FACULTY OF HEALTH SCIENCES
UNIVERSITY OF COPENHAGEN

Annual Report 2010

Center for Healthy Aging

Key persons in CEHA

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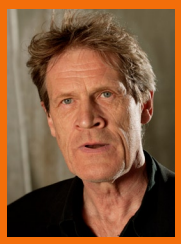
Lene Juel Rasmussen
Managing Director,
Molecular Aging

Assoc. Professor
Lene Otto
Health in
Everyday Life



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Thomas Söderqvist
Health in
Everyday Life

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Allan Krasnik
Society, Culture and
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NORDEA FONDEN

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Research for the aging society

When do we start aging? At first, this question might seem trivial, but on second thought, the answer might not be all that straight forward. The most obvious and simplest answer is that we start aging the moment we are born and continue to age as each hour, day and year passes. But does it make sense to talk about aging while we are developing and growing, and what factors influence both real and perceived rates of aging at different life stages?

In practice, our concept of when and how we age is shaped by social conventions and norms, including the legal age for retirement, age-dependent changes in health benefits and insurance, and other age-dependent patterns of behavior. But these external factors may be less important and/or secondary to intrinsic physical factors and each individual's attitude toward his or her body and life in later years? Health statistics clearly indicate that chronic diseases, including cancer, type 2-diabetes and Alzheimer´s disease, are more prevalent in older individuals. However, it is unclear what determines how well each individual ages, and why and when an individual begins to feel old. Could we live until our last day on earth and still never feel old?

Because these questions remain unanswered, and because the average age of the population is rapidly increasing worldwide, the process of aging and age-associated disease or dysfunction has become an important focus of research in both medical and non-medical areas. Along with increase in the number of elderly individuals, there is greater prevalence of age-related disease, which is stressing healthcare systems that are not prepared to handle this increased burden. Demographic studies indicate that the magnitude of this challenge will continue to increase in the decades to come.

The Center for Healthy Aging (CEHA) is studying aging as a complex process, with physical/biological and environmental components that must be viewed in a social context. We strongly believe that our cross-disciplinary approach to aging research is critical to effectively solve the challenges associated with growing older as a society in Denmark today. As evidence of our recent success, I report that CEHA has already collectively published 113 articles (well above our target of 45) and implemented a joint communication project on the theme "Aging" with the magazine Monday Morning – the *Best Age* project. In addition, we have secured substantial external funding this year (approximately 30 million DKK). In October 2010, we hosted an international conference entitled *The IARU Congress on Aging, Longevity and Health* and we launched a visiting professor program. Professor Carlos Mendes de Leon and Senior Lecturer Tiago Moreira will participate in this program in 2011, and similar associations are expected to be an ongoing feature of CEHA. Young CEHA investigators are initiating cross-disciplinary projects through the newly established

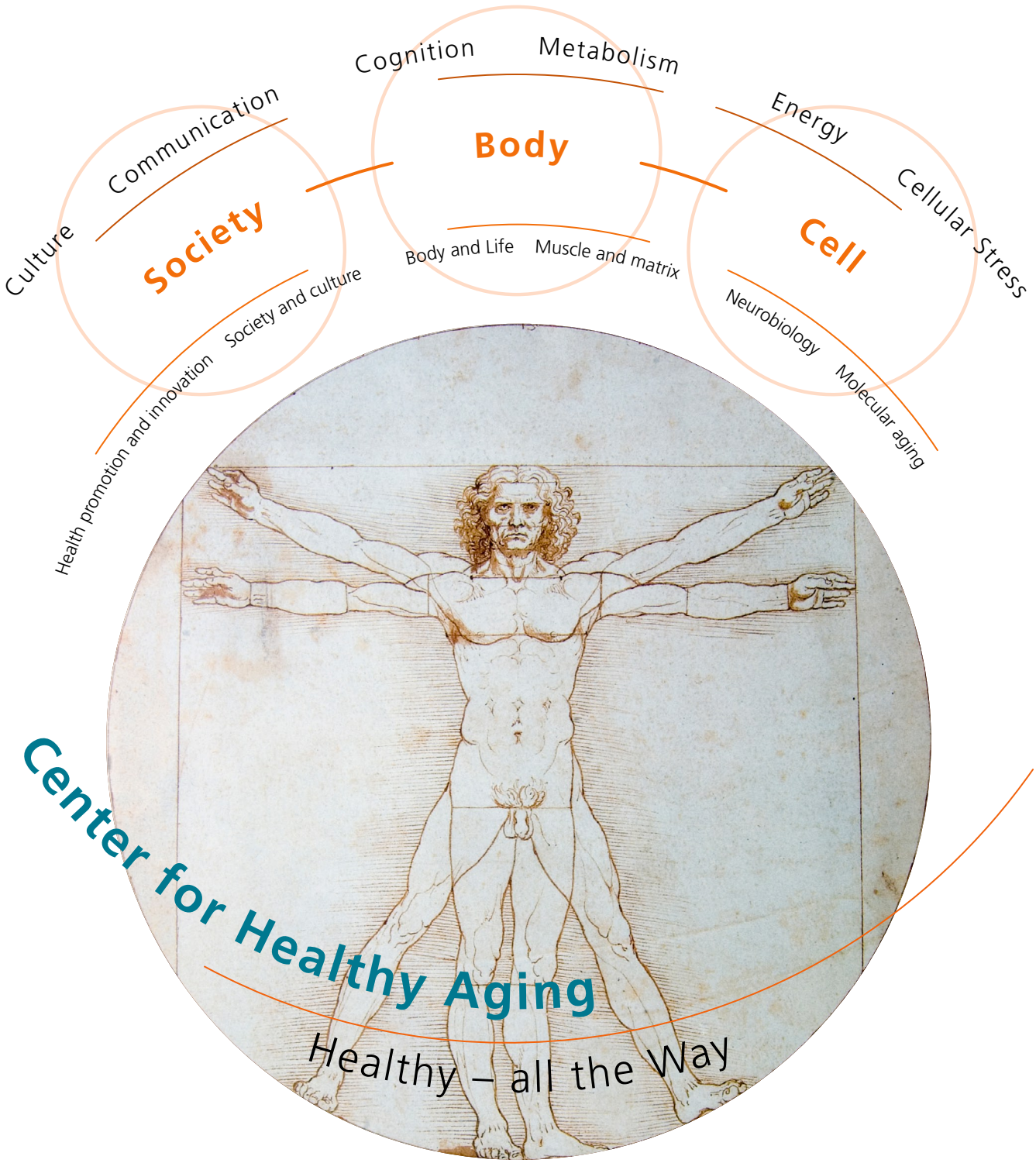
Professor Lene Juel Rasmussen, Managing Director

CEHA Network for Young Scholars, which will promote innovation and help train the next generation of experts in aging research. CEHA opened its new state-of-the-art Laboratory for Molecular Aging at Panum, where for the first time, CEHA activities will be centralized at a single research site.

Of course, there are also a number of challenges to be met in the immediate and long-term future. CEHA and the Faculty of Health Sciences at the University of Copenhagen need to promote awareness of the Center and help disseminate knowledge about health promotion and healthy aging. In order to meet this challenge, communication will remain a major focal point in 2011. We will continue to disseminate and share our research results, and to develop and use new communication tools. Our goal is to stimulate healthier lifestyles and create environments that promote health, not only during old age but during the entire life course. We now know that healthy aging is not simply a question of health in old age. The foundation for a long, healthy life is laid when we are young, and maintained through middle-age. Only with this long-term vision, can we expect to be blessed with good health throughout life.

Professor Lene Juel Rasmussen, Managing Director

CEHA's research goal is to nurture the health and prevent and/or postpone disability and aging-related disease in the entire population of Denmark. If we accomplish our goals, we envision that CEHA will be recognized as one of the top interdisciplinary aging research centers in the world.


Cognition
Metabolism
Body
Body and Life
Muscle and matrix
Communication
Culture
Society
Society and culture
Health promotion and innovation
Energy
Cellular Stress
Cell
Neurobiology
Molecular aging
Center for Healthy Aging
Healthy – all the Way

Cross-disciplinary research themes

The Center for Healthy Aging (CEHA) conducts research on interactions between humans and their environment, social conditions, and life choices in all life stages, including late life. We ask the question: Why do our bodies age and how can we maintain quality of life in later life stages? In order to address this question, we will adopt a holistic approach that will solve complex problems of aging by integrating traditional disciplines and novel perspectives. We will take all necessary steps to encourage collaboration, enhance exchange of information, promote synergy between the participating groups, and enable joint efforts involving different competencies, technologies, and traditions. With this in mind, we have recruited the best scientists from diverse backgrounds to lead cross-disciplinary aging research on the following two major themes.

Theme: A historical analysis of the concept of successful aging and its relation to human enhancement – Life course, medical/pharmacological intervention, and survival selection

Participants: Kirsten Avlund, Erik Lykke Mortensen, Allan Krasnik, Lene Otto, and Thomas Söderqvist

In this theme, we study the development of the concept of successful aging from the 1980s until today. During this period, aging research has gone from being primarily concerned with the treatment of diseases in the later part of life to an increased focus on the prevention of diseases and to a broader public health-oriented approach involving non-biomedical disciplines.

In this context, we focus particularly on the development of the successful aging concept within neuroscience, and the possible connection between successful aging and "human (cognitive) enhancement", a newly emerging concept. Notions of successful aging and human enhancement are often discussed in the same context, as it becomes possible to use novel medical technology to improve complex human functions, and as societal pressure builds to develop life-extending and life-improving medicines. To investigate the historical development and possible interconnectedness of the two concepts, this project will interrogate the specific social and cultural context of the concepts and the conceptual and material aspects of knowledge production within the neurosciences.

Medical and clinical practice has a significant impact on the real and perceived quality of life of the elderly. Social and cultural factors influence both the perception of aging and the aging process itself. Epidemiological studies are used to examine the inter-relationship between these factors, including the use of medical facilities and pharmacological interventions. It is well known that

the current population of 80-year olds is not a random sample. The survivors carry the cumulative "damage" that have affected them throughout their life course, while weaker individuals have died, resulting in selective attrition of the 80-year old population. However, we still lack an operational concept of "cumulative damage" in humans, and are not yet able to synthesize micro-data on the many specific selection effects over the life course that weaken or cause death of elderly individuals before advanced age. Several Danish cohorts, including the Copenhagen Aging and Midlife Biobank (CAMB), and the Metropolit birth cohort (11.532 boys born in 1953) provide data for analyzing these problems. Data from the Metropolit birth cohort were used to carry out a longitudinal study on whether father´s social class at participants' birth is associated with the use of prescribed drugs (i.e., antihypentensives, antithrombotic agents, lipid lowering drugs, anxiolytics, hypnotics, sedatives and antidepressants) in middle-aged men and examine associations with cognitive function in young adulthood.

CEHA funded Ph.D.-studies associated with the research theme:

- *Coordination of preventive medication in the health care system after structural reforms – a quantitative and qualitative analysis of barriers and tools in a complex organization*. Andreas Rudkjøbing.
- *Health technologies in practise. Aging and chronic disease*. Aske Juul Lassen.
- *Between evidence and practice: Production and translation of medical evidence on blood pressure reducing drugs*. Sarah Wadmann Lauritsen.
- *A genealogical survey of the concept of "healthy aging" and its relation to the idea of "human enhancement"*. Morten Hillgaard Bülow.
- *Diabetes research communication and the changing identities of type 2 diabetes patients, 1960-2010*. Adrian Joseph Bertoli.
- *A cultural analytical study of fatigue and everyday life among elderly affected by stroke*. Michael Andersen.

Theme: Fatigue, frailty, cognitive dysfunction, muscular function and neurodegeneration – Oxidative stress and mitochondrial dysfunction

Participants: Lene Juel Rasmussen, Vilhelm A. Bohr, Anne Marie Lynge Pedersen, Martin Lauritzen, Poul Jennum, Egill Rostrup, Flemming Dela, Michael Kjær, Kirsten Avlund, Rikke Lund, Merete Osler and Erik Lykke Mortensen

Frailty is a symptom of aging characterized by decreased mobility, altered gait, muscle weakness, poor exercise tolerance and sarcopenia. Studies suggest that fatigue may be useful as a self-reported indicator of frailty. Recently, the Nordic Research on Aging Cohort Study demonstrated that fatigue in non-disabled older adults correlates with multiple potentially modifiable factors, including polypharmacy, decreased muscle strength, cognitive decline and depressive mood.

The changes in cognitive function that occur with aging range in severity from mild to devastating. Cognition remains virtually intact in some individuals, as they grow older, while others become dependent on caregivers. Cognitive dysfunction, muscular function and neurodegeneration form a cluster of aging-related symptoms. Previous research has addressed how intellectual development and the physical and social environment in early life influence cognition and muscle function in midlife, as well as how cognitive and muscle function in midlife influence functional decline in late life.

Sleep and sleep disorders are very important for cognitive function and overall health. The association is particularly close between decreased total sleep (short sleep time) and the symptoms of fatigue, insomnia, pain, depression, chronic drug use, sleep apnea and motor activity with dream activity (REM Behavior). Furthermore, fatigue and sleepiness are associated with depression and cognitive dysfunction.

A suggestion was put forth in 1972 that mitochondrial production of free radicals such as reactive oxygen species contributes to the aging process (termed *The mitochondrial theory of aging*). This hypothesis has

since been supported by a number of animal and cell culture studies showing that a decreased production of mitochondrial reactive oxygen species extends lifespan. Oxidative stress represents an imbalance between the production and phenotypic manifestation of the effects of the reactive oxygen species and a biological system's ability to detoxify the reactive intermediates or to repair the resulting damage. A large body of evidence suggests that oxidative stress, oxidative damage, chronic inflammation and mitochondrial dysfunction play significant roles in cellular dysfunction in late life. Oxidative stress can be induced by increased levels of reactive oxygen species, which are a by-product of normal metabolism, as well as via exogenous exposure to chemical and physical stressors. Oxidative stress can lead to genomic instability and mitochondrial dysfunction. DNA repair capacity may decline with age, which increases the susceptibility to oxidative DNA damage. The brain and neural tissues are particularly susceptible to oxidative stress, at least in part because of increased oxygen consumption.

One major cross-disciplinary research effort at CEHA is focused on developing biomarkers for oxidative stress and correlating levels of oxidative stress at different life stages with aging-related dysfunction in mid- or late life. Oxidative stress is thought to contribute to the development of a wide range of disabilities including Alzheimer's disease, Parkinson's disease, the pathologies caused by diabetes, rheumatoid arthritis, and neurodegeneration associated with motor neuron diseases. Understanding how to reduce oxidative stress and impact the pathogenesis of chronic diseases presents opportunities for health promotion for an aging population.

Cognitive tests from 2126 male participants in the Copenhagen Aging Midlife Biobank have been merged with information on cognitive performance at age 18 from the same individuals. Based on these data, we have developed a regression model to examine how cognitive function at age 18 predicts cognitive function in midlife. Predicted values and residuals have been used to identify two groups of individuals (N=100), one with the largest decrease and one with the largest increase in cognitive function. These subjects are currently being invited to a detailed clinical and neurophysiological examination to investigate the physiological mechanisms in the brain stem or centrencefalt, which is amended by cognitive dysfunction in middle-aged men. Furthermore, investigations are being performed that address if the changes that are observed in cognitively dysfunctional men are different from what is observed during normal aging, and whether these physiological changes differ from changes associated with Alzheimer's disease pathology. The project also investigates the cohort for sleep disturbances, because these are common and frequently correlate with onset of neurodegenerative diseases such as Parkinson's or Parkinson's-related diseases, Lewy body dementia and Alzheimer's disease.

We are also carrying out brain magnetic resonance imaging (MRI) imaging and dental examinations on the participants. MRI data can detect aging- and neurodegenerative dementia-associated changes in brain function. Furthermore, we will examine salivary gland function, because change or reduction in salivary gland function is often caused by altered nervous system regulation of salivary glands.

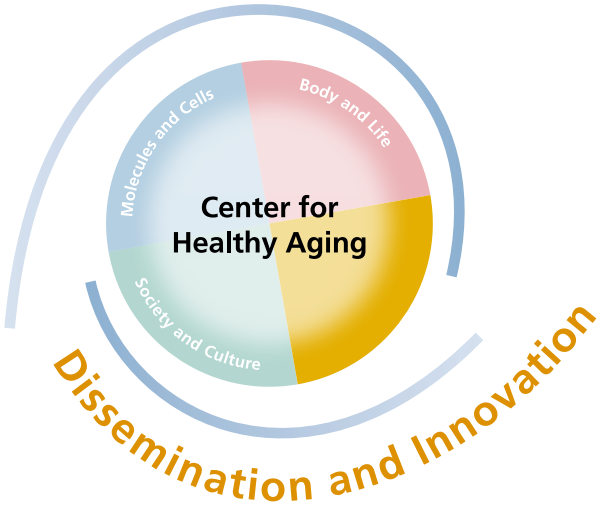
To investigate the molecular mechanisms underlying aging and to search for biomarkers, we are investigating whether oxidative DNA damage, reduced DNA repair capacity and mitochondrial dysfunction correlate with frailty and/or cognitive decline. Associations between these molecular biomarkers and self-reported fatigue or cognitive decline would be of great importance, and could be useful for prevention/postponement of symptoms of early aging. This research theme will also investigate production of endogenous reactive oxygen species, mitochondrial anti-oxidative capacity, DNA repair capacity and mitochondrial turnover in young and old human skeletal muscle. Subjects will include young and old individuals who are untrained and obese or trained and lean, respectively. This will facilitate discrimination between the effects of obesity, training status, and age on experimental parameters related to mitochondrial function/dysfunction.

Data will be stored in a clinical database accessible to all CEHA researchers.

CEHA funded Ph.D.-studies associated with the research theme:

- *Mechanisms of DNA repair in mitochondria and their role in aging*. Martin Borch-Jensen.
- *In vivo 2-photon microscopy of neural signalling, blood flow, and energy consumption in neuronal networks in old and young mice*. Sanne Barsballe Jessen.
- *Clinical, neurophysiological, immunological, and molecular biological aspects of salivary gland function in cognitive dysfunction and early neurodegenerative disease*. Christiane Elisabeth Sørensen.
- *Metabolic changes after weight loss in patients undergoing gastric bypass: Studies of obese with and without type 2 diabetes*. Michael Taulo Lund.
- *Connective tissue in tendon and skeletal muscle with aging: importance of insulin-like growth factor I (IGF-I)*. Anders P. Boesen.
- *Exercise for patients with hip artrosis – effect of strength and vascular training*. Theresa Bieler
- *Mechanisms of psychosocial and biological factors acting over a life course and low grade inflammation (mediation and interaction)*. Jolene Lee Masters Pedersen.
- *Effects of physical exercise from a health promotion perspective: metabolic health in a cultural setting*. Michala Holm Reichkendler.

Health in Everyday Life



Program 5

Health in everyday life

Group leaders
Lene Otto, Associate Professor
Thomas Söderqvist, Professor

The overall objective of this research is to contribute to the dialogue between different methodological and theoretical traditions within aging research in biomedicine, the humanities and social sciences. We explore and contribute to new strategies for addressing the everyday health concerns of our aging population. Such strategies increasingly rely on advances in technology to prevent, detect, and treat the complex health problems prevalent among older adults. Researchers with expertise in humanities and social sciences will explore how emerging practices affect everyday life in the Danish population as well as practices of the self and of body/embodiment, forms of social relationships and familiarity. The research questions fall into the two following areas:

Cultural aging and health in everyday life
Based on a cultural understanding of health, reaching beyond the mere physical aspect, and thus perceiving health as more than just the absence of illness and disease, healthy aging is understood both in a narrow, medical sense, as a means to "stay healthy" and in a broader, cultural sense, in which concepts such as "quality of life" and "the good life" are central. Health practices are explored as something that is taken care of in various collective, cultural contexts, such as local communities, workplaces, institutions and families, that are the focus of the ethnographic studies. Knowledge about the various ways in which users approach healthcare and the challenges inherent in the new technologies will be generated through cultural analysis and ethnological fieldwork. Central questions are: How are health promoting practices, products, discourses and techniques integrated into daily life? How are consumers of health technologies and services integrated as actors, citizens, clients and patients in the health care system? How can answers to these questions be applied as user-driven innovation processes in the health sector?

Communication and public engagement in science
Health promotion is not a question of dissemination and communication of medical information to an ignorant aging population. Rather, it requires a user-oriented approach, which takes into consideration the cultural life of the citizens. The quality of future health measures is dependent on multi-facetted knowledge, generated and transformed into usable methods with the users. Central questions are: How does the emergence of internet-based social media change health communication practices? How can museums of health and medicine create exhibitions focused on user-driven innovation? Is user-driven creation of medical heritage a social technology that can lead to biocitizenship?

a. Background and hypothesis

The Research Program Health in Everyday Life is being coordinated by Ethnology and conducted in cooperation with the Medical Museion. The program's mission is to promote discussion of the human aging process from the perspectives of ethnology, sociology, social anthropology, philosophy, politics, literature, arts, language, and the mass media.

Other CEHA programs focus on the epidemiology, biology, physiology, and genetics of aging, understood as a deterioration of cells, muscles and organs. In contrast, this program focuses on how aging individuals can maintain their quality of life. How do people avoid, compensate for, or accept and live with the effects of aging on biology, cognition and sense of self. Rather than seeing aging as a problem – a condition defined by decline, frailty and vulnerability, one to be addressed in terms of fiscal policy, treatment and care – this program views aging as a challenge, bringing the opportunity for radical change in cultural forms, as well as collective and individual experience. Aging is in equal parts a cultural and biological phenomenon. While acknowledging the essentially biological factors inherent in human aging, this program emphasizes those aspects of human aging that lie beyond the focus of biomedical science. Thus, in an era of increasing longevity, our perspective is that the Western perception of old age as a phase of physical degradation and dependency is no longer viable or pertinent, because it fails to provide a viable basis on which to develop strategies for staying healthy during the entire life course.

