;
- ▶ Development of new gene delivery systems for gene therapeutic approaches;
- ▶ Developing enabling technologies such as tissue specific biomarkers, single cell imaging, in-vivo and in-vitro modelling systems, bioreactors etc.;
- ▶ Technologies for personalised cell therapy and autotransplantation.

4.4 Healthy Ageing at Work

An ageing population leads to an unfavorable ratio between occupationally active and inactive people. Moreover, the ageing workforce generates new concerns about health and productivity in this population. For example, in the Netherlands, the labor market participation of people aged 55 to 65 years is below 50%. In some European countries percentages are even lower. More than half of the workers reports difficulties in work performance due to health and ageing problems. There is a need to understand the facilitators for and barriers of staying-at-work with a chronic disease, i.e., a sustainable working life, to meet the European target of increasing participation of older workers in the labour force. The identification of these factors, facilitators and barriers and the knowledge about the underlying mechanisms will allow for the development of effective tools and measures for staying-at-work. A sustainable working capacity is of great relevance and benefit to workers, employers and society.

ScanBalt recommends the following issues for the EU research agenda on maintaining a healthy workforce:

- ▶ Mechanisms of contribution of work environment to chronic disease development/natural course and vice versa how the environment supports workers with a chronic disease to stay at work;
- ▶ Multidisciplinarity and involvement of multiple stakeholders with specific attention to employers, unions, (occupational) health professionals, insurers and policy-makers;
- ▶ Encouragement of SMEs' participation focusing on accommodation older and younger workers with a chronic health condition.

4.5 E-health

The demographic transition currently taking place will lead to a situation in which the old age-dependency rate will drop from 4:1 to 2:1 within the coming decades in many Western societies. This underlines the urgency of an actual transition of care and society at large. The organisation and operation of health care as we presently know will have to undergo an (r)evolution. Self sufficiency, informal care and services provided through distant agents will gain acceptance and importance. E-health as a means to address the gap becoming manifest between demand and capacity apparently offers a potential solution. ScanBalt BioRegion is facing similar challenges. Large adherence areas sometimes scarcely populated and facing actual shrinkage offer the local partners to set up experiments. If positioned in an international network where municipalities, SMEs and academia collaborate, innovation and groundbreaking results can be expected.

5. Public Private Partnership Model

Modes of collaboration within ScanBalt BioRegion could be in the construction of Topinstitutes, i.e. in a public private EU-partnership model: 25 % industry, 25% research institute and 50% governmental contribution.

A TTI can carry out scientific research in areas that

- ▶ have been designated to be of key importance to the EU by the Council of Ministers; and that
- ▶ is subject to such industry interest that it can be funded by public-private partnership agreements.

Development of specific TTI's in the ScanBalt BioRegion should be actively explored.

Annex

Background on ScanBalt BioRegion and ScanBalt

ScanBalt BioRegion is composed of life science and biotechnology stakeholders and other important actors within Life sciences and biotechnology in the region. There are more than 60 universities and over 2100 life science/biotech companies including ~700 research based biotech SME's active in ScanBalt BioRegion.

The not for profit association ScanBalt fmba acts as a service provider for the ScanBalt BioRegion community and is a registered trademark ScanBalt™. Members are regional networks and clusters, universities, companies, hospitals, national innovation agencies, regional and national authorities.

ScanBalt is a mediating, coordinating and communicating umbrella and/or platform.

The secretariat is located in Copenhagen (Denmark) while regionally financed liaison offices are located in Tartu (Estonia), Gdansk (Poland), Rostock (Germany) and Copenhagen (Denmark).

Background on ScanBalt Academy

ScanBalt Academy (SBA) consists of a group of distinguished and prominent life scientists from academia as well as industry and government. Fellows of SBA must be born in or residents of countries and regions within ScanBalt BioRegion. Purposes of SBA:

- ▶ Adds credibility to the scientific quality of ScanBalt projects and initiatives
- ▶ SBA or SBA committee's serve as external advisory boards to ScanBalt activities

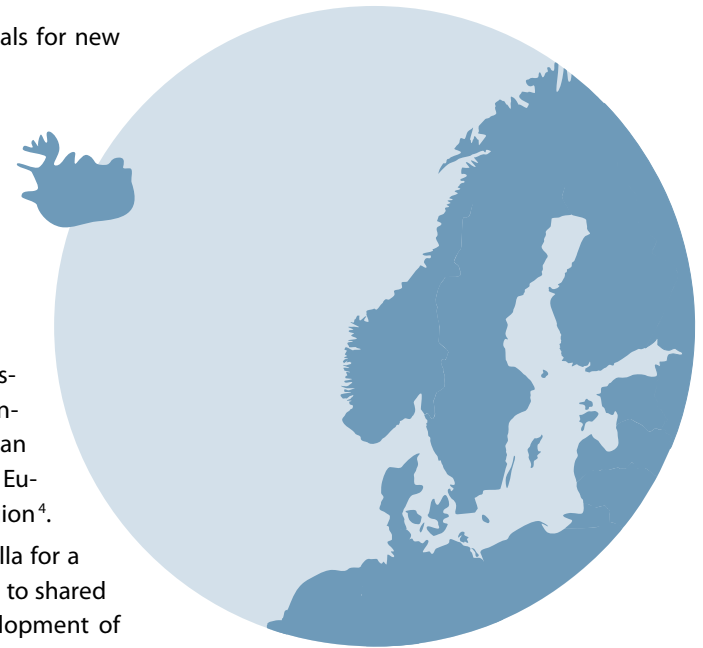
- ▶ SBA Fellows gives lectures or teach courses in ScanBalt BioRegion
- ▶ SBA Fellows act as ScanBalt Ambassadors
- ▶ SBA Fellows act as evaluators on proposals for new ScanBalt activities and projects
- ▶ SBA assists to reverse brain-drain from ScanBalt BioRegion, and help to engage ScanBalt BioRegion expatriates in ScanBalt activities