Personal experience and acculturated images and perceptions are intrinsic to any holistic understanding of the aging process. It is in this sense that the arts, the humanities and the social sciences have a fundamental role to play in the study of human aging and constitute a valuable complement to other areas of aging research. As stated above, this program will focus on and reveal culturally-determined perceptions, attitudes and effects of human aging that fall outside the scope of biomedical research disciplines, thereby providing insight into the complex and intriguing shared experience of aging.

The program contributes to:

- a cultural understanding of healthy aging
- a dialogue between methodological and theoretical traditions in biomedical health research, the humanities and social sciences
- knowledge about and improvement of health-promoting practices, techniques and products
- an understanding of the relationship between scientific and non-scientific concepts of the human body, aging and health: how healthy aging knowledge and practices become part of daily life and shape social roles, personal identity, and perception of physical self/body.

b. Status for milestones

Humanistic aging research has been absent in Denmark and from Danish universities for many years. Thus, initial steps require (re-)establishing this type of research in the context of ongoing programs. For this reason, an important objective of the program is to recruit and train young researchers in the field of humanistic or cultural aging research. In the first two years of our effort, we have recruited 7 Ph.D. students and 2 postdoctoral fellows, whose research studies are now well underway. Because these projects involve fieldwork, output in the form of publication in scientific journals will take considerable time. However, all young researchers are working towards this goal, while also giving priority to other forms of communication, such as media, lectures and presentations. Moreover, we are engaged in editorial work: Anne Leonora Blaakilde as general editor of the Danish journal Gerontologi, Astrid Jespersen as editor of Cultural Studies (with an upcoming thematic issue on health promotion) and Lene Otto as a member of the Scientific Advisory for the journal Bibliotek for læger.

One of the programs key concepts is health promotion. Researchers from the program have been involved in health promotion theoretically as well as in practice. The 2007 Danish municipal reform challenged Danish municipalities to focus on health in new ways and with greater force, e.g. citizen-oriented health promotion which aims at creating, shaping and facilitating healthy aging. The program explores how this new form of public health

shapes the everyday experience of well-being and physical self-cognition in middle-aged and older adults. The Ph.D. students are involved in extensive fieldwork in municipal settings, including citizen-oriented health promotion activities such as Senior Fitness programs. Some students are collaborating with health professionals to develop innovative programs.

All subprojects in this program are conducted individually, but are coordinated with the other four programs.

Cross-disciplinary projects

Fatigue is a serious social problem. Although an incomplete, mono-disciplinary knowledge exists concerning medical, psychological, cultural and historical aspects of fatigue, a holistic perspective is lacking. The cross-disciplinary project *Fatigue and everyday life – experiences of fatigue among healthy people and people suffering from apoplexy* (programs 1b and 5) compares experienced fatigue in healthy elderly and elderly affected by stroke or bleeding in the brain. This comparison will reveal differences and similarities in the way in which fatigue is understood and handled under different conditions. Focus is on: 1) differences and similarities in experience of fatigue in healthy and neurologically-ill elderly; and 2) whether standardized dimensions that quantify fatigue are proportional to the subjective experience of fatigue.

A cultural analytical study of fatigue and everyday life among elderly affected by stroke (programs 4 and 5) is an archive and field work-based project, involving two months of preventive home visits in the municipality of Frederiksberg. Due to late approval from the Data Protection Agency, this research project began in November 2010. The archival material has been reviewed and 10 interviews have been conducted. The results will be submitted for publication in summer 2011.

This program participates in the *No Age partnership*, a collaboration between universities, companies, health care institutions and representatives from Danish municipalities, who are in search of innovative solutions that increase quality of life and promote active & self-reliant elderly adults. The core question is to develop/identify innovative solutions that contribute to the maintenance of desired living spaces and functional capability of elderly individuals. It is envisioned that the partnership will develop new products and services which make elderly individuals more self-reliant, while improving their quality of life, reducing public expenses, and developing business export opportunities. The *No Age partnership* will end in 2014.

We are involved in two subprojects:

- *Self-monitoring:* the aim of this subproject is to develop self-monitoring technologies that help elderly individuals prevent age- and lifestyle-related diseases and accidents, manage their own treatment and enhance general well-being, safety etc., thereby allowing more elders to live independently in their own home, saving public expenditure related to consultations in clinics, hospitalization and home services, and improving quality of life.
- *The Meeting Spot:* the aim of this subproject is to establish a physical and/or virtual facilitator for meetings between elderly people in order to keep them fit mentally and physically. This project will increase quality of life among elderly people in an aging society by facilitating togetherness and social activities, to allow elderly individuals, including those with chronic diseases, to live independently in their own home, independent of health care providers, and to facilitate better use of healthcare technologies in daily life by including them in a meeting spot.

c. Group members

Paid by CEHA:

- Lene Otto, Associate Professor (4 months)
- Lucy Lyons, Postdoc (12 months)
- Anne Leonora Blaakilde, Postdoc (12 months)
- Adrian Bertoli, Ph.D.-student (12 months)
- Morten Bülow, Ph.D.-student (12 months)
- Michael Andersen, Ph.D.-student (12 months)
- Hanne Eriksen, Ph.D.-student (12 months)
- Louise Scheel Thomasen, Ph.D.-student (12 months)
- Maja Schøler, Ph.D.-student (12 months)

- Aske Juul Larsen, Research Assistant (12 months)
- Julie Bønnelycke, Research Assistant (12 months)
- Anette Ellingsgaard, Secretary (2 months)

Not paid by CEHA but associated with the center:

- Tine Damsholt, Associate Professor (12 months)
- Hysse Forchhammer, Head of Dep. of Clinical Neuropsychology, Hospital of Glostrup (12 months)
- Astrid Jespersen, Assistant Professor (12 months)
- Signe Mellemgaard, Associate Professor (12 months)
- Karen Dam Nielsen, Research Assistant (12 months)

Society, Culture and Health Care Policy

Program 4

Society, culture and health care policy

Group leaders
Allan Krasnik, Professor

Drugs constitute a massively important intervention technology for preventing, postponing and curing frailty and chronic diseases in elderly people. In Denmark about 85% of the population aged 75 years or older consumes at least one prescription drug daily, and 60% consume more than three prescription drugs daily. In addition to prescription drugs, non-prescription medicines and food supplements are used to promote health. As longevity and its concomitant frailties and chronic conditions increase, the issue of long-term medication for prevention and health promotion becomes an ever more urgent problem for policy makers, health care providers, caretakers, and older people themselves. This level of drug use is associated with huge costs, ethical dilemmas, as well as increased risk of serious adverse drug reactions and/or interactions. The benefits of preventive treatment are often not clear, should be balanced against potential complications, and considered in the context of sustainability, timeframe of effects, possible alternative approaches such as increased physical activity and dietary changes, and people's own understanding and care of their health.

Many different actors are involved in the decisions regarding prescriptions, follow-up and termination of drug consumption, including general practitioners, specialists, hospitals, home care services, the patients and individuals in the patient's social network. However, the decision-making process related to prescription and non-prescription drug consumption is often poorly coordinated, thereby potentially contributing to huge unnecessary costs and sub-optimal interventions. Roles, responsibilities, competencies and coordinating mechanisms related to drug use are unclear, in spite of the increasing need for continuity and integrated care, in light of the dramatic growth in use of preventive and curative drugs. The effects of poor communication between consumers and professionals on the optimal utilization of drugs are also a major concern – not least with older individuals. Little is known about how older people combine prescription and non-prescription drugs and food supplements, and how they communicate with health professionals about their drug use habits.

a. Background and hypothesis

The research in this program is based on a cross-disciplinary approach with a special focus on the role of preventive medication as a major intervention with strong implications for society, health services and the health of an aging population. The program has three main subthemes: a) decision making process and actors, b) social and ethnic inequalities in use of prescription and preventive medication, and c) development, use and effects of

tools to coordinate use of preventive medication. Studies have been established in all three sub-theme areas.

Data collection has been initiated in a hospital department, in general practice and in municipal home care services on how evidence on use of antihypertensive drugs is produced and translated into clinical practice and how this evidence can facilitate clinical decision making. Initial field work and interviews have been conducted in a municipality in southern Denmark and among a group of elderly in Copenhagen. This study will analyze decision-making among lay persons regarding preventive approaches and use of drugs in patients with cardiovascular conditions and pre-diabetes.

In accordance with a comprehensive model "Framework for Focusing Research on Preventive Medication," our studies will elaborate tools that help general practitioners improve the prescribing of preventive medication. A workshop was held in August with representation from researchers and practitioners from public health, general practice and clinical pharmacology. Baseline information will be collected by conducting a field-tested audit of interested general practitioners. A formal collaboration has been established with the Institute for Rational Pharmacotherapy to develop national standards for use of appropriate medication in older people.

In Denmark, 70% of individuals ≥ 80 years have hypertension and approximately 600,000 individuals are being treated for this condition. In addition, more than 300,000 patients are prescribed cholesterol-lowering drugs. Special conditions exist in relation to medication of elderly patients, which calls for a careful prescription policy and sometimes avoidance or withdrawal of drugs including preventive medicine. We have developed a protocol to study the practice of withdrawal of drugs and the general practitioners' and patients' reflections on discontinuation of prescribed drugs.

A sub-study within the theme of social and ethnic inequalities in prescription and use of preventive medication will use register-based data to develop a pharmaco-epidemiological model for analyzing drug utilization according to indication, gender and age. A database has been established that links a number of national registries. Data analysis is ongoing and is being conducted as a multidisciplinary collaborative effort involving pharmaco-epidemiologists and biostatisticians. A cohort-related database on preventive drug use among immigrants and Danish-born individuals has been created. This database will be used for studies on ethnic inequalities in prescription of preventive drug.

A sub-project will be conducted on coordination of preventive medication in the health care system after structural reforms. This project investigates how integrated plans can be developed to coordinate decision-making and practice for preventive medication among the elderly. Questionnaires for decision makers in different parts of the health care system have been developed. These questionnaires will be distributed electronically to municipal health directors, regional and hospital directors and general practitioners in the beginning of 2011, and first data collection will begin.

The program will also develop an approach to aging in a life course perspective that emphasizes the role of health policy and new biomedical technology. Social and moral dimensions of preventive medication and concomitant risk measurement will be investigated. One endpoint will be to show how both expectations and practice are changing in Denmark and other countries of the Global North.

The Program contributes to healthy aging in the following ways:

- A better understanding of the role of long-term preventive medication in healthy aging
- Better coordination and decision-making regarding choice of preventive interventions by health care providers and consumers
- More equitable and fair policy and practice related to preventive drug interventions with an impact on healthy aging

b. Status for milestones

Recruiting of researchers

Three Ph.D. students started their studies in 2010 and a fourth student has been recruited to start Ph.D. study in January 2011. This has been possible due to additional external financing for the students. Two students are focusing on decision-making (as indicated in the 2009 milestones) related to the production and translation of evidence on preventive medication related to general practice and home nursing, one student is working on a study of coordinating tools across different health services, and the last student will focus on decisions related to prescription policies and withdrawal of preventive drugs. Two postdoctoral fellows have been recruited in 2010 to study social and ethnic equity.

Surveys on coordination and decision making

Questionnaires have been developed for the *first survey among policy actors and managers* including general questions on coordinating issues. The questionnaire for municipal directors has been tested and will be distributed electronically to all municipalities in Denmark in January 2011. Questionnaires for regional directors, hospital directors, heads of clinical hospital departments and general practitioners will be distributed in spring 2011. A second sub-study (including surveys and interviews) will focus on facilitating factors and barriers related to coordination of preventive drug prescription. This study will be carried out in the second half of 2011 and beginning of 2012.

Register studies on social equity and drug consumption

A database has been established for the sub-study on social equity in the use of cholesterol lowering drugs for prevention of cardio-vascular diseases. The database links data from various registers on social status, migration status, drug consumption and heart disease. Furthermore, a database has been established on a large cohort of immigrants and a matched group of Danish-born individuals using data on prescribed drug use, health and morbidity from the National Board of Health and Statistics Denmark. Both databases are now available for sub-studies on equity issues regarding preventive medication and the first data analyses have been initiated.

The role of preventive home visits

A Ph.D. study based on interviews and observations will analyze the role of home nurses for preventive medication among the elderly. The first data collection has been initiated. Data from a previous randomized study on the effect of training programs for preventive home visitors have been analyzed with a special focus on the effect on use of sleeping medication.

Joint projects with other programs

Rethinking life course analysis is a joint project conducted by Themes 3, 4, and 5. A one-day conference followed by a two-day Ph.D. course is planned for 2011. The working title of the conference is: *Measuring life courses: Analytical and methodological approaches to aging.* Keynote speakers, who will also participate as teachers in the Ph.D. course, have been identified. The conference will create a dialogue about epidemiological and social science approaches to life course analysis with a focus on aging. A manuscript is being prepared for publication, which will also serve as a foundation for discussion at the conference. The research outcome will be a new argument by lay people and physicians about how health measurements are increasingly being used to conceptualize the life course.

The cross-disciplinary project *Childhood social position, cognitive function in early adulthood and use of preventive medicine in midlife* (Programs 3 and 4) is a longitudinal study based on data from the Metropolit birth cohort (11.532 boys born in 1953). The aim is to investigate whether father´s social class at participants' birth is associated with use of prescribed drugs in middle-aged men and examine whether any associations are associated with cognitive function in young adulthood. The selected drugs are antihypentensives, antithrombotic agents, lipid-lowering drugs, anxiolytics, hypnotics, sedatives and antidepressants. The Danish Drug Prescription Register for the period 2006-2008 will be updated, and data will be analyzed by a senior researcher.

c. Group members

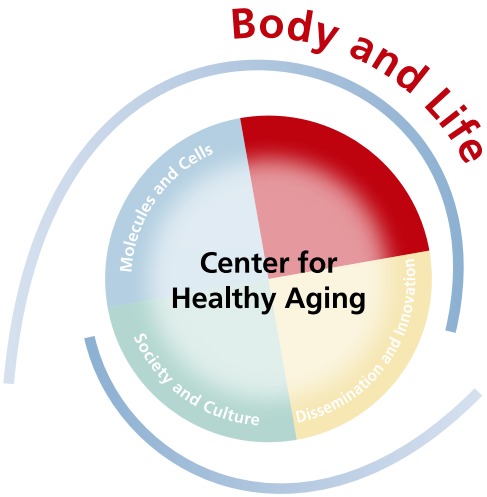
Paid by CEHA:

- Allan Krasnik, Professor (3 months)
- Susan Reynolds Whyte, Professor (12 months, part time)
- Bjarke Oxlund, Postdoc (12 months)
- Helle Wallach Kildemoes, Postdoc (11 months)
- Mikkel Vass, Postdoc (12 months, part time)
- Sarah Wadmann Lauridsen, Research assistant (2 months)
- Sarah Wadmann Lauridsen, Ph.D.-student (6 months)
- Andreas Rudkjøbing, Ph.D.-student (3 months)
- Michael Nixon, Research Assistant (2 months)
- Laura Lindberg, Research Assistant (5 months)
- Janne Sørensen, Administrative Officer (10 months, part time)
- Ditte Schmidt Jeppesen, Student Assistant (3.5 months, part time)
- Marie Nissen, Student Assistant (8.5 months, part time)
- Marie Tolstrup, Scholar student (2 months)
- Kamilla Gundersen, Scholar Student (2 months)
- Natasja Koitzsch Jensen, Research Assistant (1 month)
- Trine Wulff, Research Assistant (1 month)

Not paid by CEHA but associated with the center:

- Carsten Hendriksen, Associate Professor (12 months, part time)
- John Sahl Andersen, Associate Professor (12 months, part time)
- Bodil Ludvigsen, Ph.D.-student (12 months)

Body and Life



Program 3

Body and life

Group leaders
Kirsten Avlund, Professor
Erik Lykke Mortensen, Associate Professor

Physiological, psychological and social factors all increase the risk of disability and frailty in older adults. When planning prevention for many older individuals with comorbidity and complex problems, there may be little value in targeting one risk factor, but much greater benefit in targeting factors that increase the risk of disability, regardless of specific cause. Therefore it seems highly relevant to explore early signs that can be measured, but which are not yet manifested as disease or pathological conditions. Such early signs may be useful in primary prevention to identify well-functioning individuals at high risk for functional decline or frailty by characterizing an early functional state that is associated with later disability and frailty.

It has been increasingly recognized that the aging process is shaped throughout the entire life course, not only in old age. Strain in childhood, youth and early adulthood (e.g.; disease, poverty, low education, high loads of stress in the working environment) increases the risk of early occurrence of chronic disease (e.g.; cardiovascular disease, pulmonary disease) and comorbidity, which in turn increases the risk of premature disability and frailty. Further, a number of psychological factors, in particular, cognitive performance and psychiatric illness, influence how people handle risk factors for illness and disability and thereby shape the aging process.

Life course research is primarily based on prospective studies and focuses on biological, psychological and social factors that influence the association between development and aging processes over the entire life course. Moreover, life course research demands a clearer exploration of strain factors over the life span, i.e., when and how long do they typically influence the individual? It is important to elucidate whether there are certain periods (e.g., early childhood) when one is particularly vulnerable to certain types of strain and whether the duration of strain is of special importance.

We utilize data from Copenhagen Aging and Midlife Biobank (CAMB) to 1) explore the independent effects of and interplay between social, cognitive and health factors earlier in life on several indicators of early aging and 2) explore the cumulative effect of these different factors. The analyses are based on cohorts of individuals who have been interrogated at several points in time. Therefore, individual records can be used to analyze the complex interplay between biological, mental and social variables over time, and the difficult question of causal direction can be addressed. The strength of CAMB is that a majority of the relevant predictor variables and outcome variables are measured at several points in

time. This means that it is possible in several of the analyses to study the predictive value of changes in the determinant at two or more points in time on changes in the outcome measure at two or more points in time. Methods are available to analyze such trajectories and to utilize repeat observations of predictors. These methods and more traditional regression methods will be applied in ongoing studies in this theme.

Our analyses will also consider *induction time* from exposure to effect, the possibility that causes exposures may have different effects in different periods of life *(critical periods of exposure time)*, and whether there are critical periods in which specific risk factors have detrimental effect on the aging process. Lastly, we will consider whether the effect of exposure *accumulates* additively or whether earlier exposure alters susceptibility to later exposure through antagonistic/synergistic interactions.

a. Background and hypothesis

One crucial research question in relation to healthy aging is to identify markers, which may accelerate the aging process. These markers may be early biological and physiological indicators of frailty and disability, including decline in cognitive performance, decline in physical performance. We have focused on several biological markers (e.g. oxidative stress, DNA repair capacity and mitochondrial function), physiological indicators (e.g. sarcopenia, grip strength), cognitive decline and self-reported indicators of aging (e.g. disability and fatigue). The aim is to identify associations between these different signs of aging and to examine whether they follow the same patterns or whether they act independently.

Further, we have focused on the influence of life course processes on frailty and specific signs of early aging. We study 1) the influence of strain factors over the life span, i.e., when and how long do they typically influence the individual? 2) the relevance of critical periods to vulnerability to certain types of strain, and 3) whether the duration of strain is of special importance.

The program contributes to:

- A life course perspective on healthy aging
- A dialogue between biomedical, psychological, sociological, epidemiological and qualitative research traditions
- Knowledge about how social, biological and psychological early life course factors may interact and accumulate in relation to healthy aging
- A better understanding of why some people live to old age in good health, which may serve as basis for interventions that promote healthy aging

b. Status for milestones

In the studies on early markers of aging, we build on the existing research in the group on measures of functional limitations, disability and fatigue. The group has initiated several new studies on fatigue and fatigability. In 2010, we especially studied how fatigue is influenced by mitochondrial function, telomere length, white blood cell count, tooth loss and muscle strength, and relational strain. For example, one cross-disciplinary project (described under Molecular Aging) showed that levels of mitochondrial function differed significantly between middle-aged men with and without fatigue. Another study found that white blood cell count is related to fatigue in young and old populations, but the mechanisms for the association vary by age. We also studied whether factors in the environment are related to fatigue – and found that strain in social relations is strongly related to fatigue in middle-aged men.

In 2010, we recruited Minna Mänty, Post Doc, from Jyväskylä University, Finland. Her first study shows that muscle strength is one of the underlying factors between self-reported fatigue and walking speed in older people.

Our results underscore the idea that causes of fatigue are multifactorial and that it seems meaningful to target self-reported fatigue in interventions to prevent disability. We have also initiated a qualitative study on the meaning of fatigue for persons in midlife and a validation study on muscle fatigue.

Another line of research in relation to early markers of aging is on periodontal inflammation. We have found that older persons with cognitive decline are at higher risk of periodontitis, and that periodontal inflammation in early old age correlates with mortality during 21-year

follow-up. This indicates that periodontitis is an indicator of a history of chronic inflammation or a weakness of the immune system. In 2010, we initiated several new research projects on whether periodontitis in old age is influenced by childhood socioeconomic status, allostatic load, social relations, cognitive decline or depressive mood.

The main focus of life course studies in 2010 was to establish CAMB. The data collection runs as planned. We have invited 17.899 48-60-year old persons to take part in the study (7.794 from the Metropolit Study, 4.913 from the Danish Longitudinal Study on Work, Unemployment and Health, 5,192 from the Copenhagen Perinatal Birth Cohort). Cognitive testing, administration of questionnaires and blood sampling are in progress. The physical tests include measurements of height, weight, fat percentage, blood pressure, spirometry, muscle strength, maximum muscle force, flexibility, balance, chair-rise test, and reaction time. In 2010, we added the Aastrand 1-point test (aerobic capacity) and a muscle fatigue test to the test battery. Blood samples are analyzed immediately or stored in the Biobank for future use.

Data are collected directly from a test station or via Microsoft Access at CAMB's server. Freezer-steering, registration of tubes and their placement in the freezers are managed by a program called Freezerworks. Data are subject to regular quality control checks and are protected from loss by daily back-up. Questionnaires and written tests are scanned and data are verified on an ongoing basis. Our goal is to document all parts of data collection. Data collection is followed by data cleaning, merging and documentation in order to make data easily accessible and future proof for analytical purposes. By end of 2010, the number of participants is expected to be approximately 5,000. Data collection will end on 1. March 2011. Oral examinations for periodontitis ended in February 2010 with a total of 1521 participants.

Several ongoing projects are being conducted using data in existing databases. Questions addressed in these projects include how education early in life and socioeconomic status interact with social relations in relation to dynamic balance, mobility limitations, disability and fatigue. One finding was that the development of mobility limitations begins earlier in the lower than in the higher social strata and that these differences are present already in 40 year old individuals. Furthermore, we found that simultaneous exposure to being living alone and low socioeconomic position increased the odds ratios for onset of mobility disability, and that men who live alone may be able to alleviate their risk of mobility disability by being socially active.

In 2010, we also initiated several new research projects on whether and how specific early aging signs are influenced by childhood socioeconomic status (SES), the psychosocial and working environment, how SES early in life interacts with physiological function in midlife in relation to early aging signs and how cognition and health early in life interact in relation to social differences in midlife. We found that socioeconomic position of the father influences development of obesity in middle-aged men. Ongoing Ph.D. projects are studying: 1) Mechanisms of psychosocial and biological factors acting over a life course and low grade inflammation (mediation and interaction); 2) Is intelligence and health early in life related to social differences in early aging in midlife, 3) Influence of physically hard work during life on early aging, and 4) The importance of physical performance and physical activity in midlife for sick leave in the later part of the working career.

Progress and research outcomes – cross-disciplinary projects

As the CAMB data collection is not yet finalized, it has only been possible to make analyses on restricted samples and selected data from CAMB. For example, CAMB blood samples were used in the cross-disciplinary project *Identification of molecular biomarkers for fatigue and cognition*, which analyzed mitochondrial function and ROS, and in the project *Test profile for identification of predictors of minimal cognitive decline* (program 1a, 1b, and 3). This project involves cognitive tests from 2126 male CAMB participants as well as data on cognitive performance at age 18 from the same individuals. Data were used to generate a regression model to examine

how cognitive function at age 18 predicts cognitive function in midlife. Predicted values and residuals have been used in the selection of two groups (N=100) with the largest decrease and highest increase in cognitive function, respectively. These subjects have been invited to participate in a detailed neurophysiological examination.

c. Group members

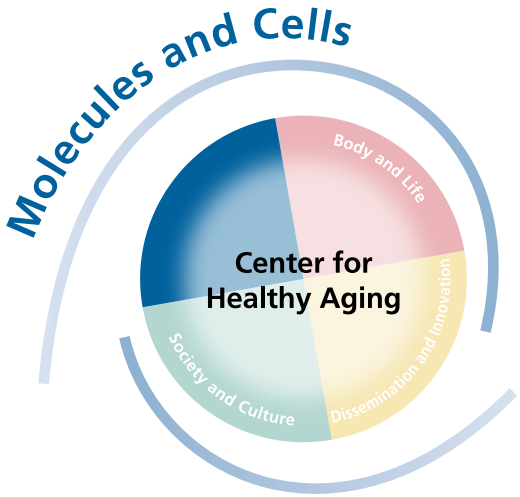
Paid by CEHA:

- Kirsten Avlund, Professor (3 months)
- Erik Lykke Mortensen, Associate Professor (2 months)
- Rikke Lund, Associate Professor (3 months)
- Carlos Mendes de Leon, Professor (Visiting Professor 2010) (2 Month)
- Minna Mänty, Postdoc (4 months)
- Rikke Hodahl Meincke, Research Assistant (12 months)
- Anne-Mette Larsen, Research Assistant (2 months)
- Ditte Dyrholm, Research Assistant (12 months, part time)
- Kristine Harrsen, Research Assistant (8 months)
- Drude Molbo, Data-coordinator (6 months, part time)
- Eva Jepsen, Project coordinator, Program coordinator (6 months)
- Vivi Møller, Secretary (3 months)

Not paid by CEHA but associated with the center:

- Finn Diderichsen, Professor (12 months)
- Merete Osler, Professor (12 months)
- Rikke Lund, Associate Professor (9 months)
- Yukari Yamada, Postdoc (12 months, part time)
- Laila Bendix, Postdoc (12 months)
- Anette Ekmann, Ph.D.-student (12 months 37 hrs/week)
- Charlotte Nilsson, Ph.D. -student (12 months)
- Tine Poulsen, Ph.D.-student (12 months, part time)
- Santiago Rodriguez, Ph.D.-student (3 months)
- Chris Salazar, Ph.D.-student (1 month)
- Jens Worm Begtrup, Cand.Mag (12 months)
- Rasmus Lund, Cand.Mag (12 months, part time)
- Monica Coyle Jarlby, Dental Hygienist (12 months)

Muscle and Matrix



Program 2

Muscle and matrix

Group leaders
Flemming Dela, Professor
Michael Kjær, Professor

Metabolism in aging skeletal muscle
Physical inactivity and lack of muscle use increase the risk of many aging-associated chronic diseases, including the cluster of phenotypes known as metabolic syndrome. Biomarkers associated with metabolic syndrome will be evaluated in aged, healthy, and diseased individuals at different life stages and after perturbations, such as reduced physical activity. Candidate biomarkers include cytokines in the GH/IGF-1 and/or NF-kB pathways, estrogen and testosterone, the ubiquitin-proteosome system, ROS and lipofuscin. These and other candidate biomarkers will be evaluated in individuals with or without signs of muscle atrophy and with or without specific co-morbidities associated with aging. The effect of periods of physical activity or physical inactivity will be examined, as well as the effect of nutritional or pharmacological interventions. The interventions in aged healthy and aged patients with type 2 diabetes include inducement of physical inactivity (bed-rest or reduced daily movements), followed by re-training. It is hypothesized that inactivity will be associated with reduction in insulin sensitivity in parallel with loss of mitochondrial function. In contrast, exercise inhibits insulin resistance and frailty, at least in part by stimulating mitochondrial function. We will study the effect of major changes in daily physical activity on endothelial function, insulin sensitivity, mitochondrial function (fat and muscle), ROS production, and antioxidant enzyme activity. This will be done in middle-aged population subgroups with phenotypical characteristics that predict a susceptibility to the metabolic syndrome, insulin resistance and frailty.

Sarcopenia, frailty and impaired tissue regeneration
Age-related sarcopenia and frailty is associated with increased risk for falls and fractures, but the mechanisms contributing to skeletal muscle atrophy in the elderly are not well understood. In elderly individuals, growth factors such as IGF-1 antagonize muscle atrophy during periods of reduced physical activity. Further, factors linked to inflammatory pathways may limit muscle growth; therefore, we will investigate the effect of inflammation on growth-stimulating pathways. Frailty is a continuum with several degrees of severity, such that frailty may develop over decades, beginning well prior to old age. We hypothesize that physical inactivity causes loss of motor function, decreased muscle performance and reduced capacity for tissue regeneration, leading to associated metabolic and energetic dysfunction, and that there is a direct link between insulin resistance and frailty. Physical activity restores impaired signaling pathways in aging muscle. Similarly, connective tissue deteriorates with inactivity and regains functional characteristics with training. We will investigate the mechanisms leading to

aging-associated loss of regenerative capacity in skeletal muscle and connective tissue, and test the hypothesis that age-associated low-grade inflammation impairs the capacity to recover from injury or disease-related inactivity.

a. Background and hypothesis

Aging is associated with changes in tissue metabolism, structure and function. However, the timing of these changes is highly individual and highly dependent on lifestyle throughout the life course. *Our overall working hypothesis is that all types of physical activity protect against aging-associated dysfunction and that lack of physical activity is the predominant predictor for age-related morbidity and premature mortality.*

In 2010, we continued studying the biological mechanisms underlying the effect of physical activity on age-related deterioration of health, e.g. sarcopenia & frailty, low-grade inflammation, insulin resistance and metabolic syndrome, and metabolic and mitochondrial dysfunction. The following paragraphs briefly describe some of our ongoing projects, illustrating the range and depth of our research program.

b. Status for milestones

A semi-quantitative immunohistochemical technique has been developed to measure ceramide content in single muscle fibers from muscle cryosections of trained and untrained individuals. Intracellular distribution of the fatty acid transporter (FAT/CD36) and myosin heavy chain type I can also be measured in single muscle fibers by fluorescence immunostaining. Semiquantitative biomarkers of oxidative stress-induced DNA (8-OXO) and protein (NITT) damage have been developed and will be measured in skeletal muscle from young and elderly subjects and patients. A semiquantitative immunofluorescence method has also been developed to measure lipid and glycogen content, consumption and re-synthesis in skeletal muscle. Intracellular distribution of VEGF has been measured in human skeletal muscle before and after acute exercise. Biopsies have been collected, fixated, and immunostained for light and electron microscopy analysis. Analysis of mitochondrial function in human heart showed that heart failure is associated with a shift in substrate preference from fatty acids towards carbohydrates and sustained mitochondrial capacity for oxidative phosphorylation. Mitochondrial respiration was analyzed in heart tissue from mice with a knock-down (kd) of AMP-activated protein kinase (AMPK). Knock-down of AMPK, a master-switch of mitochondrial substrate utilization, compromised mitochondrial function mimicking the effect of aging. Substrate sensitivity was analyzed in skeletal muscle of insulin-resistant patients, obese and lean control subjects- covering a wide age-range. No difference in respiratory capacity per mitochondrion was found. However, mitochondrial substrate sensitivity was higher in aged patients with type 2 diabetes than in obese and lean controls. The increased substrate sensitivity may help regulate ROS production, because a high mitochondrial respiratory flux decreases mitochondrial membrane potential, which in turn decreases ROS production. Mitochondrial respiratory capacity, substrate sensitivity and content were compared in young and middle-aged men matched for maximal oxygen uptake. Mitochondrial substrate sensitivity was similar in young and middle-aged men. Respiratory capacity per mitochondrion was higher in young men. Middle-aged men need a higher mitochondrial content to sustain a high maximal oxygen uptake than young men. Previous reports indicate that metformin inhibits complex I. This idea was tested in elderly patients who use metformin and by titrating metformin to mitochondria. Although the data show toxic effects of metformin, clinically relevant concentrations of metformin (1000-2000 mg/day) did not inhibit complex I. Statins are potent cholesterol lowering drugs widely used in the elderly; however, approximately 20% of statin users complain of mylagia (muscle pain). This may reflect that fact that statins impinge on Q10 in the electron transport chain. Therefore, we will investigate the effect of statins specifically on Q10 and more generally on mitochondrial respiration. Pilot experiments were carried out to investigate the effect of physical inactivity and retraining in 15 young (20-30 years) and 15 old (60-70 years) healthy, lean, inactive subjects. The activity restricted phase will involve 2 weeks of one legged immobilization, and the retraining phase will include 6 weeks of supervised aerobic exercise (1 hour, 4 times/week). The primary focus will be the effect of acute exercise and physical inactivity on

mitochondrial respiration, membrane potential and ROS release in young and elderly subjects. As a secondary focus, intra-muscular lipid-droplets will be measured in young and old sedentary subjects during acute exercise after immobilization with or without retraining.

In regards to muscle and matrix loss with aging, studies have been carried out on young and old individuals that demonstrated a very fast initial drop in muscle force and mass. After this initial phase, a signaling pattern compatible with maintenance of skeletal muscle is found in the elderly. This underscores the importance of rapid intervention against loss of muscle in the elderly. Further experiments are currently examining the effect of growth hormone or placebo on IFG-I, as well as the effect of estrogen replacement in elderly women. The regenerative response of muscle after heavy muscle loading with injury has been studied in young individuals with or without blockade of inflammatory pathways, showing that inflammation modulates activation of satellite cells. In elderly individuals, inflammation was blocked during retraining after immobilization, when elderly have a lower satellite cell response than young counterparts. Elderly tendons have low collagen content, but the number of cross-links is comparable in elderly and young subjects. The mechanical pattern is maintained in elderly if regular physical activity is performed. The effect of circulating growth factors on fibrillogenesis and collagen synthesis in tendon is being studied. Finally, the chondroprotective effect of interleukin-10 (IL-10) is being studied in individuals with knee osteoarthritis. In these individuals but not in healthy individuals, the effect of strength training in patients does not seem to be influenced by intake of anti-inflammatory, pain-reducing medication.

Progress and research outcomes – cross-disciplinary projects

The major aim of the cross-disciplinary project entitled *Mitochondrial damage as a cause of Huntington Disease – a Premature aging model/skeletal muscle stem cells as a model for age-related accumulation of mtDNA mutations and possible underlying mechanisms* (programs 1a and 2). The goal of this project is to analyze mitochondrial function (including nucleotide pool maintenance), cell death (FACS analysis) and repair of endogenous DNA strand breaks and oxidative DNA lesions as biomarkers forHuntington disease (HD). HD is a fatal neurodegenerative disorder with no known treatment. Presently, little is known about the etiology of HD. Specific brain regions in HD patients show increased oxidative damage to mitochondrial DNA (mtDNA), increased mtDNA mutations and decreased mitochondrial enzyme activity. A common symptom of late stage HD is extensive weight loss, consistent with the hypothesis of impaired energy metabolism. An emerging concept suggests that HD is associated with excessive oxidative load, low mitochondrial number, and high production of reactive oxygen species (ROS). Here, we will test the hypothesis that HD is associated with excessive oxidative DNA damage as a consequence of mitochondrial dysfunction. The project is a unique collaboration between the BMI and ICMM Institutes at the University of Copenhagen. This collaboration will benefit from expertise in analysis of mitochondrial function and expertise in HD neurobiology of the section of neurogenetics.

A second cross-disciplinary project is entitled *SIRT1 mediated protection of mitochondrial biogenesis in Cockayne Syndrome B protein deficient cells upon oxidative stress"* (programs 1a, 1b, and 2). This project aims to characterize the biological function of Cockayne syndrome group B (CSB) protein. Cockayne syndrome is a premature aging condition associated with severe neurodegeneration. CSB protein plays a significant role in nucleotide excision repair and base excision repair, two major pathways of DNA repair, and in transcription. CSB is present in mitochondria, suggesting a possible role in mitochondrial DNA repair and/or mitochondrial inner membrane structure. We are investigating mitochondrial dysfunction and bioenergetics in cells and mice lacking the CSB protein. Mouse models will be used to explore the neurological consequences of CSB deficiency in the brain.

A newly started cross-disciplinary project *GASMITO* will investigate the effect of gastric bypass surgery on glucose and lipid metabolism and mitochondrial respiration (Programs 2 and 3). A Ph.D. student Michael T. Lund will study the Roux-en-Y procedure, which elicits a marked

loss in body weight (predominantly adipose tissue), as well as the associated unexplained effect on hormonal secretion and insulin resistance. The effects of diet- and surgically induced weight loss will be examined, including baseline, post-diet and 4 and 12-18 months post-operative adaptations to bariatric surgery. The program includes invasive, state-of-the-art experimental and analytical setups. Furthermore, psychological effects of the interventions will also be examined. This project will contribute to understanding of the mechanisms underlying insulin resistance – a phenomenon that is prevalent in the elderly population.

Another project is entitled *Rehabilitation after immobilization of skeletal muscle and matrix tissue.* This study will investigate whether elderly individuals (65-70 yrs) who are low in muscle strength are more susceptible to muscle loss when subjected to a period of inactivity, and if they have less capacity to recover. The goal is to identify factors that predict age-related vulnerability to decreased physical activity. The most likely candidate factors are low protein synthesis in skeletal muscle due to anabolic resistance towards nutrition, or high dependence on muscular activity to maintain muscle. Positive associations will provide a "blue prints" for understanding development of sarcopenia, and will help develop interventions that could potentially counteract muscle loss and to accelerate rehabilitation after immobilization due to disease or injury.

It has been suggested that inflammation and immobilization affect muscle stem cell activity in older individuals. Therefore, the project *Muscle stem cell activity in elderly* will attempt to elucidate the effect of anti-inflammatory medication (NSAIDs) on muscle stem cell activity and whether this response differs in healthy older and healthy young individuals. We hypothesize that NSAIDs alter Notch and Wnt signalling and modulate the switch between these two signaling pathways, thereby inhibiting satellite cell activity and reducing low-grade inflammation in older individuals, which could re-sensitize muscles to Notch and Wnt signaling and promote muscle regeneration after exercise.

c. Group members

Paid by CEHA:

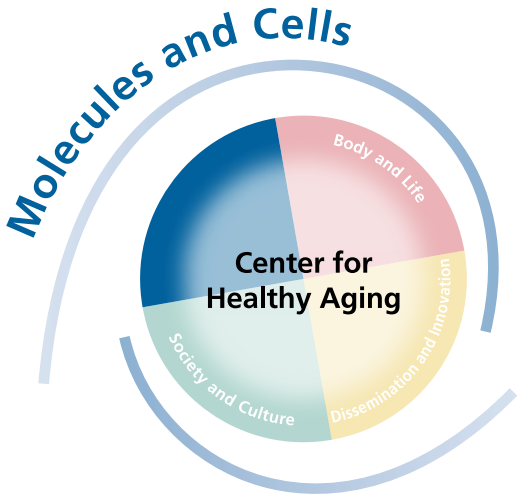
- James A. Timmons (Royal Veterinary College, University of London), guest Associate Professor (12 months, part time)
- Martin Hey-Mogensen, Postdoc (5 months)
- Abigail Mackey, Postdoc (12 months)
- Ulla Ramer Mikkelsen, Postdoc (6 months)
- Mads Kongsgaard Madsen, Postdoc (6 months)
- Lars Holm, Postdoc (1 month)
- Chalotte Suetta, Senior Researcher (12 months, part time)
- Christian Couppé, Ph.D.-student (5 month)
- Scott Patrick Joseph Maynard, Postdoc (12 months, part time)
- Niels Andreas Vigelsø Hansen, Research Assistant (2 months and two months on part time)
- Christina Neigaard Hansen, Staff Scientist (12 months)
- Jacqueline van Hall, Secretary (12 months, part time)

Not paid by CEHA but associated with the center:

- Peter Magnusson, Professor (6 months, part time)
- Robert Boushel, Associate Professor (12 months)
- Jørn Wulff Helge, Associate Professor (12 months)
- Clara Prats, Associate Professor (12 months)
- Henning Langberg, Associate Professor (6 months part time)
- Nina Beyer, Associate Professor (3 months, part time)
- Peter Schjerling, Senior Researcher (6 months, part time)
- Jesper Løvind Andersen, Senior Researcher (6 months, part time)
- Katja Heinemeier, Postdoc (6 months, part time)
- Mette Hansen, Postdoc (12 months)
- Rasmus Rabøl, Postdoc (12 months)
- Lise Højbjerre, Ph.D.-student (3 months)
- Steen Larsen, Ph.D.-studendt (12 months)
- Michael Taulo, Lund Ph.D.-student (12 months)
- Nis Stride, Ph.D.-student (12 months)
- Anders Ploug Boesen, Ph.D.-student (12 months)
- Theresa Bieler, Ph.D.-student (12 months)
- Monika Bayer, Ph.D.-student (12 months)
- René Brüggebusch Svensson, Ph.D.-student (12 months)

- Martin Gram Jensen, Research Assistant (8 months); Ph.D.-student (5 months)
- Jeppe Bach, Technician (12 months)
- Regitze Kraunsøe, Technician (12 months)
- Thor Munch Andersen, MD (12 months, part time)

Neuro-science



Program 1b

Neuroscience

Group leaders
Martin Lauritzen, Professor
Poul Jennum, Professor
Egill Rostrup, Professor

This research program explores how aging influences brain function. Our brains' response to the environment as well as our own thoughts require energy, and minor defects or changes in energy metabolism as well as genetic factors, can cause nerve damage and disrupt oxygen delivery to the neuronal cell. Researchers will identify age-related factors that affect information processing in the brain, shedding light on how imbalance in oxygen and sugar metabolism may contribute to premature aging, impaired brain function and neurodegeneration.

Markers of brain function will be examined in persons with mild dementia. Brain scanning methods will be used to monitor neuronal activity involved in perception, attention and problem-solving, and unique patterns of activity associated with dementia will be identified. The clinical neurobiology research group will also develop tools to analyze sleep patterns in persons with mild cognitive impairment, Alzheimer's and Parkinson's disease. These studies will generate tools for identifying individuals at risk for progressive disease, and facilitate development of preventive interventions or treatment options.

a. Background and Hypothesis

This program will focus on neurodegenerative disorders, cognitive decline and sleep disorders, with emphasis on information processing, cognitive function and energy metabolism in the brain. Small defects in energy metabolism cause genomic instability that in turn gives rise to oxidative stress and neuronal damage. Markers of aging and neurodegeneration will be identified and the possible role of altered oxygen and sugar metabolism in early aging and cognitive decline will be examined. Functional neuroimaging techniques will be used to examine changes in brain function in individuals with mild cognitive impairment. Sleep disturbances will be monitored in the same individuals.

Our research program explores the following hypotheses:

1. Sleep disturbances influence cognitive performance and may coincide with and cause cognitive impairment, neurodegeneration and unhealthy aging.
2. Altered patterns of neurological activity predict mild cognitive impairment and unhealthy aging.
3. Deregulation of brain oxygen metabolism causes oxidative DNA damage and contributes to the pathology of neurodegenerative disorders.
4. Oxidative stress and mitochondrial dysfunction contribute to neurodegenerative processes and aging-associated cognitive decline.