Background on ScanBalt Health Region

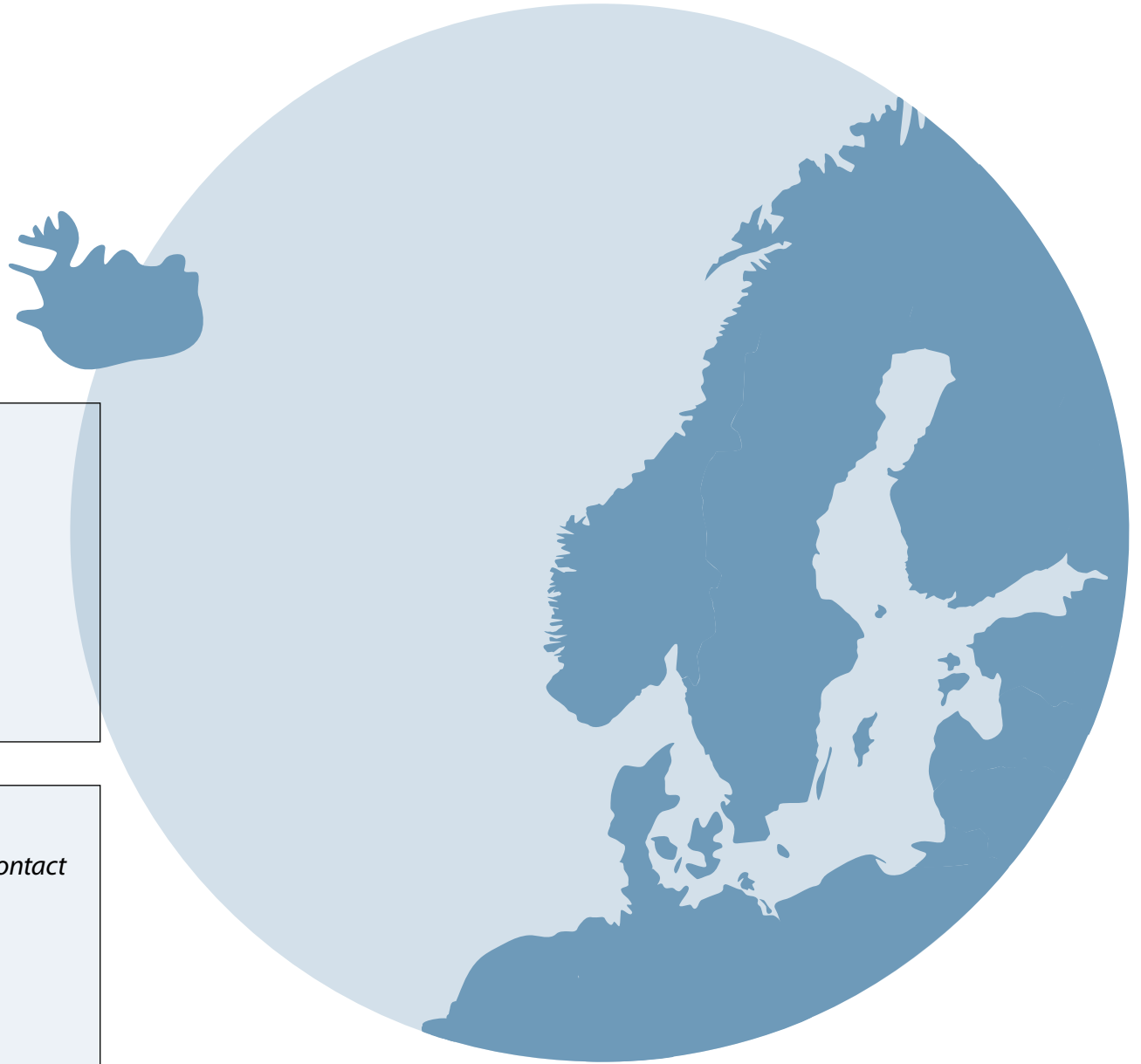
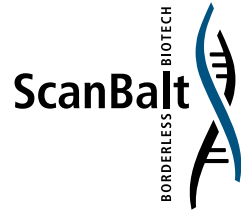
The ScanBalt Health Region (full title "Cross-Sectoral and Transnational Projects for Innovation in Health and in Life Sciences") is an acknowledged flagship project within the European Union Strategy for the Baltic Sea Region⁴.

ScanBalt Health Region serves as an umbrella for a multitude of coordinated activities applying to shared visions, values and strategies for the development of the region and utilizing a common communication structure. Otherwise the individual activities act independently. This is a discipline (Health) specific bottom-up approach combined with a top-down advisory structure which has been developed, tested and applied for ScanBalt BioRegion since 2001.

It ensures specific themes to be dealt with in depths by a multitude of groups while still referring to an overall strategy and using existing structures for coordination and efficiency.



⁴ The EU BSR Strategy and the Action Plan in its last version.



Contact information

Folkert Kuipers, Dean/Board Member
University Medical Center Groningen
f.kuipers@rvb.umcg.nl

Josine van 't Klooster, EU Liaison Officer
University Medical Center Groningen
j.c.g.van.t.klooster@rvb.umcg.nl

*For general questions to ScanBalt BioRegion,
ScanBalt and ScanBalt Health Region please contact*

ScanBalt™ fmba
Mobile + 45 27141078
e-mail pf@scanbalt.org
skype pfranksb
www.scanbalt.org

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www.steinbeis-nordost.de