Our goal is to develop tools to predict, prevent and treat cognitive impairment, and conduct targeted campaigns to promote healthy aging.

b. Status for milestones with an introduction of concepts

(i) Sleep disturbances, neurodegeneration, and cognitive impairment

Sleep-wake regulation depends on complex functions in the brain stem, thalamus, hypothalamus and basal forebrain. Several neurodegenerative disorders and especially Parkinson-like syndromes are characterized by early degeneration of basal brain areas. This gives rise to symptoms such as sleep-wake deregulation, abnormal dreaming activity, abnormal motor control during sleep (REM behavior disorder (RBD)), abnormal autonomic regulation in wake and sleep, cognitive impairment, depression, nocturnal voiding that are manifest many years before classic signs of neurodegenerative disease. Our study will identify sleep disturbances that might serve as early markers of neurodegenerative disease, with the goal of identify candidates for preventive treatment.
Milestones 2011: Two CEHA funded Ph.D.-students are working on this study. Data will be completely collected and analyzed by the end of 2011. Manuscript preparation is planned for the first half of 2012.

(ii) Aging, health and chronic neurological disease

The primary goal of this project is to evaluate the health consequences of selected major sleep and neurological diseases in terms of direct and indirect costs at the national level as a function of age. Morbidity, mortality and social factors will be considered separately. Diseases included in the study include sleep apnea, narcolepsy, hypersomnia, multiple sclerosis, epilepsy, dementia and stroke. The studies will be Oxford classification I studies (controlled) and will include all Danish patients diagnosed with the indicated diseases within an 8-year period. Milestones 2011: Two manuscripts have been accepted for publication and are *in press*. Additional manuscripts are in preparation and will be submitted for publication in 2011.

(iii) Functional neuroimaging

Functional magnetic resonance imaging (fMRI) is a neuroimaging method that can identify local changes in perfusion and activity in selected brain regions, providing important information on brain function, including cerebral blood flow and oxygen supply. While the spatial distribution of correlated networks is relatively constant in healthy subjects, this pattern is altered in individuals at risk for Alzheimer's disease. We explore the possibility that fMRI data can be used to distinguish between healthy and unhealthy aging brains. Three protocols have been submitted for approval by the ethical committee, with the following titles:

a. T*est profile for identification of predictors for minimal cognitive impairment.* This project will use fMRI to analyze brain structure and performance in middle aged men with or without cognitive decline (relative to previous performance). Intrinsic connectivity, brain structure and perfusion will be analyzed in a cohort of 200 subjects from the CAMB/Metropolit study.
Milestones: Protocol has been approved. Data collection began in December and five subjects have been interrogated to date.

b. *Brain resting state network activity in patients with Alzheimer's disease: effect of anti-cholinergic treatment.* This project will analyze intrinsic connectivity networks in patients with Alzheimer's disease, before and after initiation of cholinergic treatment. The aim is to elucidate the functional brain correlates of dementia and whether they are modified during standard treatment.
Milestones: Protocols b and c are in the final phase of evaluation in the ethical committee.

c. *Brain resting state network activity under conditions of experimental modulation of brain oxygen supply.* This project will compare the neural networks deduced by fMRI and EEG. This will make it possible to evaluate the hypothesis that intrinsic connectivity patterns have a predominantly neural background. Furthermore, this study will explore how brain perfusion and oxygenation modulate network patterns. These data will help interpret the networks in healthy

middle aged subjects and patients with dementia.
Milestones: Protocols b and c. are in the final phase of being evaluated by the ethical committee. Pilot studies using protocol c have been initiated.

(iv) BrainPower: Failure of oxygen supply as a mechanism of aging and neurodegeneration:
Limited supply of oxygen and glucose contributes to initiation and progression of neurodegenerative disorders, but the mechanisms are incompletely understood. This question will be examined by carrying out two-photon *in vivo* imaging of brains of normal young mice, normal old mice and mice with accelerated aging (Werner's syndrome). Electrophysiological and Ca^{2+} imaging techniques will be used to evaluate cerebral blood flow and oxygen metabolism. Age dependent changes in Ca^{2+}-related biomarkers will be monitored, including glial calcium waves, synaptically activated Ca^{2+} transients, and the sensitivity of these variables to rises in synaptic inhibition. Compartmentalization of Ca^{2+} signaling in neurons will also be examined.

Milestones, 2011:

- Activity-dependent changes in blood flow, oxygen consumption and intracellular Ca2+ (2-photon microscopy) in transgenic mice with deficiencies of base excision repair causing Werner's syndrome. Cockayne B mice have been imported from NIA, NIH and a breeding program has been started.
  Mice will be ready for analysis in first half of 2011.

- Explore the possibility of using 2-photon microscopy in conscious, freely moving animals.
  Project initiated in 2nd half of 2011.

- Examine stimulus-dependent production of glial calcium waves in mouse cerebellum in mature and aged mice.
  Project ongoing in 1st half of 2011.

- Correlation between calcium spikes in neuronal and astrocytic cell structures and blood flow response in mouse whisker barrel cortex.
  Paper will be prepared in first half of 2011.

- In vivo 2-photon microscopy of neuronal signaling, blood circulation and energy consumption in nerve circuits in mature and aged mice: Effect of activation of GABA receptors.
  Project ongoing in 1st half of 2011

Progress and research outcomes – cross-disciplinary projects:
Project coordination, clinical neuro-projects. We have prepared all documents and approvals necessary to initiate a clinical research project that involves Program 1A, 1B, 2, and 3 as well as to facilitate the different research groups in their activities. The clinical research protocol was approved by the Science Ethics Committee in May 2010 and in November 2010 the Danish Data Inspection gave permission to work with personal data in the project. Four hundred and five CPR numbers, divided into two groups, of potential study participants have been obtained from Copenhagen Aging Biobank (CAMB)/ Metropolit cohort. Enrollment of participants started in November 2010. Sixty participants have been invited and s23 have agreed to participate in the project. Programs 4 and 5 will be involved after data have been collected and analyzed. Milestones: A web-based database in SPSS-format will be established in 2011. The neuroscience data will be accessible to all CEHA researchers.

Basic neuroscience project: The projects involve formal collaboration between programs 1A and 1B.

c. Group members

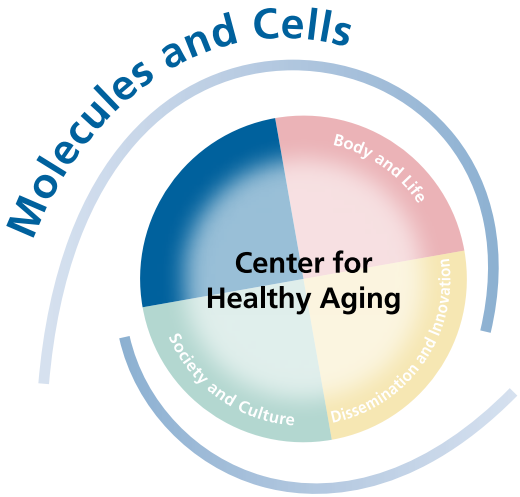
Paid by CEHA:

- Jacob Kempfner,Ph.D.-student (12 months)
- Gertrud Laura Sørensen, Ph.D.-student (12 months)
- Katja Linda Grafer, Ph.D.-student (12 months)
- Ulrich Lindberg, Research Assistant (4 month)
- Claus Mathiesen, Postdoc (12 months)
- Naja Liv Hansen, Ph.D.-student (12 months)
- Otto Henriksen, Ph.D.-student (6 months, part time)
- Sanne Barsballe Jensen, Ph.D.-student (12 months)
- Hannes Mogensen, Research Assistant (3 months)
- Bryan Haddock, Research Assistant (6 months)
- Michael Lønstrup, Technician (12 months)
- Louise Juhl Boni, MSc, Ph.D., Research coordinator (12 months, part time).

Not paid by CEHA but associated with the center:

- Albert Gjedde, Professor (12 months)
- Henrik Larsson, Professor (12 months)
- Adam Hansen, Physicist (12 months)
- Bodil Gesslein, Postdoc (12 months)
- Kirsten Thomsen, Postdoc (12 months)
- Barbara Lykke Lind, Ph.D.-student (12 months)
- Marielle Zoetmulder, Ph.D.-student (12 month)

Molecular Aging



Program 1a

Molecular aging

Group leaders
Ian D. Hickson, Professor
Lene Juel Rasmussen, Professor
Vilhelm A. Bohr, Professor
Anne Marie Lynge Pedersen, Associate Professor
Steen Dissing, Professor

One of the most important topics in current biology and health science is the aging of the human body. Not a single individual is exempt from the deleterious health aspects that accompany increasing chronological age, and yet a molecular understanding of the factors that specify organismal lifespan remain largely mysterious. Single DNA mutations can lead to impressive elongation of lifespan in organisms a diverse as yeast, worms, fruit flies, and mice. While this might seem like an attractive strategy in humans, most studies that are aimed at unraveling the molecular mechanism that contribute to lifespan determination do not focus on an extension of lifespan, but instead seek to improve the general health status of older individuals. In order to increase this "healthspan," it is imperative that the underlying mechanisms that contribute to the aging phenotypes are resolved. It is clear that many factors are likely to contribute to organismal aging. These include accumulation of damaged DNA or aberrantly-folded proteins in long-lived cells, transcriptional infidelity as a consequence of epigenetic abnormalities, immune senescence and impaired defense mechanisms, and perturbed glucose and lipid metabolism.

A major hypothesis to explain the underlying cause of aging is that oxidative DNA damage as well as other oxidative processes gradually destroy cellular macromolecules and alter energetic processes in the mitochondria. Normal metabolic processes generate potentially deleterious reactive oxygen species, which cause oxidative damage and inflammation, which in turn may contribute to cellular senescence, an irreversible cessation of proliferation that likely depletes tissues of competent stem cells. Aging is associated with low-grade elevation of circulating inflammatory cytokines, which play a role in chronic age-associated disease leading to increased morbidity and mortality. However, it is presently unclear whether this chronic inflammation is caused by deregulation of the immune system in older individuals or is a consequence of increased cell stress in senescent cells.

a. Background and hypothesis

Mitochondria are the powerhouse that generates cellular energy, and are important for a number of basic processes such as the regulation of energy homeostasis and programmed cell death. Mitochondrial dysfunction and mtDNA mutations contribute to the ontogeny of cancer, diabetes, blindness, deafness, migraine, and diseases of the heart, kidney, liver, and muscles. Further-

more, mitochondrial dysfunction is involved in aging and neurodegenerative disorders such as Parkinson's disease and Alzheimer's dementia. Because the primary function of mitochondria is to generate cellular energy through oxidative phosphorylation, many of the tissues affected by mitochondrial diseases have an unusually high energy demand. Approximately 40 mitochondrial syndromes have been described, most of which affect several organ systems and display a severe, progressive phenotype.

We study the molecular processes and identify components associated with DNA damage, DNA repair, and mutagenesis in human mitochondria. Expression of mitochondrial genes is required to maintain the proper function of this organelle, suggesting that even a slight perturbation of the mitochondrial genome could have profound cellular effects. We hypothesize that cancer cells lose their mitochondrial function and consequently generate a mutator phenotype. Our results show that mitochondrial dysfunction is associated with genomic instability and high levels of genomic DNA damage. Mitochondrial activity also affects nucleotide metabolism, and impaired nucleotide biosynthesis contributes to mutagenesis and the nuclear genomic instability.

A major research activity in the molecular aging program is to characterize the role of chromosomal instability in the aging process. In particular, we are defining how RecQ helicase family proteins suppress premature aging. Our recent studies are consistent with the hypothesis that RecQ helicases facilitate repair of damaged DNA in regions of the genome vulnerable to instability during S phase. Most relevant to aging, RecQ helicases play an important role in maintaining chromosome ends (telomeres).

We also explore salivary gland function and structure in patients with the systemic, inflammatory disease, Sjögren's syndrome, as a model for the aging process. In this disease, salivary gland tissues undergo accelerated aging with progressive inflammation, degeneration and fibrosis, leading to salivary gland dysfunction. Our hypothesis is that oxidative stress-induced cell death and necrosis in the salivary gland results in a cascade of events that involves T-cell activation, cytokine synthesis, impaired capillary function and poor blood supply.

The molecular aging program contributes to:

- An understanding of the molecular and cellular mechanisms that underlie the aging process
- Knowledge of the genetic determinants of human aging through analysis of human diseases syndromes associated with premature aging
- Definition of molecular parameters that contribute to age-related morbidity and lower quality of life for the elderly
- Facilities and expertise for interdisciplinary and translational studies on biopsy samples from patients being treated for age-associated pathologies

b. Status for milestones

One focus of research in this program is to elucidate the basis for human genetic disorders associated with premature aging. Several of these disorders are caused by mutation or inactivation of DNA repair genes or other mechanisms causing genome instability. For example, mutations in RecQ helicases BLM, WRN and RECQ4 are mutated in the human premature aging diseases; Bloom's syndrome, Werner's syndrome and Rothmund-Thomson's syndrome, respectively. Therefore, we conduct biochemical and molecular/cell biological analyses of RecQ helicases and proteins that regulate the activity of these helicases, such as human Exonuclease 1 (Exo 1), which plays an important role in DNA mismatch repair and double-stranded DNA break (DSB) repair. Our research sheds light on how defects in these processes lead to loss of cell vitality associated with aging and to age-related neurodegeneration and cancer. Some studies use animal model systems, including yeast and chicken cells, which provide sophisticated tools for genetic analysis and manipulation.

ROS are a major endogenous source of DNA damage, mainly generated by mitochondrial respiration. ROS attack DNA leading to oxidized bases or other modifications including strand breaks. Because many oxidative lesions are mutagenic, persistent oxidative DNA damage has deleterious consequences. Therefore, cells have

evolved multiple mechanisms for repairing oxidative DNA lesions. In the nucleus, the glycosylase OGG1 carrries out the first step (incision of the modified base) in BER targeted to 8-oxoguanine. The OGG1 gene produces two major products alpha-OGG1, which is more abundant in the nucleus than in mitochondria, and beta-OGG1, expressed exclusively in mitochondria. We are investigating the biological role of OGG1 in mitochondria.

Glutamate is the major neurotransmitter in the central nervous system. However, high levels of glutamate can cause cellular toxicity and cell death. We recently observed that physiological concentrations of glutamate cause oxidative DNA damage, but this damage is efficiently repaired in neurons. In addition, low levels of glutamate induce AP endonuclease, a major BER protein. Aberrant regulation of glutamate is associated with age-related neurodegeneration, notably Alzheimer's disease, and synaptic glutamate plays a role in learning and the response to physical exercise. Studies of glutamate homeostasis may provide important insight into mechanisms of Alzheimer's disease and other types of neurodegeneration.

Progress and research outcomes – cross-disciplinary projects

We are conducting a cross-disciplinary research project in collaboration with programs 1b, 2, and 3 that will investigate the role of oxidative DNA damage, DNA repair capacity and mitochondrial dysfunction in frailty and cognitive decline. This project will study 100 individuals with fatigue from the Metropolit Study (males born in 1953). The study will analyze molecular biomarkers related to mitochondrial function, including nucleotide pool status, endogenous DNA strand breaks and other oxidative DNA lesions (i.e., oxidative base modifications/damage).

Frailty in the elderly is associated with decreased mobility, disturbances in gait, muscle weakness, poor exercise tolerance and sarcopenia, resembling the consequences of lack of physical activity. Studies from the Avlund group in CEHA suggest that fatigue may be an indicator of frailty, defined as *a physiologic state of increased vulnerability to stressors that results from decreased physiologic reserves* and even dysregulation of multiple physiological systems.

It is not known whether fatigue and/or frailty are related to molecular biomarkers such as DNA repair capacity, oxidative stress and mitochondrial function. However, because these markers are associated with aging, and because mitochondria play a critical role in energy metabolism, we are investigating the association between fatigue and mitochondrial function, DNA damage and nucleotide pool levels. As described above, these parameters will be measured in lymphocytes from age-matched subjects with various fatigue levels from the Metropolit cohort. The data show an increase in lymphocyte mitochondrial respiratory activity after addition of FCCP (uncoupler of mitochondrial oxidative phosphorylation) (termed reserve capacity); however, reserve capacity was lower in subjects with fatigue than in non-fatigued controls. In addition, dTTP levels (relative to the overall dNTP pool) were altered in fatigue subjects. These data suggest that these parameters are potential biomarkers for fatigue.

Because neurons have a high rate of oxygen consumption and a low level of antioxidants, neurons are more susceptible than other cell types to ROS-induced oxidative damage. This is consistent with the fact that mitochondrial DNA damage and mitochondrial dysfunction are thought to play a role in age-associated neurodegenerative disease, e.g. increased oxidative DNA damage has been observed in brain tissue from Alzheimer disease patients. In a recently started project coordinated by program 1b (Neuroscience), we look for measurable alterations in lymphocyte parameters that correlate with reported cognitive function of the subjects.

Saliva serves multiple functions, and the importance of saliva in oral health is evident when saliva flow is reduced. Impaired salivary secretion and altered salivary composition, which can be caused by a variety of medical conditions and medications, is associated with a significantly increased risk of oral infection, dental caries and erosion, oral mucosal dryness and discomfort, poor

oral function, and poor nutrition. As a consequence, salivary gland dysfunction usually leads to restricted activity, decreased general well being and poor social interactions. Salivary gland secretion is controlled by the autonomic nervous system and the salivation center is located in the medulla oblongata. Our knowledge of salivary gland structure and function and the clinical implications of salivary gland dysfunction in persons with signs of early neurodegenerative disease are very limited. Nevertheless, autonomic dysfunction is likely to have an effect on peripheral function and structure of the salivary glands. The purpose of this project is to compare clinical, neuro-physiological and immunological aspects of salivary gland function in middle-aged men with early cognitive dysfunction and age-matched controls with normal cognitive function. The goal is to determine whether reduction/changes in salivary gland function and taste are initial manifestations of premature aging/ early neurodegenerative conditions. These endpoints will be compared with effects on sleep patterns and other basic brain functions. We hypothesize that functional and structural changes of the salivary glands may correlate with specific sleep disturbances and cognitive variables. If this hypothesis is confirmed, our study may indicate that reduced salivary flow and changes in salivary composition, xerostomia, taste and dental loss are useful as early manifestations of cognitive dysfunction/ neurodegenerative disease.

c. Group members

Paid by CEHA:

- Hocine Mankouri, Associate Professor (3 months)
- Scott Maynard, Assistant Professor (12 months, part time)
- Claus Desler, Postdoc (12 months)
- Sascha Emilie Liberti, Postdoc (10 months)
- Jacqueline Enzlin, Postdoc (2 months)
- Martin Borch Jensen, Ph.D.-student (12 months)
- Sara Bursomanno, Research Assistant (3 months)
- Nicolai Larsen, Research Assistant (1 month)
- Lis Sørensen, Laboratory Technician (12 months)
- Anne Marie Bundgaard, Laboratory Technician (12 months, part time)
- Wid Mouayad Talal, Laboratory Technician (12 months)

Not paid by CEHA but associated with the center:

- Katerina Tritsaris Jondahl, Associate Professor (12 months)
- Ying Liu, Assistant Professor (12 months)
- Diana Huttner, Postdoc (12 months)
- Susanne Germann, Postdoc (12 months)
- Wai-kit Chu, Postdoc (12 months)
- Li Bo, Postdoc, (12 months)
- Guido Keijzers, Ph.D.-student (12 months)
- Julie Hentze, Ph.D.-student (12 months)
- Lene Pedersen, Medical laboratory technician (12 months)
- Bjarke Thomsen, Laboratory technician (12 months)

Publications

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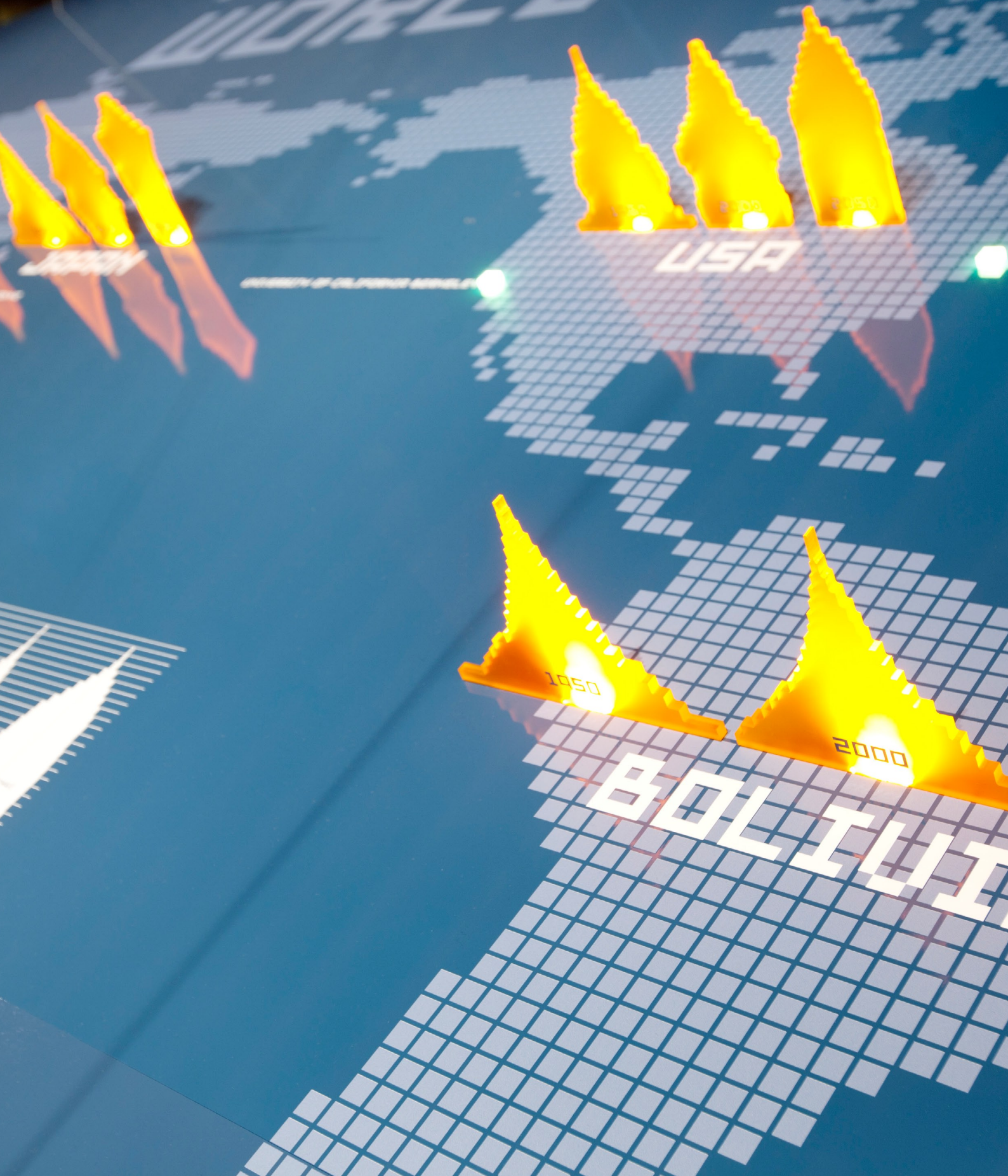
Internationalization and Networking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Internationalization and networking

IARU – International research cooperation

The close association between CEHA and the International Alliance of Research Universities (IARU) is a cornerstone in our effort to internationalize CEHA. IARU members include: University of Copenhagen, Yale University, University of California, Berkeley, ETH in Zurich, Switzerland, University of Cambridge, University of Oxford, National University of Singapore, Australian National University, Peking University and the University of Tokyo.

In 2010, an IARU Congress on Aging, Longevity and Health, was held on 5-7 October in Copenhagen. It was hosted by Rector Ralf Hemmingsen, University of Copenhagen and Dean Ulla Wewer, Faculty of Health Sciences, University of Copenhagen and organized by Center for Healthy Aging under the leadership of Managing Director Lene Juel Rasmussen and Prof Vilhelm Bohr, National Institute on Aging, NIH, Baltimore, USA (associated to CEHA). The purpose of the Congress was to provide an opportunity for researchers from the IARU Aging, Longevity and Health Network and others to exchange data and ideas, and to plan, initiate or extend collaborative research projects.

At the Congress, 123 delegates from participating IARU countries/universities discussed their ongoing research activities. The presentations at the Congress were very diverse, including molecular and cellular studies as well as population-based and sociological studies. Researchers discovered their existing complimentary research activities and identified novel opportunities for new coordinated, and/or synergistic research projects. Opportunities and plans for future workshops, doctoral research projects and doctoral and post-doctoral training programs were also discussed. An article describing the IARU Congress in great detail will be published in the near future.

IARU installation – An Aging World

An exciting public installation, which lies on the "art-science" interface, was inaugurated by Director of Medical Museion Thomas Söderqvist at the Faculty of Health Sciences, during the opening session of the IARU Congress in October, 2010. The purpose was to raise awareness of the IARU collaboration, CEHA and aging research at the University as well as to create a nice aesthetically-pleasing contribution to the IARU Congress. The installation was produced by Medical Museion, the Faculty's science communication research and museum unit.

The idea for this installation emerged from the observation that age structure diagrams for worldwide populations were evolving to reflect the increasing average age of human population, as described in the 2007 "Oldetopia" exhibition at Medical Museion. That installation,

in turn, was inspired by the early 20th century German philosopher of science Otto Neurath's notion of "pictorial statistics", which were put to practice in the Deutsche Hygiene Museum in Dresden in the interwar years. The curatorial team for "Oldetopia" took Neurath's idea a step further by creating physical age structure diagrams to illustrate global demographic change.

The Medical Museion team developed this idea further by putting the age structure diagrams on a three-dimensional world map, such that geographic and demographic data were captured simultaneously. This made it possible to show, at a glance, patterns of demographical change over time and the persistent large differences in population age structure in rich and poor countries around the world. The physical diagrams were constructed from acrylic plastic and illuminated by fibre optics, and the map of the world was presented quite unconventionally as a disc, with China, Japan and Papua New Guinea in the center of the earth.

This fascinating installation became a magnet for researchers, staff, students and visitors passing through the Faculty lobby, many of whom gathered spontaneously in small groups to discuss global aging. The "An Aging World" installation will be available in future for export to other IARU partners.

iHAN

Inspired by the work in the IARU Aging, Longevity and Health project, collaboration partners led by Professor Albert Gjedde from CEHA, Denmark, are working on an International Healthy Aging Network (iHAN) involving researchers outside of the established IARU network. The idea is to link iHAN to IARU. The iHAN organizing committee includes representatives from the University of Copenhagen (from CEHA), National University of Singapore, Australian National University and Tokyo University.

The aim of iHAN is to create a network of researchers with expertise in mitochondrial molecular biology and energetics, brain imaging and analysis and epidemiological studies of novel biomarkers of aging. iHAN will help establish connections between experts in aging research, foster international collaboration and support emerging young scientists interested in aging research.

iHAN will focus on three fundamental hypotheses related to energy consumption in the brain:

- Partial uncoupling of mitochondrial function contributes to inter-individual differences in individual energy production, differences in RONS (reactive oxygen and nitrogen species), and DNA damage and repair, and these differences contribute directly to inter-individual variation in aging.
- There is a direct relationship between inter-individual differences in brain energy utilization, brain morphology and/or activity.
- There is a direct relationship between energy consumption in the brain and aging, and this relationship can be investigated by studying aging and brain energy consumption in selected populations.

Collaboration in iHAN involves the University of Queensland (Brisbane, Australia), where a new brain imaging center is examining the pathogenesis of neurodegeneration after stroke, the University of Oslo, (Oslo, Norway), where research is focused on the compartmentalization of energy metabolism among glial cells and neurons in the brain, and Aarhus University (Aarhus, Denmark), where the importance of mitochondrial function for brain energy metabolism is being explored using positron emission tomography. The Universities of Brisbane and Aarhus are also mapping glucose uptake and glucose consumption in brain tissue after ischemic or anoxic insults. Based on successful interactions at the IARU congress in Copenhagen in October 2010, a study at the University of Berkeley was proposed that will analyze uncoupling of mitochondria in the human brain.

iHAN holds meetings on collaboration strategies at IARU sites approximately every six months. Meetings were held in September 2009 (Singapore) and March 2010 (Tokyo). The next meeting is scheduled to take place at the University of Berkeley (Berkeley, California, USA) in the spring of 2011.

The IARU installation – An Aging World

Visiting Professor Program

Visiting professor program

During 2010, CEHA established a visiting professor program for international researchers interested in visiting CEHA as guest professors for short periods. The purpose was to facilitate cross-disciplinary interaction, collaboration and internationalization of CEHA research. To date, the following individuals have participated in this program:

Professor Carlos Mendes de Leon

Carlos F. Mendes de Leon, Rush Institute for Healthy Aging, Chicago, visited CEHA for seven weeks in the autumn of 2010. Professor Mendes de Leon has for many years conducted essential aging research. His main focus is how social relations, social inequality and ethnic differences affect the aging process. He has contributed a large number of international publications in these areas. During his stay, his knowledge, inspiration, ideas and skills made a significant contribution to the research and management of CEHA. He also gave a lecture and supervised CEHA Ph.D.-students and postdoctoral fellows, giving ideas for interdisciplinary projects within CEHA. Furthermore, he participated as panelist at a CEHA press conference on Aging and acted as an informal discussant on interdisciplinary aging research issues throughout the IARU congress.

Senior Lecturer Sarah Nettleton

On 28 Sept.-1 Oct. 2010, CEHA welcomed Sarah Nettleton from the Department of Sociology, University of York, UK. Sarah Nettleton is Senior Lecturer in Social Policy in the Department of Sociology at the University of York. She is primarily a medical sociologist and has undertaken empirical research on a variety of health-related topics. Her lecture at a CEHA seminar provided a brief outline of the emergent sub-field of sociology; the sociology of the body; and she introduced the sociological concepts "body projects", "body techniques", "reflexive body techniques", and "changing bodies". She also led a Master Class for an interdisciplinary group of Ph.D. students, whom she also guided individually.

Senior Research Fellow Alex Faulkner

Alex Faulkner, Centre for Biomedicine and Society, King's College London, visited CEHA on 2-3 November. His research focuses on the dynamics between medical technologies, healthcare and society, especially science and technology involved in studying aging and regeneration. Besides giving a CEHA Seminar lecture, he led a Master Class for an interdisciplinary group of Ph.D. students, whom he also guided individually. Health technologies are an important focal point in CEHA, and Dr Faulkner's theo-

retical knowledge as well as his practical research insights made a great contribution to ongoing CEHA research.

Senior Lecturer Tiago Moreira

On 26-29 October 2010, CEHA hosted Tiago Moreira from the School of Applied Social Sciences and Wolfson Research Institute. His research explores the complex worlds that are enacted in contemporary biomedicine, with particular attention to the role of technology in medical work, the use of health technology at home, the collective production of health care standards and the politics of clinical trials. He is also interested in ethnographic studies of neurosurgery and one of his current research themes is "Aging, biotechnology and society". His publications are widely referred to by the research groups of CEHA. Besides his CEHA lecture, he led a Master Class for an interdisciplinary group of Ph.D. students, whom he also guided individually. His visit attracted a lot of attention from other research groups at the University, and he provided inspiration for future development of cultural gerontology at the university and in CEHA.

Professor Sharon Kaufman

On 11-12 October 2010, CEHA hosted Sharon Kaufman, from Medical Anthropology in the Institute for Health and Aging at the University of California, San Francisco. In her well-attended CEHA lecture, she presented some of her recent work on aging, family decision making, the ethics of life extending technology. The following day was devoted to a workshop for CEHA researchers. Selected CEHA projects were presented and Sharon Kaufman provided constructive criticism of each project. She gave an overview of the Institute of Health and Aging at San Francisco and discussed plans for future co-operation. Arrangements for two CEHA Ph.D. students to spend a semester at her Institute in the fall of 2011 were discussed.

The visiting professor program was of great value to CEHA. As a result, more permanent affiliation between CEHA and Professor Carlos Mendes de Leon and Senior Lecturer Tiago Moreira is planned for 2011 and beyond.

Educational Activities

Educational activities

CEHA places a high priority on educational initiatives aimed at target groups at all educational levels. In 2010, CEHA researchers facilitated the following research training and educational activities:

Ph.D. courses

Ph.D. courses offered in 2010 were:

- *Life course influences on health changes in adult life*
  In the spring Associate Professor Rikke Lund and Professor Kirsten Avlund planned and conducted this course with teachers from several CEHA research groups. The course was undertaken as a combined elective pre-graduate course for public health students and a Ph.D.-course.

- *Cerebral blood flow and metabolism*
  Professor Martin Lauritzen organized and chaired a 4-day Ph.D.-course in 2010 with 60-70 Ph.D.-students and faculty members attending, both from the University of Copenhagen and from Universities in Europe and USA.

- *Brain aging*
  Professor Martin Lauritzen organized and chaired a 2-day Ph.D.-course in 2010 with 20 Ph.D.-students, mainly from Danish Universities.

- *Tissue issues in exercise science*
  International Ph.D. course, December 13-16, Snekkersten, organized by AMBEHR, CEHA and Institute of Sports Medicine

- *1st International graduate course in exercise & clinical physiology*
  October 25-29, Concordia, Canada, organized by CEHA, Xlab and the University of Concordia.

- *Aging, technologies, and the body*
  Master classes for Ph.D. students within the Health in Everyday Life Program, and "SAXO/CPh – Ph.D. Program". Three researchers from UK gave master classes for interested Ph.D. students: Sarah Nettleton, Alex Faulkner and Tiago Moreira.

- *Reading circle*
  Reading circle for Ph.D. students in Body and Health led by Associate Professor Lene Otto

Faculty supported Ph.D. projects

As part of its research strategy, the Faculty of Health Sciences, University of Copenhagen, has generously supported CEHA with eight one-third time Ph.D. scholarships, corresponding to DKK 500,000 each.

This support has lead to the following new CEHA Ph.D. projects in 2010:

- Ph.D. Student: Sarah Wadmann Lauritsen (Program 4)
  Project: *Between evidence and practice: production and translation of medical evidence on blood pressure reducing drugs in Denmark*

- Ph.D. Student: Andreas Rudkjøbing (Program 4)
  Project: *Coordination of preventive medication in the health care system after structural reforms – a quantitative and qualitative analysis of barriers and tools in a complex organization*

- Ph.D. Student: Christiane Elisabeth Sørensen (Program 1a and 1b)
  Project: *Clinical, neurophysiological, immunological and molecular biological aspects of salivary gland function in cognitive dysfunction and early neurodegenerative disease*

- Ph.D. Student: Naja Liv Hansen (Program 1b)
  Project: *Brain connectivity and cognitive function in healthy and accelerated aging*

- Ph.D. Student: Anders P. Boesen (Program 2)
  Project: *Connective tissue in tendon and skeletal muscle with aging: importance of insulin-like growth factor I (IGF-I)*

- Ph.D. Student: Adrian Joseph Bertoli (Program 5)
  Project: D*iabetes research communication and the changing identities of type 2 diabetes patients, 1960-2010*

- Ph.D. Student: Jolene Lee Masters Pedersen (Program 3)
  Project: *Mechanisms of psychosocial and biological factors acting over a life course and low grade inflammation (mediation and interaction)*

- Ph.D. Student: Aske Juul Larsen (Program 2 and 5)
  Project: *Health technologies in practice. Aging and chronic diseases*

Pre-graduate and Master courses

A number of pre-graduate and master courses were arranged and offered in 2010 by CEHA researchers:

Pre-graduate level

- *Prevention in adults and older people – the role of the social – and health care system*, elective course for public health students by Associate Professor Carsten Hendriksen and Professor Kirsten Avlund.

- *Epidemiology* for medical students, Student Activating Teaching, by Post doc HW. Kildemoes

- *Medication of elderly patients* for last term medical students by Associate Professor John Sahl Andersen

- *Applied anthropology in health* by Bjarke Oxlund

- *Aging and intergenerational relations* for course in Applied Anthropology by Professor Susan Whyte

Master level

- *Cultural health studies* by Associate Professor Lene Otto and Assistant Professor Astrid Jespersen

- *Medical anthropology* by Post doc Bjarke Oxlund

Presentations for students

CEHA presented its research themes at a lecture for 5th semester medical students in August 2010. The purpose was to raise awareness of the possibilities to make medical bachelor assignments related to the research themes of CEHA. Furthermore, CEHA participated in the *Forsk 2010 Initiative* in September 2010, which is a conference for research year pre-graduate students arranged by the Faculty of Health Sciences, University of Copenhagen. These arrangements have led to some new inquiries from students interested in the research on healthy aging.

Open University of Denmark (Folkeuniversitetet):

Professor Kirsten Avlund and Associate Professor Erik Lykke Mortensen lectured in 2010 at the Danish Open University on *Functional ability in everyday life – how can we improve it?* (Folkeuniversitetet, Odense) and *The Aging Intellect* (Folkeuniversitet, Århus), respectively.

Joint activities, Awards and Events

Joint activities, awards and events

CEHA Seminars

The CEHA Seminar series is a focal point in CEHAs strategy to promote understanding between CEHA research groups and provide inspiration for cross-disciplinary collaboration. The seminars are aimed at Center members and other interested researchers. The purpose is to regularly inspire staff and students and to disseminate information on CEHA research.

Fifteen seminars were presented in 2010:

3 March 2010:

Regeneration of skeletal muscle in aging

Seminar with two presentations, arranged by Program 2 at Panum:

- *Tissue regenerative capacity and exercise* by Professor Fawzi Kadi, Ørebro University, Sweden.
- *Effects of anti-inflammatory medication on muscle regeneration in young and old* by Postdoc Abigail Mackey, Department of Biomedical Sciences, CEHA.

7 April 2010:

Neurobiology

Seminar with three presentations, arranged by Program 1b at Panum:

- *Brain energy metabolism and receptor function in aging* by Professor Albert Gjedde, Molecular Neurobiology of Aging Unit, CEHA
- *The aging human brain in numbers* by Professor Bente Pakkenberg, Research Laboratory for Stereology and Neuroscience, Bispebjerg Hospital.
- *Brain blood flow and energy metabolism in rodent cerebellum* by Associate Professor Kirsten Caesar, Institute for Neuroscience and Pharmacology, CEHA.

5 May 2010:

Communication and innovation

Seminar with three short and one longer presentation, arranged by Program 1b at Panum:

- *A historical analysis of the concept of successful aging and its relation to the idea of human enhancement* by Ph.D. student Morten Hillgaard Bülow, Medical Museion, CEHA.
- *Health in the interplay between local health promotion activities and everyday practice* by Ph.D. student Maja Schøler, Ethnology, CEHA.
- *A municipal setting for the use of health technologies in everyday life* by Ph.D. student Hanne Hellerup Eriksen, Ethnology, CEHA.
- *Drawing workshops from the Museion – a practical methodology for communicating aging health care issues* by Postdoc Lucy Lyons, Medical Museion, CEHA.

18 May 2010:

Life course

Seminar with one presentation, arranged by Program 3

at Center for Health and Society, University of Copenhagen:

- *A toast to health in later life! Wise drinking as you age* by Professor Arlene Fink and Professor John Beck, UCLA (University of California, Los Angeles).

3 June 2010:
Science communication
Seminar with one presentation, round table, and workshop, arranged by Program 5 at Panum:

- Roundtable: Communication experiences.
- *Ideas for a Ph.D. course on science communication* by Professor Thomas Söderqvist and Postdoc Adam Bencard, Medical Museion, CEHA.
- Workshop: *Spot-survey of the communication habits of Ph.D. students.*

11 June 2010:
Prevention in old age
Seminar with three presentations, arranged by Program 4 at Aleksandersalen, Bispetorv 1-3, 1167 Copenhagen:

- *The role of preventive health care* by Professor Thomas Gill, Yale University, USA.
- *Prevention in old age from the primary care perspective* by Professor Steve Iliffe, University College London, UK.
- *Ethical dilemmas of the research and implementations* by Professor emeritus, Chairman of Age Forum Povl Riis.

16 June 2010:
Molecular aging
Seminar with one presentation, arranged by Program 2 at Panum:

- *CSB regulates mitochondrial metabolism* by Postdoc Morten Scheibye-Knudsen, National Institutes of Health, USA.

25 June 2010:
Molecular aging
Seminar with one presentation, arranged by Program 1a at Panum:

- *Mitochondrial hormesis as a strategy to extend healthy lifespan: C. elegans as a model organism* by Postdoc Natascia Ventura, Department of Experimental Medicine and Biochemical Sciences, University of Rome "Tor Vergata", Italy.

17 August 2010:
Molecular aging
Seminar with three presentations, arranged by Program 1a at Panum:

- *Mutatis mutandis: Mutagenic translesion synthesis, fitness and disease* by Professor Niels de Wind, Leiden University Medical Center, The Netherlands.
- *DNA repair in stem cells and association with aging* by Assistant Professor Scott Maynard, Department of Cellular and Molecular Medicine, CEHA.
- *Mitochondrial dysfunction, dNTP levels and mutagenesis* by Postdoc Claus Desler, Department of Cellular and Molecular Medicine, CEHA.

13 September 2010:
Molecular aging
Seminar with one presentation, arranged by Program 1a at Panum:

- *FANCM: Molecular matchmaker at the replication fork* by Professor Wojciech Niedzwiedz, Weatherall Institute of Molecular Medicine, Department of Molecular Oncology, Oxford University.

29 September 2010:
Embodying sociology:
conceptual tools and analytic resource
Seminar with one presentation, arranged by Program 5 at Faculty of Humanities, University of Copenhagen:

- *Embodying sociology: conceptual tools and analytic resource* by Professor Sarah Nettleton, University of York.

11 October 2010:
Making longevity in an aging society
– linking technology, policy, ethics
Seminar with one presentation, arranged by Program 4 at Center for Health and Society, University of Copenhagen:

- *Making longevity in an aging society – linking technology, policy, ethics* by Sharon Kaufman, Medical Anthropology, Institute for Health & Aging, University of California.

28 October 2010:

Aging in technological democracies

Seminar with one presentation, arranged by Program 5 at Medical Museion, University of Copenhagen:

- *Aging in technological democracies* by Professor Tiago Moirera, School of Applied Social Sciences, Durham University. Lecturer in the School of Applied Social Sciences; Fellow of the Wolfson Research Institute.

2 November 2010:

Constructions of aging: Innovation, governance and usership of medical technologies

Seminar with one presentation, arranged by Program 5 at Faculty of Humanities, University of Copenhagen:

- *Constructions of aging: Innovation, governance and usership of medical technologies* by Alex Faulkner, Centre for Biomedicine & Society, King's College London.

10 November 2010:

The Chicago Health and Aging Project: A multidisciplinary program on Alzheimer's disease and late-life health

Seminar with one presentation, arranged by Program 3 at Center for Health and Society, University of Copenhagen

- *The Chicago Health and Aging Project: A multidisciplinary program on Alzheimer's disease and late-life health* by Professor Carlos Mendes de Leon, Rush University, Chicago.

Network for Young Scholars

In 2010, a Network for Young Scholars (NYS) program was established to bring increased visibility and attention to CEHA pre- and postdoctoral fellows. The goal is to create and support an interdisciplinary research platform for research groups and programs across CEHA, as well as to establish a forum for social connection and understanding between young CEHA researchers. The Network is coordinated by CEHA Ph.D. and postdoctoral volunteers, who have formed a Steering Group. The main job of the Steering Group is to organize seminars and workshops based on interests of Network members. The goal is to organize 2-3 seminars and workshops annually, one of which would be open to participants outside CEHA. Journal clubs are also active in some CEHA research groups, earning ECTS points for the Ph.D. students.

The NYS Steering Group members are:

- Sanne Jessen, Ph.D. student (Program 1b)
- Claus Desler, Postdoc (Program 1a)
- Morten Bülow, Ph.D. student (Program 5)
- Hanne Eriksen, Ph.D. student (Program 5)
- Maja Schøler, Ph.D. student (Program 5)
- Line Damberg, Assistant, CEHA Administration

NYS's Activities in 2010 were:

Kick off Seminar

On 28 May, twenty five young CEHA researchers participated in a Kick Off Seminar. The aim of this first meeting was to introduce the different research programs of CEHA, initiate discussions on future network activities, and provide a forum for social connection between young researchers across research groups and programs.

The agenda included:

- Introduction to the structure of NYS and short presentations by participants;
- Discussions in mixed groups on what kind of activities the network should offer;
- Presentations on CEHA research programs by leading CEHA researchers and Managing Director Lene Juel Rasmussen.

The day generated many ideas, including suggestions for future network seminars, workshops and field trips.

CEHA theme seminar on science communication

On 3 June 2010, Program 5 arranged a CEHA Seminar on Science Communication, mainly aimed at young CEHA investigators (also mentioned above). The idea was to explore the need for a Ph.D. course in Science Communication and discuss possible content of such a course. Based on these discussions, a Ph.D. course on Science Communication is being prepared for 2011.

Workshop on oral communication

On 5 November, NYS invited all CEHA Research Assistants, Ph.D.s, and Postdoctoral fellows to a workshop on communication, primarily focused on how to deliver a good oral presentation – an idea which came up during the Kick Off seminar.

Lecturer Ditte Blohm Poulsen from School of Design in Kolding (Kolding Designskole) conducted the workshop, which included a basic introduction to body language, tone of voice, what to say and how to say, etc. The participants were asked to give a short presentation on which they received feedback from fellow speakers. Tips on Power Point presentations were also provided. The cross-disciplinary setting added an important dimension, which NYS will use in a future workshop.

Awards

In 2010, the following CEHA researchers received national or international awards:

Professor Ian D. Hickson received the Fellow of Royal Society (FRS) award

Professor Ian David Hickson, who started his professorship in CEHA during 2010 with an international research group – the Molecular Aging Unit – received the prestigious *Fellow of Royal Society* (FRS) award in 2010. The Royal Society acts as the UK government's chief scientific advisory group.

Candidates for election to the Fellowship must have made "a substantial contribution to the improvement of natural knowledge." The Society covers all areas of science. The award is open to all UK nationals and those of any Commonwealth country around the world and around 40 are awarded each year across all disciplines. The committee making the decision is asked to confirm that the candidate has produced scholarly work that "changes the views of the scientific community of how processes work in any given scientific discipline."

Professor Kirsten Avlund received the Andrus Viidik Prize in Gerontology

Professor Kirsten Avlund received the Andrus Viidik Prize at the 20 Nordic Congress in Gerontology held in Reykjavik in 2010. The prize is given every other year to an outstanding researcher in Gerontology in the Nordic countries. In relation to the prize, Kirsten Avlund published an overview article on her main research area (Fatigue in Older adults. An Early indicator of the Aging Process?, Aging Clinical and Experimental Research 2010; 22: 100-115).

Furthermore – and at the same Nordic Congress in Gerontology – a group of researchers from Program 3 received a prize of 3,000 NKK. The prize was given for the best poster by the choice of the congress delegates. The poster was entitled: "Variations in Physical Performance among 50-60-year-old Men and Women. CAMB – Copenhagen Aging and Midlife Biobank". The poster was prepared by Monica Coyle Jarlby, Eva Jepsen, Rikke Hodahl Meincke, Ditte Dyrholm, Drude Molbo, Jens Worm Begtrup, Åse Marie Hansen and Kirsten Avlund.

Professor Albert Gjedde received the Global Excellence Award in Health

Professor Albert Gjedde from the Molecular Neurobiology of Aging Unit of CEHA was among ten Copenhagen hospital and university units awarded the Capital Region's coveted Global Excellence Award. Professor Albert Gjedde received the award because of his research in age-related brain diseases such as Alzheimer's and Parkinson's. The award came with a grant of 1.5 Million kroner, a plaque and a bowl. The funds are intended for teamwork and outreach activities. Global Excellence – in Health is a development program of the Capital Region of Denmark with the aim of promoting competent professional environments of international excellence in health at the region's universities and hospitals.

Professor Michael Kjær received "Dronning Ingrids Forskerpris"

Professor Michael Kjær received the "Dronning Ingrids Forskerpris 2010". The award was presented by the patron of the Arthritis Society, HM The Queen. The award is awarded once a year and given to a person providing a focused and active contribution to the Danish arthritis research and through this research advance the possibilities for preventing and treating arthritis. The award included 100,000 DKK.

Events

CEHA professorships

Two Professors were appointed to CEHA in 2010: Ian D. Hickson and Managing Director Lene Juel Rasmussen.

Ian D. Hickson was awarded a professorship in Molecular Aging in the Department of Cellular and Molecular Medicine in 2010. The professorship is anchored to CEHA and started 1st January 2010. He is now establishing his research program on molecular aging in CEHA. Ian D. Hickson has actively researched repair mechanisms and pathways in multiple organisms and made outstanding scientific contributions to this field. He takes a multidisciplinary approach and his research has yielded novel insight into human aging and age-associated disease.

On 8 February 2010, Ian D. Hickson gave the inaugural lecture *Genomic instability and its role in cancer and aging.*

Lene Juel Rasmussen was awarded a professorship in Molecular Aging in the Department of Cellular and Molecular Medicine, University of Copenhagen. Lene Juel Rasmussen will strengthen CEHA, performing cross-disciplinary aging research. A substantial part of her research focuses on molecular aging and this part of her research will make an important contribution to the University of Copenhagen, the Department, and CEHA. In CEHA, Lene Juel Rasmussen will continue to perform basic research on genome stability and human aging in the context of ongoing collaborations within CEHA.

On 18 March 2010, Lene Juel Rasmussen gave her inaugural lecture entitled *How do we maintain our DNA in order to prevent disease and unhealthy aging?*

Lab opening: New molecular aging lab

The CEHA Molecular Aging Unit in the Department of Cellular and Molecular Medicine opened its newly renovated laboratories in building 18.1 in the Panum building. This event marked the first major initiative to gather CEHA researchers at a central physical location.

The Faculty of Health Sciences, University of Copenhagen, supported the renovation of the Molecular Aging Laboratories. It is expected that these new facilities will contribute significantly to CEHAs scientific contributions and will help attract students, young researchers, guest professors and collaborators to CEHA.

Management

Management

Steering Committee

The role of the Steering Committee is to discuss and ensure research progress, economy and recruitment, as well as to plan research and disseminate activities. The Steering Committee members are the program leaders of the six research programs:

- Director Lene Juel Rasmussen, Head of the Committee and Program leader (Program 1a)
- Professor Martin Lauritzen (Program 1b)
- Professor Michael Kjær (Program 2)
- Professor Kirsten Avlund (Program 3)
- Professor Allan Krasnik (Program 4)
- Associate Professor Lene Otto (Program 5)

Meetings in 2010: 18 January, 1 March, 7 April, 3 May, 3 June, 13 September, 1 November, 16 November.

Executive Board

The role of the Executive Board is to plan Center activities, approve budgets, ensure milestones, evaluate research progress and review new research initiatives. The members are the Dean, the Managing Director, two principal investigators representing Programs 1+2 and Programs 3+4+5 respectively, as well as one international principal investigator. The members are:

- Dean Ulla Wewer, Head of the Board
- Managing Director Lene Juel Rasmussen
- Professor Michael Kjær (Program 1+2)
- Professor Erik Lykke Mortensen (Program 3+4+5)
- Professor Vilhelm Bohr (international principal investigator, NIH, USA)

Meetings in 2010: 8 February, 12 April, 26 June, 28 July, 14 September, 8 October, 15 November, 13 December.

International Scientific Advisory Board

The role of the International Scientific Advisory Board (SAB) is to provide advice about strategic planning, recruitment, feasibility, progress, and development of the Scientific Program. Such input plays an important role in optimizing Center performance. The board proposes criteria for evaluating scientific progress and success, assists in establishing suitable external collaborations, both domestic and international, and advises on scientific goals. Finally, SAB helps CEHA leadership ensure that its research programs meet the highest international standards and achieve optimal scientific impact.

The International Scientific Advisory Board (SAB) includes nine distinguished scientists, representing a broad scientific base that covers the Centers research areas. SAB is crucial for the Center's scientific development. The Board meets once a year in Copenhagen, and can also be consulted for advice at any time (i.e., in between annual meetings).

The SAB members are:

- Professor Tone Tonjum, Head of the Board, Oslo University
- Professor Ian Deary, Edinburg University
- Professor Rudi Westendorp, Leiden University Medical Center
- Professor Jan Vigh, Albert Einstein College of Medicine
- Professor Leona Samson, Massachusetts Institute of Technology
- Professor Diana Kuh, MRC Unit for Lifelong Health and Aging and MRC National Survey of Health and Development
- Professor Steve Iliffe, University College of London
- Professor Sara Arber, University of Surrey, Guildford
- Professor David G. Nicholls, Buck Institute for Age Research

The first SAB meeting took place on 8 October 2010, just after the IARU congress *Aging, Longevity and Health* (described earlier).

CEHA Administration

Administrative staff manage logistics of Center activities and help coordinate research activities and programs. The secretariat is centrally located at Panum. It includes one full-time and three part-time employees: Tina Gottlieb, Center Administrator (full-time); Anders Østergaard Kronland, Economy Officer (part time); Line Damberg, Assistant (part time); Mikael Kjærsgaard Møller, Communication Officer (part time).

Economy

Economy

Summary

CEHA research activities and expenditures increased significantly in 2010, with a total of 30.4 million DKK actual expenditures and a revised 2010 budget of 33.7 million DKK.

CEHA research activities are moving rapidly towards full capacity, in accord with the planned schedule of activities and expenditures. A noteworthy break-through in 2010 was the award to CEHA of 30 million DKK additional external funding from various external funding sources. Also, the number of researchers participating in cross-disciplinary research activities and the output of these activities has continued to increase significantly in 2010.

In this 2010 annual report, CEHA financials and research activity are presented, with a recently implemented method developed for evaluating annual spending and overall research activity by specific parameters of research output. The research output measures are presented graphically, allowing a direct visual presentation of the data for 2010 and for each annual reporting period henceforth. This reporting method was developed and implemented during the latter half of 2010, and it is intended to help analyze and visualize CEHA activity and performance now and in the future.

Professor Lene Juel Rasmussen, Managing Director

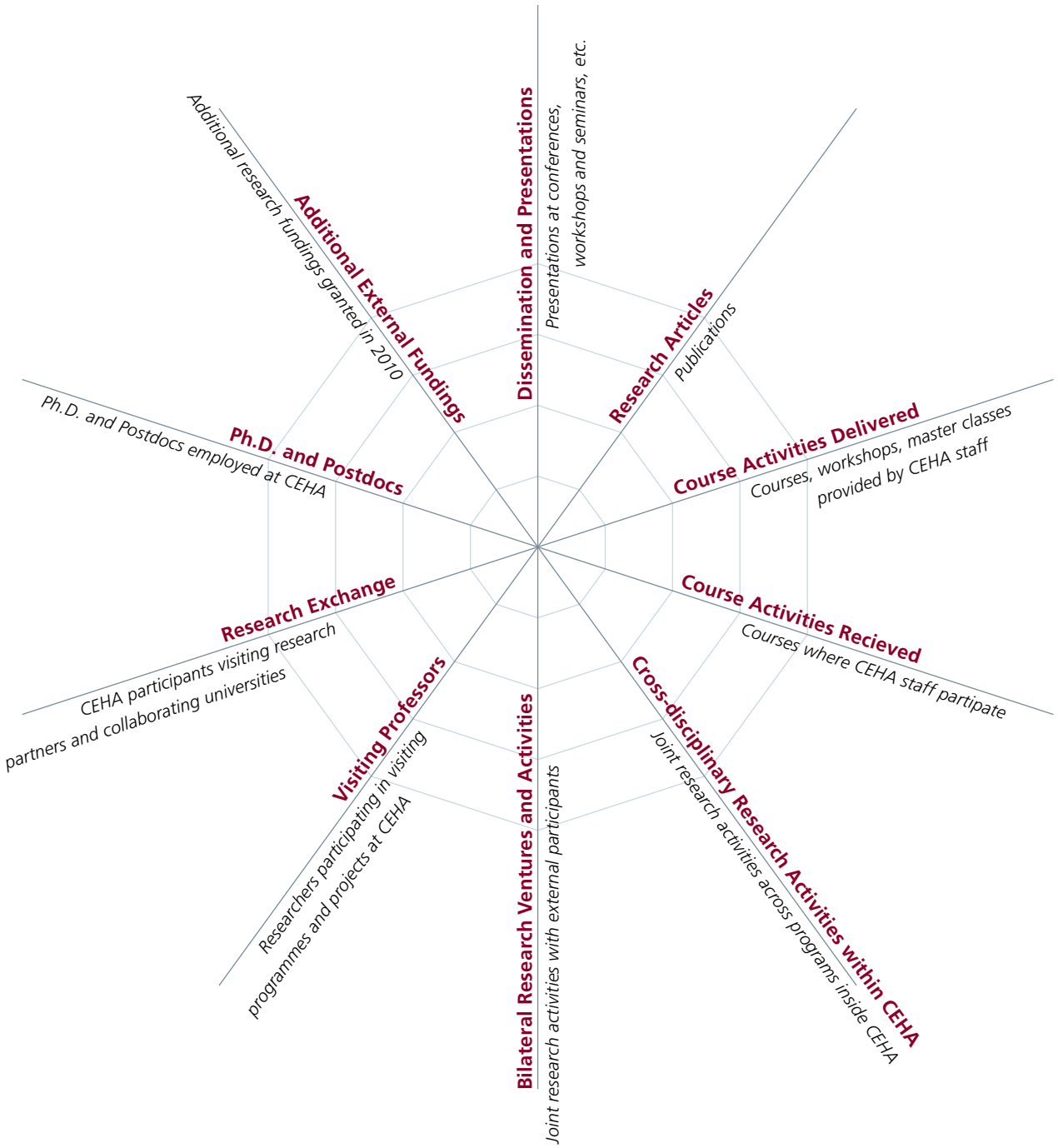
2010 Overview: Financials and Research Activity

The 2010 CEHA Annual Report for the first time provides a graphic presentation of CEHA financials and research activity. The graphics provide a simple visual overview of annual research activity and how it aligns with annual expenditures.

The parameters were selected to provide a means to measure annual research productivity during different reporting periods. Consequently, the measures applied are to be as simple as possible, and equally simple to collect. For each parameter, one (1) "event" is the basic unit (i.e., 1 publication, 1 employee, 1 seminar, 1 workshop, etc.). This type of metric discerns between event and no event; and this is precisely what is needed to standardize the metrics for different categories. From a strict methodological point of view, the primary strength of this method is that it provides a straightforward means to quantify research activity. This is also the most relevant way of evaluating research activity, because it is not a given that an increase in research expenditure produces a linearly correlated increase in output. A graphic presentation based on simple counts is therefore the most appropriate way of displaying research activities for a given period.

The analysis is based on measurements of the ten parameters shown in Figure 1.

Ten parameters Figure 1



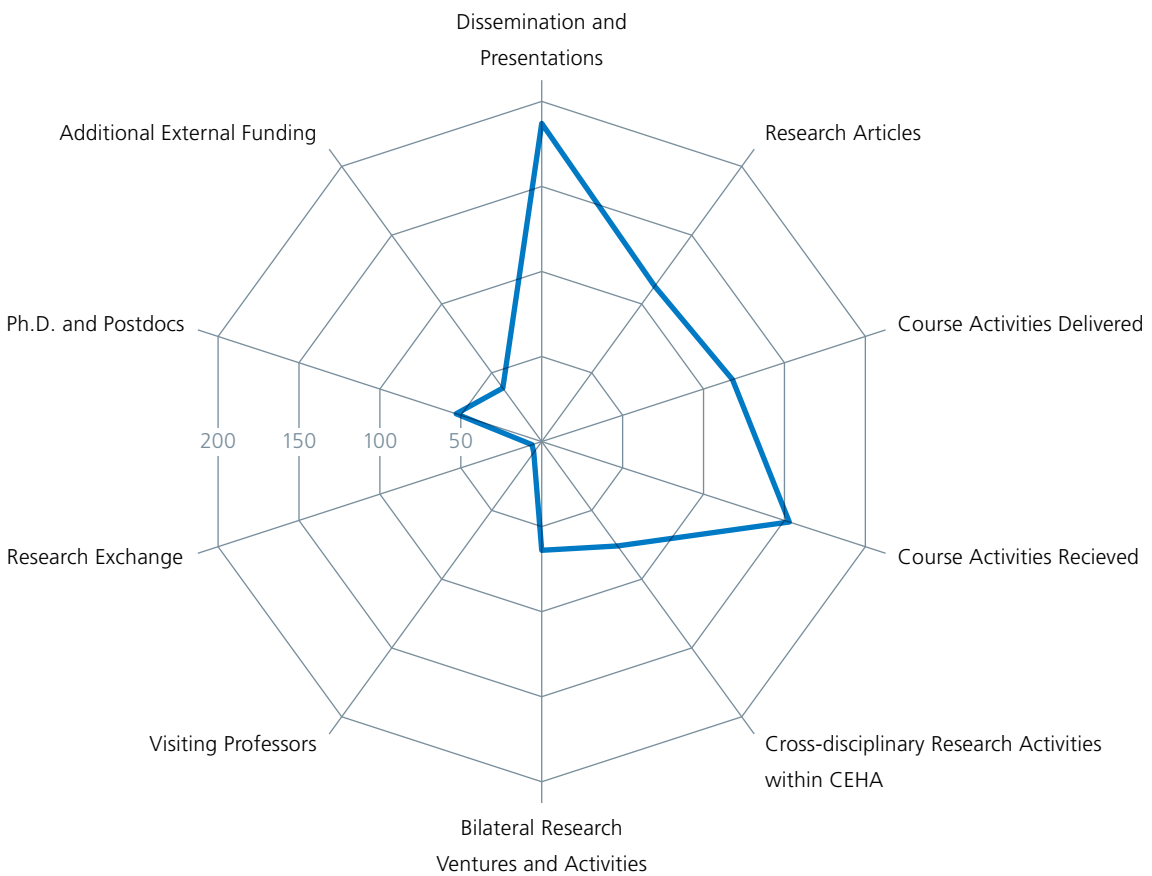
Research Activity 2010: Overview

The results of the analysis are presented as spider web diagrams displaying output for direct-funded CEHA research activity during 2010. Figure 2 includes all activity, including activity in joint cross-disciplinary projects and activity in each of the five research programs; Figure 3 includes output only of joint cross-disciplinary projects.

The ten parameters in Figure 1-3 are grouped in a reader-friendly manner according to type of activity. Note that because the unit of each parameter is different, output between parameters cannot be compared. However, the intention is to collect data on the same parameters in future years, and present output for the same parameters. The method will be used to plot and show research activity in all parameters over several years.

The general assessment is that CEHA is a research center working at nearly full capacity. The proportion of collaborative and cross-disciplinary research activities was high in 2010. Research articles, disseminations and presentations, indicated on the first two vertical axes in Figure 2, were also high in number in 2010. Disseminations and presentations include CEHA presentations at conferenc-

Research Activity 2010, number of activities Figure 2



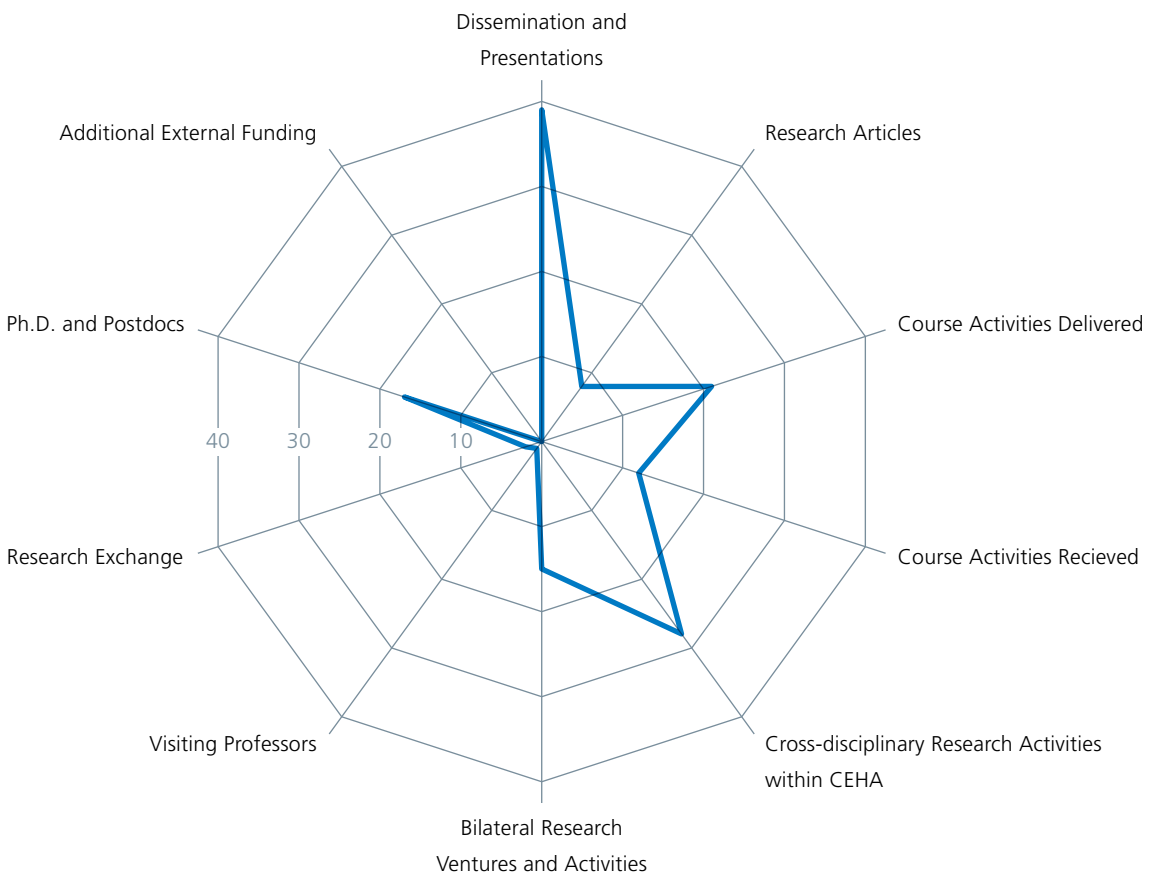
es, workshops and seminars. Additional external funding is shown on the last radial axis. CEHA received 39 grants in 2010, representing a total of 30 million DKK, which is more than five times higher than in 2009 (not shown).

Research Activity 2010:
Joint Cross-disciplinary projects

Output of joint cross-disciplinary projects is included in Figure 2, whereas Figure 3 below shows the output of the joint cross-disciplinary projects in an isolated manner. All CEHA joint cross-disciplinary projects in 2010 were funded by CEHA, corresponding to a budget of 7.8 mio.

Although a number of the joint cross-disciplinary projects were continued from 2009, the total number of cross-disciplinary projects in 2010 has increased. These collaborative research projects produced a high number of disseminations and presentations and many cross-disciplinary activities and bilateral research ventures. In addition, a significant number of Ph.D. students and postdoctoral fellows were involved in one or more joint cross-disciplinary projects in 2010.

Joint Cross-disciplinary Projects 2010, number of activities Figure 3



Total Expenditure 2010, DKK Table 1

	Result 2010	Revised Budget 2010	Difference	Result 2009	Revised Budget 2009
Program 1	6,950,393	7,047,280	96,887	3,324,467	3,655,112
Program 2	4,152,298	4,571,451	419,153	3,651,845	3,865,406
Program 3	3,281,962	3,180,578	-101,384	2,571,370	2,713,768
Program 4	3,235,307	3,148,883	-86,424	1,654,914	1,945,647
Program 5	3,658,254	4,553,082	894,828	791,595	1,624,616
Joint Cross-disciplinary Projects	6,671,858	7,874,947	1,203,089	6,150,259	6,837,603
Center Administration	2,468,483	3,328,892	860,409	1,807,299	2,716,030
Total	30,418,556	33,705,113	3,286,557	19,951,748	23,358,182

Financials Overview 2010

Financials for 2010 are presented in Table 1.

Total 2010 annual expenses for joint cross-disciplinary projects and the five CEHA research programs were 30.4 million DKK. This compares well with the revised 2010 budget as presented to and granted by the Nordea Foundation of 33.7 million.

Research activity was higher in 2010 than in 2009, which is reflected in higher total expenditures in 2010 than in 2009. Accordingly, the revised 2010 budget was also nearly 50 percent larger than the revised budget in 2009. Most of this increase is due to a higher number of research staff. CEHA hopes to carry the 2010 budget surplus of 3.3 million DKK forward to its 2011 budget. In addition to its base level 2011 budget, this carry-over will help maintain and improve upon the current level of activity and output in CEHA.

Principal Expenditure Items 2010, DKK Table 2

	Research Staff	Administrative Staff[1]	Equipment[2]	Operational Costs[3]	Total
Program 1	3,939,583	150,173	539,388	2,321,249	6,950,393
Program 2	3,126,029	172,587	328,020	525,662	4,152,298
Program 3	2,119,276	236,820	49,123	876,744	3,281,963
Program 4	2,451,904	144,895	29,490	609,019	3,235,308
Program 5	2,808,153	129,389	109,640	611,072	3,658,254
Joint Cross-disciplinary Projects	2,942,270	149,803	601,110	2,978,675	6,671,858
Center Administration	858,818	1,129,286	6,859	473,519	2,468,482
Totals	18,246,033	2,112,953	1,663,630	8,395,940	30,418,556

Notes

1 Direct administrative expenditures.

2 "Art 33000 Udstyr, etc."

3 Includes total overhead.

Expenses by principal items

Itemized 2010 expenses by principal items (i.e., staff, equipment, operational costs) are shown in Table 2.

Total expenditure for research staff represented 60 percent of total expenditures in 2010, compared to 36 percent in 2009. This large increase in expenditures for research staff reflects increased level of research activity throughout 2010, and the fact that basic research facilities for the start-up phase were acquired in 2009, thus reducing costs for basic research facilities (i.e., there were no fixed asset investments in 2010). By definition, fixed assets are single equipment items valued at or greater than 100.000 DKK.

Overhead costs amounted to just over one million DKK in 2010. Overhead costs include administrative back up and basic facilities. Together with the direct expenditure for administrative staff, including Center Administration, the total administrative back-up represented 10.4 percent of total expenses in 2010, reflecting increased research activity.

Equipment expenditures in 2010 were lower than equipment (i.e., start-up) expenditures in 2009. This reflects the fact that the highly specialized laboratory equipment was acquired in 2009. Hence, in 2010 equipment expenditures equals direct running costs for all CEHA laboratory and other research activities, and correspond to 5.5 percent of total expenditures, while they accounted for 18 percent of total expenditures in 2009.

Total Work Years 2010 Table 3

	Research Staff	Administrative Staff	Total	# Heads[1]
Program 1	8.25	0.50	8.25	33
Program 2	5.00	0.58	5.58	13
Program 3	4.08	1.01	5.09	16
Program 4	3.00	0.55	3.55	19
Program 5	1.25	0.17	1.42	11
Joint Cross-disciplinary projects	3.75	0.00	3.75	27
Center Administration	1.00	1.92	2.92	5
Totals	26.33	4.73	31.06	124

Note

1 # Heads include Ph.D.-employees, student-staff, etc.

Total work years

Full-time employment equivalents in all direct CEHA-funded research activities in 2010 are shown in Table 3. Full-time employment of research staff in 2010 was more than twice the number in 2009 (i.e., 26 vs 12). Total number of employees (124) was also more than twice the number of employees (57) in 2009.

Additional External Funding

2010 proved to be a break-through year for CEHA in terms of spin-off effects of the Nordea Foundation grant. Thus, as shown in Table 4, CEHA received 30 million DKK in 2010 of additional external financing. This is an achievement well beyond our expectations, also compared to 2009 total grant awards of approximately 5.7 million DKK. The latter was considered a massive success, as indicated in the 2009 annual report. However, we report here even greater success in 2010.

Additional External Funding, DKK

Table 4

Funded by	Funding [1]	Program	Grant total / Period [2]
Lev vel	333,333	5	1,000,000 / 2010-2013
Sygekassernes Helse fond	500,000	4	
Region Hovedstadens Sundhedsvidenskabelige Forskningsfond	775,000	3	
Hjerteforeningen	400,000	3	
Bønnelycke Foundation	25,000	2	
Skovgaards Foundation	75,000	2	
Karen Elise Jensens Foundation	450,000	2	
Hørslev Foundation	715,500	2	
Aase og Ejnar Danielsens Foundation	50,000	2	
Danish Medical Research Council (FSS)	732,420	2	2,360,424 / 2010-2013
Danish Agency for Science Technology and Innovation	3,740,061	2	18,700,304 / 2011-2015
jakob and Olga Madsens Foundation	20,000	2	
Wedel-Wedelsborg Foundation	40,000	2	
A.P. Møller and hustru Chastine Mc-Kinney Møllers Foundation	40,000	2	
Aksel Meyer Nielsen memorialtrust	50,000	2	
Ketty og Ejvind Lyngsbæks Foundation	800,000	2	
Mampei-Suzuki Diabetes Foundation	533,767	2	JPN 8,000,000 [3]
Danish Medical Research Council (FSS)	3,600,000	2	3,600,000 / 2011-2013
Gigtforeningen (DK Rheumatism Society)	1,200,000	2	
A.P. Møller and hustru Chastine Mc-Kinney Møllers Foundation	200,000	2	
Novo Nordisk Foundation	400,000	2	
Augustinus Foundation	300,000	2	
Ministry of Culture, Sports Research	500,000	2	
Aase and Ejnar Danielsens Foundation	100,000	2	
Bispebjerg hospital Research Foundation	200,000	2	
Lundbeck Foundation	1,050,000	1	3,150,000 / 2010-2012
Danish Medical Research Council (FSS)	800,000	1	
Foundation Leducq Transatlantic N o E Grant	1,200,000	1	6,000,000 / 2008-2012
Novo Nordisk Foundation	3,000,000	1	
Lundbeck Foundation	220,000	1	660,000 / 2009-2011
Lundbeck Foundation	300,000	1	900,000 / 2011-2013
Parkinson Foundation	200,000	1	600,000 / 2009-2011
Respironics Research Foundation (USA/France)	400,000	1	1,200,000 / 2009-2011
Danish Medical Research Council (FSS)	600,000	1	1,800,000 / 2010-2012
Advanced Technology Foundation	600,000	1	1,800,000 / 2010-2012
Danish Medical Research Council (FSS)	360,850	1	721,700 / 2010-2011
Association for International Cancer Research	1,666,444	1	£ 188,669[3]
Danish Cancer Society	1,400,000	1	4,200,000 / 2011-2013
Danish Medical Research Counci l (FSS)	2,562,984	1	7,688,95 / 2011-2013
Total	30,140,358		

Notes

1 Accounting period for the individual grant is assessed for 2010

2 Grant obtained for 2010 if not otherwise is stated

3 Exchange rate as of 6th of february 2011

Communication, Outreach and Press

Communication, outreach and press

Website

CEHA's website, which is available in both Danish and English, provides general information about CEHA organization, research, staff and collaborations. It also includes a calendar and announces news, newsletters, press, events and other CEHA activities.

The website can be accessed through www.sundaldring.ku.dk and www.healthyaging.ku.dk

IARU News letters

Approximately once a year, the Faculty of Health Sciences, University of Copenhagen, publishes the newsletter IARU News, which provides information on the *Aging, Longevity and Health* project and other relevant IARU activities. IARU News is an important international platform for the dissemination of information on CEHA and CEHA activities. In 2010, IARU News was issued twice in April and November (healthyaging.ku.dk/international/iarunews).

Best Age and Press Conference

Taking advantage of the fact that many experts in aging research were gathered in Copenhagen for the IARU Congress, the University of Copenhagen, the Faculty of Health Sciences and CEHA held a press conference on 4 October 2010, followed by a round table discussion entitled – *Living longer and stronger – A new approach to age.* The press conference was designed to increase public awareness of the concept of "Healthy Aging", IARU and the importance of aging research. More than 100 individuals attended this event, which provided high visibility coverage in the media including print publications and Danish National Radio.

A panel of distinguished researchers provided their views on aging, its problems, challenges and opportunities. Panelists also emphasized the need for new solutions, and provided perspective on how to adapt to the current and future demographic change in Danish society and other cultures around the world.

The panel included the following leading scientists:

- Professor Carlos Mendes de Leon, Rush University Medical Center, Chicago, USA
- Professor Julia Twigg, University of Kent, Canterbury, UK
- Professor Vilhelm Bohr, National Institute On Aging, NIH, Baltimore, USA (associated to CEHA)
- Professor Albert Gjedde, CEHA, University of Copenhagen, Denmark

Speeches presented at the Press Conference included *Age as a core competence* by the Minister for the Interior and Health Bertel Haarder and *Five ways to understand aging by* Managing Director Lene Juel Rasmussen, CEHA.

The press conference also served as a kickoff event for a collaboration between the renowned Danish magazine Monday Morning, the University of Copenhagen and CEHA. The aim of this collaboration entitled "Alderbedst" (Best Age) was to give a more varied picture of the elderly and the aging world. An online forum associated with the event also provided additional opportunity for discussion with a panel of researchers, politicians, representatives of professional organizations and prominent public figures. The conclusions and outcomes of "Best Age" were published on 13 December 2010 in the Monday Morning Supplement *The force of the elderly* (Ældrestyrken).

Exhibition on Healthy Aging and CEHA

Included in the inauguration program for Professor Ian D. Hickson in February 2010, the exhibition *Healthy aging: A lifespan approach* opened in the Panum Building. The Medical Museion in collaboration with CEHA produced the exhibition, which ran until the closing of the IARU Congress in October, enabling national and international audience participation. The exhibition focused on healthy aging research and CEHA. It also included photos and interviews of Danish centenarians by the photographer Liv Carlé Mortensen (*100 Light Years*).

Internal newsletter

The CEHA Newsletter provides a mechanism for communication within CEHA. The purpose of the newsletter is to keep CEHA researchers and staff aware of meetings, seminars, press and administrative issues. The newsletter also describes research progress and promotes networking within and outside of the Center.

The newsletter is published approximately every second month. In 2010, it was published in January, March, May, June, September and November.

Presentations and conference papers

CEHA researchers have actively participated in the following national and international conferences during 2010:

Andersen, J.L. February 2, 2010. KU, DIF, DBU seminar om Boldspil og Sundhed: *Muscular strength and balance after footballtraining – the ageing muscle.*

Andersen, M. A, Jespersen, J. Bønnelycke. September 2010. EASST Conference, Trento 2010: *Synergy and some less misleading terms to describe interdisciplinary collaboration.*

Avlund, K. March 2010. 1. Scientific workshop on healthy ageing. FUTURAGE. A Road map for Ageing research, Newcastle upon Tyne, England: *Prevention and promotion of healthy ageing: Additionall/ new evidence needed.*

Avlund, K. April 2010. DGS' Årsmøde, Fredericia, Denmark: *Mænds funktionsevne i alderdommen.*

Avlund, K. GRASPH's årsmøde, Middelfart, Danmark: *Aldringsepidemiologi.*

Avlund, K. April 2010. Institutkonference. Institut for Folkesundhedsvidenskab, LIFE, Københavns Universitet: *Fra købt samarbejdsprojekt til frie forskningssamarbejder om aldring.*

Avlund, K. May 2010. Congress in Geriatric Rehabilitation, Brussels, Belgium: *Self-perceived fatigue and its impact on functional decline and mortality.*

Avlund, K. June 2010. International Forum ARC (Aging Research Center), Stockholm University: *Preventive home visits in Denmark. How to do it in the best way?*

Avlund, K. June 2010. 20th Nordic Congress in Gerontology, Reykjavik, Iceland: *Fatigue in older adults: an early indicator of the aging process.*

Avlund, K. August 2010. VELUX FONDENs sommerudflugt, København, Danmark: *Copenhagen Aging and Midlife Biobank – CAMB.*

Avlund, K. October 2010. IARU-conference, Snekkersten, Denmark: *Unexplained fatigue in older adults – an early sign of frailty?*

Avlund, K. October 2010. Forskningsenhed for Almen Praksis, Købehavn, Danmark: *Tidlige tegn på aldring – træthed som eksempel.*

Avlund, K. October 2010. 7th European Congress of Biogerontology, Palermo, Italy: *Immunological parameters and fatigue. Associations in a young and an old study population.*

Avlund, K. November 2010. København City Rotary: *Hvordan får vi en sund aldring?*

Blaakilde, A. February 2010. Dept. of Ethnology, Saxo-Institute, Univ. of Copenhagen. *Kulturgerontologi. Alder og aldring.*

Blaakilde, A. March 7, 2010. Institute of Sociology, University of Copenhagen: *Kulturgerontologi. Alder og alders-domme i kulturelt perspektiv. Med særligt henblik på alderdom og ældre.*

Blaakilde, A. March 8, 2010. SUFO´ s Annual Meeting, Horsens, Danmark: *Holdningsmæssige barrierer for forebyggelse og sundhed? – Kan borgere blive FOR proaktive i forhold til deres eget helbred – eller i forhold til sundhedsvæsenets holdninger?*

Blaakilde, A. March 12, 2010. Seminar "KrObjekt", the SAXO-Institute, University of Copenhagen: *Fibromyalgi. Kroppe i smerte – objektificeret gennem filmkameraets linse?*

Blaakilde, A. April 9, 2010. Research Seminar, Dept. of Ethnology, Saxo-Insitute, University of Copenhagen: *Following Fibromyalgia.*

Blaakilde, A. April 16, 2010. MA-course in Humanistic Palliation, University of Aalborg, Denmark: *Kulturgerontologi. Forestillinger om alder, aldring og ældre.*

Blaakilde, A. May 10-11, 2010. COST meeting on Migrant Health and Ageing. The University of Copenhagen, Center for Health and Society (CSS): *Danish Dynamite burning out at Costa del Sol. International retirement migration from a Danish perspective.*

Blaakilde, A. August 2010 VIA University College, Aarhus. Summerschool: The Meeting of Cultures in the Health Service. Summer School of Health Sciences 2010: *Cultures of aging and the aged.*

Blaakilde, A og Schøler, M. August 23, 2010. EASST Conference, Trento, Italy: *Following and filming fibromyalgia.*

Blaaklide, A. November 11-12, 2010. Forum for humanistisk- samhällsvetenskaplig hälsoforskning forskerkonference: Sega strukturer och kontinuitet i moderniseringen av vård och omsorg, Gotland University, Sweden: *"Du ser da godt ud!" Smertende kroppe i et forhandlingsfelt om sundhed og sygdom.*

Blaakilde, A. November 9, 2010. Seminar, Saxo-Institute, University of Copenhagen: *Diffuse lidelser.*

Beyer, N. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen, Denmark: *Physical activity and daily function in elderly people.*

Beyer, N. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen, Denmark: *Physical training in elderly hospital patients.*

Beyer, N. May 30-June 2, 2010. 20th Nordic Congress of Gerontology, Reykjavik, Island: *Physical activity in older people.*

Beyer, N. October 13, 2010. Netværkskonference for demensudredningsenheder, Odense, Danmark: *Training of patients with cognitive dysfunction.*

Bohr, V.A. October 2010. IARU-conference, Snekkersten, Denmark: *DNA Repair and neurodegeneration*.

Bülow, M.H. September 2, 2010. Konstruktionen af maskulinitetsbegreber i forskningsprojekter om testosteron fra 1910'erne til 1980'erne. Historisk Samfund, Det kongelige bibliotek: *Det stof mænd er gjort af.*

Bülow, M.H. October 7, 2010. ENSN Neuroschool 2010, Würzburg, Germany: *The history of the concept of successful ageing within neuroscience and its relation to ideas about cognitive enhancement.*

Bülow, M.H. October 15, 2010. Good Life Better, Workshop for young scholars, Lübeck, Germany: *Good old brains – how concerns about the ageing society and ideas about cognitive enhancement interact in neuroscience.*

Bülow, M.H. November 30, 2010. Forskningsseminar: *"Gamle mennesker i moderne samfund: Deltagende samfundsborgere og socialt konstruerede identiteter", RUC, Denmark: Good old brains.*

Bülow, M.H. December 7, 2010. International conference: *"Neurosociety... What is it with the brain these days?" Saïd Business School, Oxford, England: Ageing brains and wishful thinking.*

Dela, F. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen: *Metabolic Aging.*

Dela, F. May 27-30, 2010. Institute for Research in Biomedicine (IRB Barcelona) Seminar in Molecular Medicine Program. Barcelona, Spain: *Insulin resistance and mitochondrial respiration.*

Dela, F. June 21-25, 2010. European College of Sports Science 15th Annual Congress, Antalya, Turkey: *Frailty and exercise.*

Dela, F. July 2, 2010. Physiological Society UK. Annual Meeting, symposium, "Exercise metabolism in skeletal muscle – from fuel to structure", Manchester, United Kingdom: *Glucose homeostasis in healthy and diabetics – influence of physical activity.*

Dela, F. September 29-October 1, 2010. 7th Mitochondrial Physiology Conference, Obergurgl, Austria: *Mitochondrial respiration in subcutaneous and visceral adipose tissue from patients with morbid obesity.*

Dela, F. October 5-7, 2010. IARU congress on "Ageing, longevity and health", Snekkersten, Denmark: *Glucose homeostasis and mitochondrial respiration in aging.*

Dela, F. October 25-29, 2010. 1st International Graduate Course in Exercise & Clinical Physiology, Concordia, Canada: *Exercise and type 2 diabetes.*

Dela, F. November 12, 2010. Department of Cellular and Molecular Medicine, Faculty of Health Sciences. Annual seminar, Helsingør, Denmark: *Measurements of mitochondrial respiration ex vivo – in health and disease.*

Dela, F. December 16, 2010. 5th International Congress on Science and Skiing, St. Christoph, Austria: *Glucose homeostasis and cardiovascular disease biomarkers in older alpine skiers.*

Desler, C. April 2010. Annual meeting of the Danish Mitochondrial Disease Association, Nyborg, Denmark: *Basic biology of mitochondria.*

Desler, C. June 2010. MITO-School, Aarhus University, Denmark: *Mitochondrial dysfunction and dNTP regulation.*

Desler, C. August 2010. Gordon Research Conference, Maine, USA: *Mitochondrial dysfunction and dNTP regulation.*

Eriksen, H.H. August 2010. EASST Conference, Trento, Italy: *Health technology as authority and empowerment*

Helge, J.W. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen: *Multiple factor intervention: The Danish KRAM investigation?*

Helge, J.W. June 1 -5, 2010. American College of Sports Medicine. Annual Meeting, symposium "Training for Metabolic Fitness", Baltimore, USA: *Metabolic fitness after low intensity training – long duration?*

Helge, J.W. June 18, 2010. Lecture at Ph.D. course at LIFE, University of Copenhagen: *Fat oxidation, obesity and energy balance.*

Helge, J.W. September 22-23, 2010. Unilever, SPARK workshop, Singapore: *Muscle mitochondrial function, fat oxidation and muscle lipid stores: influence of lifestyle modifications.*

Helge, J.W. October 1, 2010. GRASPH seminar. SIF, Copenhagen, Denmark: *Physical activity and Cardiopulmonary Fitness.*

Helge, J.W. October 25-29, 2010. 1st International Graduate Course in Exercise & Clinical Physiology, Concordia, Canada: *Lipid Metabolism during exercise.*

Hendriksen C. June 11, 2010. Center for Healthy Aging and International Alliance of Research Universities (IARU), University of Copenhagen, Denmark: *Prevention in old age.*

Hendriksen C. May 27, 2010. Seminar MPHÉRE, University of Copenhagen, Denmark: *Integrated Health Care – examples of development and research opportunities.*

Hendriksen C. May 10, 2010. COST meeting about Migrant Health and Ageing. Care for Migrants and Ethnic Minorities, University of Copenhagen, Denmark: *Prevention and healthy ageing.*

Hendriksen C. November 16, 2010. Danish Medical Association annual meeting 2010. Symposium: *Ageing and doctors.*

Hey-Mogensen, M. October 25-29, 2010. 1st International Graduate Course in Exercise & Clinical Physiology, Concordia, Canada: *Mitochondrial function and exercise.*

Hickson, I.D. April 2010. Abcam International Conference on "Maintenance of Genome Stability", Antigua, West Indies: *Role of RecQ helicases in maintenance of genome stability.*

Hickson, I.D. May 2010. Memorial Sloan Kettering Cancer Center, New York, USA: Genomic instability, cancer and aging: *lessons from analysis of Bloom's syndrome.*

Hickson, I.D. May 2010. National Institute on Aging, Baltimore, USA: *Genomic instability, cancer and aging: lessons from analysis of Bloom's syndrome.*

Hickson, I.D. May 2010. National Cancer Institute, National Institutes of Health, Bethesda, USA: Genomic instability cancer, and aging: *lessons from analysis of Bloom's syndrome.*

Hickson, I.D. June 2010. EMBO Meeting on "Recombination and Connections to SUMO and Ubiquitin Modifications", Il Ciocco, Italy: *Role of BLM in the resolution of recombination intermediates.*

Hickson, I.D. July 2010. The Royal Society of London, United Kingdom: Genomic instability, cancer and aging: *role of BLM.*

Hickson, I.D. October 2010. IARU Congress on "Ageing, longevity and health", Snekkersten, Denmark: *Genome instability and its role in aging and age-related disease.*

Hickson, I.D. October 2010. Novo Nordisk Foundation Center for Protein Research, University of Copenhagen, Denmark: *Genomic instability, cancer and aging: lessons from analysis of Bloom's syndrome.*

Hickson, I.D. November 2010. The Tracy and Ruth Storer Endowed Lecture in The Life Sciences, University of California at Davis, USA: *Role of RecQ helicases in maintenance of genome stability.*

Hickson, I.D. December 2010. Danish Cancer Society, Copenhagen, Denmark: Genomic instability, cancer and aging: *lessons from analysis of Bloom's syndrome.*

Kildemoes H.W. November 2010. Danish Forum for Health Service Research, Annual Meeting 2010: *Growing statin utilization reflects a broader range of conditions for initiating statin treatment and the "abolition of ageism.*

Kjaer, M. March 2010. Joint congress of the Scandinavian and the German Physiological Societies, Copenhagen, Denmark: *Exercise dependent signalling of the ECM.*

Kjaer, M. June 2010. Conference on Rehabilitation after Surgery, Rigshospitalet, Copenhagen, Denmark: *Pre-operative physical training?*

Kjaer, M. June 21-25, 2010. European College of Sports Science 15th Annual Congress, Antalya, Turkey: *The role of exercise in age-related changes in muscle and matrix.*

Kjaer, M. June 21-25, 2010. European College of Sports Science 15th Annual Congress, Antalya, Turkey: *Are cells in the ageing muscle frail?*

Kjaer, M. September 2010. Gigtforeningen, Gribskov, Denmark: *Osteoarthritis.*

Kjaer, M. October 2010. Selskab for Teoretisk og Anvendt Terapi (Jakobinerklubben), Copenhagen, Denmark: *The impact of physical training on ageing-related changes in skeletal muscle and matrix*

Kjaer, M. October 2010. Gigtforeningen's Birthday lecture to HM Queen Margrethe II, Skelskør, Denmark: *Kroppen i Bevægelse – fra barndom til sund aldring*

Kjaer, M. October 3-7, 2010. 5th International Congress of the GRS and IGF Society, New York, USA: *Role of GH/IGF-1 in adaptation of matrix in skeletal muscle and tendon to exercise.*

Kjaer, M. October 5-7, 2010. IARU Congress on "Ageing, longevity and health", Snekkersten, Denmark: *Skeletal muscle and matrix loss with ageing.*

Kjaer, M. October 30. 7th International Congress on Strength Training, Bratislava, Slovakia: *Skeletal muscle stem cells and muscle regeneration: Effect of ageing.*

Kjaer, M. October 2010. Dept of Physiology, Deutsche Sportuniversität, Cologne, Germany: *Role of changes in extracellular matrix for muscle-tendon function in ageing.*

Kjaer, M. November 24-27, 2010. British Association for Sports and Exercise Medicine Congress, London, United Kingdom: *Science behind tendon pathology.*

Kjaer, M. November 2010. Geriatric Theme-day for physiotherapists in Region Hovedstaden, Gentofte Hospital, Denmark: *Function- and muscle loss with ageing – why and how to counteract with physical training?*

Kongsgaard, M. June 9-12, 2010. International Award Winners Session. European Society of Sports Traumatology, Knee Surgery and Arthroscopy, Oslo, Norway: *Fibril morphology and tendon mechanical properties in patellar tendinopathy – effects of heavy slow resistance training.*

Kongsgaard, M. September 2010. BSMB annual symposium, Norwich, England: *Human tendon adaptations.*

Krasnik A. October 7, 2010. IARU Conference, Snekkersten, Denmark: *The role of preventive medication for healthy aging – a major challenge for health policy, health services and patients.*

Langberg, H. June 2010. Annual meeting in Turkish Sport Physiotherapists Association, Antalia, Turkey: *Treatment of the chronic painful tendon injuries.*

Langberg, H. June 21-25, 2010. European College of Sports Science 15th Annual Congress, Antalya, Turkey: *Evidence based physiotherapy: Sport injury prevention – What to do?*

Langberg, H. September 27-29, 2010. 2nd MuscleTech Network Workshop: From Translational Research to Translational Medicine, Barcelona, Spain: *Connective tissue – from basic Science to Clinical Practice.*

Langberg, H. November 19, 2010. Annual meeting in Schweizerischer Verband für Sportsphysiotherapie, Bern, Sweitz: *An update on Achilles tendon rehabilitation.*

Langberg, H. December 4, 2010. American Sports Physical Therapy Section, Annual Congress, Las Vegas, USA: *Tendinopathy in soccer.*

Ludvigsen B. August 24-27, 2010. 11th EASA (European Association of Social Anthropologists) Biennial Conference, Maynooth, Ireland: *Who cares? Implications of the carrying state for the social relations of elderly Danes.*

Lyons, L. September 2010. 15th biannual conference of the European Association of Museums for the History of Medical Science, Meeting on Museums and Contemporary Biomedicine, University of Copenhagen: *What am I looking at?*

Lyons, L. August 2010. Centre for Research on Socio-Cultural Change 6th Annual Conference 2010: The Social Life Of Methods, St Hugh's College Oxford: *Drawing your way into understanding – (Re) seeing medical objects.*

Lyons, L. July 2010. AMH Conference 2010, Humanities at the Cutting Edge Conversations between Surgery, Pathology, The Humanities & The Arts, Truro and Tate St Ives, United Kingdom: *Drawing relationships with medicine.*

Lyons, L. June 21, 2010. Art and its Archives, Nottingham Trent University, United Kingdom: *Drawings from the Musieon – a practical methodology*

Mackey, A. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen: *Muscle injury healing – satellite cells and anti-inflammatory medication.*

Mackey, A. June 29, 2010. Manchester Metropolitan University. Inaugural symposium of the IRM, The Physiology, Mechanics and Control of Human Movement Across the Life Span, United Kingdom: *Interventions to modulate satellite cell behaviour in young and old individuals.*

Magnusson, P. February 4-6, 2010. Scandinavian Congress of Medicine and Science in Sports 2010, Copenhagen, Denmark: *Tendon structure & Function.*

Magnusson, P. June 25, 2010. European Congress of Sports Science. 15th Annual Congress, Antalya, Turkey: *Mechanical properties of human tendon at the different hierarchical levels.*

Magnusson, P. October 1-2, 2010. 3rd European Conference of Sports Rehabilitation, Stockholm: *Tendon structure and function in relation to tendinopathy.*

Maynard, S. June 28, 2010. Mitochondrial Research School, Aarhus University, Aarhus, Denmark: *DNA glycosylases in mitochondrial DNA repair.*

Maynard, S. November 12, 2010. ICMM Annual Meeting, Helsingør, Denmark: *Mitochondrial activity in fatigue-defined subjects.*

Mortensen E.L. May 2010. Folkeuniversitet, Århus, Danmark: *Det aldrende intellekt.*

Mortensen E.L. October 2010. IARU-conference, Snekkersten, Denmark: *Predictors of cognitive decline during the life span from 50 to 90.*

Neyer, N. June 21-25, 2010. European College of Sports Science 15th Annual Congress, Antalya, Turkey: *Frailty – reversal by exercise training?*

Nielsen, K.D. October 29, 2010. Lev Vel – Forebyggende Selvmonitorering workshop 1, 29.10.2010, DTU Scion, Hørsholm: *Perspektiver på målgruppen "de ældre" og ældres forhold til teknologi.*

Nilsson, C.J. June 2010. 20th Nordic Congress of Gerontology, Reykjavik, Iceland: *Social inequality in onset of mobility disability – the mediating role of cohabitation status and social participation.*

Otto, L. September 2010. EASST Conference, Trento, Italy: *The Articulated Body – Physical activity, Fitness and New Technologies of Health.*

Otto, L. September 2010 Conference: HEALTH. A new religious awakening in Western Societies? CBS, Denmark: *Exercise identity as subjectification. Physical activity discourse and new technologies of health.*

Otto, L. October 5-7, 2010. IARU Congress on AGING, LONGEVITY AND HEALTH, Snekkersten, Denmark: *Ageing and new health-related roles and identities.*

Oxlund B. June 18, 2010. Self-Health: A Symposium on the New Forms of Patient's Narratives, Subjectivities and Ethics in Health Care, The Bios Centre, London School of Economics, United Kingdom: Living by numbers: *The interplay of numerical standards and exercise in preventive health practices of senior citizens in Denmark.*

Oxlund B. September 2-4, 2010. EASST 2010. Practicing Science and technology, Trento, Italy: Do you know your number: *The dynamic interplay of measurement technologies, asymptomatic conditions and preventive medication in relation to older adults in Denmark.*

Oxlund B. October 13-15, 2010. Health – a new religious awakening in Western societies? Copenhagen Business School, Denmark: Toward a numerical ontology: *The case of preventive medication of asymptomatic conditions in a Danish community.*

Oxlund B. November 17-21, 2010. 109th Annual Meeting of the American Anthropological Association, New Orleans, USA: *Aging identities: Preventive health and the circulation of threshold values in Denmark.*

Poulsen, T. November 2010. 63rd Annual Scientific Meeting in Gerontological Society of America, New Orleans, USA: *Measuring aspects of social capital in a gerontological perspective.*

Prats, C. October 25-29, 2010. 1st International Graduate Course in Exercise & Clinical Physiology, Concordia, Canada: *Imaging intracellular compartmentalization of skeletal muscle metabolism and signaling cascades.*

Rasmussen, L.J. March 2010. University of Copenhagen, Denmark: *The role of DNA Mismatch Repair in colorectal cancer.*

Rasmussen. L.J. April 2010. Annual meeting of the Danish Mitochondrial Disease Association, Nyborg, Denmark: *The role of mitochondria in disease and aging.*

Rasmussen. L.J. June 2010. University of Groningen Medical Center, Groningen, Netherlands: *Interdisciplinary aging research in Denmark.*

Rasmussen. L.J. June 2010. MITO-School, Aarhus University, Denmark: *Helicobacter pylori infection induces genetic instability of nuclear and mitochondrial DNA in gastric cells.*

Rasmussen. L.J. October 2010. IARU conference, Snekkersteen, Denmark: *Interdisciplinary aging research.*

Rostrup, Henriksen, Larsson, Hansen: April 30-May 7, 2010. International Society of Magnetic Resonance in Medicine, annual meeting 2010: *Stability of quantitative CBF measurements using the T1-based DCE approach.*

Schøler, M. October 12, 2010. Seminar med Sharon Kaufman, Institut for antropologi CSS, Københavns Universitet. *Health in the interplay between local health promotion activities and everyday practice.*

Schøler, M. October 7, 2010. IARU congress, Snekkersten, Denmark: *Health promotion in everyday practices; Studying overweight, exercise and technologies.*

Sørensen, C.E. November 2010. Section of Oral Medicine, Clinical Oral Physiology, Oral Pathology and Anatomy, Department of Odontology, Faculty of Health Sciences, University of Copenhagen, and at the Department of Biology. Presentation of Ph.D.-project.

Söderqvist, T. May 2010. Museo de Ciencia, Lisboa, Portugal: Cultures of meaning and cultures of presence: *the use of material objects in history of science, medicine and technology.*

Söderqvist, T. October 2010. International congress "Ageing, Longevity and Health", University of Copenhagen: *Healthy ageing on the art-science interface*

Söderqvist, T. November 11, 2010. Svenska nationalkommittén för teknik- och vetenskapshistoria, biannual meeting, Gothenburg, Sweden: *Vetenskaps- och teknikhistoria 2.0: Vilka konsekvenser kommer sociala webmedier att få för vetenskaps- og teknikhistorien och för STS-området?*

Thomasen, L.S. September 21, 2010. Lev Vel (Mødestedet), workshop 1 på IT-Universitetet. *Ældre' som målgruppe i projekt Mødestedet. Perspektiver og fakta.*

Thomasen, L.S. June 2, 2010. Mundtlig præsentation på 20th Nordic Congress of Gerontology, Reykjavik, Iceland: *A good old age for frail nursing home residents*

Thomasen, L.S. October 14, 2010. Mundtlig præsentation på EGVs 100 års conference: *Spor fra en uges feriefællesskab.*

Vass M. April 2010. The Danish Road Directorate 2010: *Older drivers and licence renewal.*

Vass M. September 6, 2010. Conference on prevention in old age – building relations, Drammen, Norway: *Preventive home visits – Building relations and the importance of follow-up.*

Vass M. October 5, 2010. The Medical Society of Copenhagen, Denmark: *Think twice before you say "It is age" – physicians attitudes and roles.*

Vass M. November 2010. Danish Medical Association annual meeting 2010. Symposium: *Pharmacotheray in older people: Non-pharmacological treatment of elderly.*

Vass M. November 2010. Danish Medical Association annual meeting 2010. Symposium: *Ageing and doctors.*

Vass M. November 2010. Danish Medical Association annual meeting 2010. Symposium: *The older patients – a huge challenge.*

Vass M. November 2010. Danish Medical Association annual meeting 2010. Symposium: *Older drivers.*

Vass M. November 2010. Danish Medical Association annual meeting 2010. Symposium: *Sleep, medication and ageing – how can we keep our minds working?*

Vass M. November 2010. Theme days for Region Sealand 2010: *Ageing and the GP*

Wadmann S. June 2010. DASTS (Danish Association for Science and Technology Studies) in Copenhagen, Denmark: *Prescribing blood pressure medication – Reduction in decision-making uncertainty and the shaping of clinical practice.*

Wadmann S. August 2010. The 4S (The Society for Social Studies of Science) yearly meeting in Tokyo, Japan: *Prescribing blood pressure medication – Reduction in decision-making uncertainty and the shaping of clinical practice.*

Wadmann S. October 2010. Presentation at workshop arranged by the European Sociological Association (ESA) and the Sociology of Science and Technology Network (SSTNET) in Helsinki, Finland: *Prescribing blood pressure medication – Reduction in decision-making uncertainty and the shaping of clinical practice.*

Wadmann S. November 2010. Danish Forum for Health Services Research in Copenhagen, Denmark: *Prescribing blood pressure medication – An organizational perspective on clinical practice.*

Whyte SR. July 2010. The Royal Anthropological Institute conference on medical anthropology, Oxford, UK: *Chronicity: time, control and sociality in lives with long-term illness.*

Whyte SR. August 2010. Steno Health Promotion Centre, Denmark. Presentation and discussion of work in Theme 4 at meeting with Dr. Lenore Manderson, editor of Medical Anthropology, Professor Max de Courten, and Dr. Jens Aagaard-Hansen.

Press activities in 2010

CEHA has been mentioned in the media several times during 2010:

15/01 2010 Jyllands Posten – *New methods keeps elderly people fit* (Nye metoder holder ældre friske)
17/01 2010 Politiken – *Death is postponed and has new causes* (Døden udsættes og får nye årsager)
21/01 2010 Børsen – *Mental fitness is used to keep elderly people fit* (Mental fitness skal holde de ældre friske)
28/01 2010 Universitetsavisen – *Accessions* (Tiltrædelser)
01/02 2010 Dagens Medicin – *Ian Hickson new professor of molecular aging* (Ian Hickson ny professor i molekylær aldring)
03/02 2010 Jyllands Posten – *Accessions* (Navne i noter)
04/02 2010 fpn.dk – *Blood tests reveal if training is useful* (Blodprøver afslører om træning nytter)
05/02 2010 fysio.dk – *Genes reveal how much benefit we have from physical training* (Gener styrer træningseffekten)
08/02 2010 altinget.dk – *Oxford professor to lead molecular aging research* (Oxford-professor i spidsen for molekylær aldringsforskning)
09/02 2010 University Post – *New Professor at "Aging" exhibition*
24/02 2010 Ekstrabladet – *Old age makes you happier* (Alderdommen gør dig lykkeligere)
02/03 2010 Nyhedsinformation – *Genes reveal how much benefit we have from physical training* (Gener afslører hvor meget gavn vi har af fysisk træning)
25/03 2010 Universitetsavisen – *Researcher Hotel or Center success* (Forskerhotel eller centersucces)
03/04 2010 Kristeligt dagblad – *He is researching in time* (Han forsker i tidens tand)
23/04 2010 Sygeplejersken – *Now I'm going to have a scolding – how to verbalize care* (Nu skal jeg ind og have skældud – om at sætte ord på omsorg)
25/04 2010 DR P1 Radio – *Old Age – Feast or Decline* (Gammel – fest eller forfald)
26/04 2010 Politiken – *Divorces among The Elderly Doubled* (Skilsmisser blandt ældre fordoblet)
26/04 2010 Politiken – *To death do us part – once again* (Til døden os skiller – én gang til)
26/04 2010 Politiken.dk – *Increased number of divorces among elderly people* (Flere ældre bliver skilt)
16/05 2010 Indre Missions Tidende – *Increased number of divorces around retirement age* (Flere bliver skilt omkring pensionsalderen)
21/05 2010 Information – *Gender differences in aging* (Køn og skæbne i gamle kroppe)
04/06 2010 sl.kvl.dk – *Focus on more outdoor activities for senior citizens* (Fokus på mere friluftsliv for ældre borgere)
08/06 2010 Nyhedsinformation for Social- og Sundhedssektor – *Genes reveal how much benefit we have from physical training* (Gener afslører hvor meget gavn vi har af fysisk træning)
08/06 2010 Frederiksberg bladet – *Outdoor activities for senior citizens* (Ældre ud i det fri)
08/06 2010 Ritzau Servicemeddelelser – *Time and place* (Tid og sted for fredag)

17/06 2010 Information – *Should the body be aided to greater performance?* (Skal kroppen hjælpes på vej til større præstationer?)

17/06 2010 Information.dk – *Should the body be aided to greater performance?* (Skal kroppen hjælpes på vej til større præstationer?)

06/09 2010 BT – *Elderly people in Denmark* (Ældre i Danmark)

08/09 2010 Berlingske Tidende – *Debate* (Debat: Groft sagt)

19/09 2010 Jyllands Posten – *Debate* (Debat: Jeg bærer med smil min byrde)

26/09 2010 bt.dk – *Youth pill soon available* (Ungdomspille snart en realitet)

29/09 2010 Politiken – *six out of ten awards was given to Rigshopitalet* (Seks ud af ti priser gik til Rigshospitalet)

03/10 2010 Mandag Morgen (mm.dk) – *Best Age* (Alderbedst)

03/10 2010 Mandag Morgen – *Unlocking the age code* (På sporet af aldringens gåde)

03/10 2010 Mandag Morgen – *Why are elderly people also a ressource?* (Hvad skal gøre ældre til en ressource?)

03/10 2010 Mandag Morgen – *The aging society can be a resource* ("Ældrebyrden" kan blive en samfunds-økonomisk gevinst)

04/10 2010 P1 Radio

04/10 2010 Presswire.dk – *Skewed population pyramid at international congress* (Skæv befolkningspyramide på international kongres)

04/10 2010 dgi.dk – *Conference about running* (DGI-konference om løb)

04/10 2010 dr.dk – *Elderly people want leisure rather than money* (Ældre ønsker fritid frem for penge)

04/10 2010 Ritzau – *Elderly people want leisure rather than money* (Ældre ønsker fritid frem for penge)

05/10 2010 Kristeligt Dagblad – *Elderly people want leisure rather than money* (Ældre ønsker fritid frem for penge)

05/10 2010 Børsen.dk – *Elderly people want leisure rather than money* (Ældre ønsker fritid frem for penge)

05/10 2010 dinepenge.dk – *Elderly people want leisure rather than money* (Ældre ønsker fritid frem for penge)

05/10 2010 Kristeligt dagblad – *A foretaste of retirement* (En forsmag på otiummet)

06/10 2010 Information – *Beautiful clothes and lifelong learning will make old age better* (Lækkert tøj og livslang læring skal gøre alderdomme bedre)

07/10 2010 DR2 TV, Danskernes Akademi – *Old age in a culture-historical perspective* (Alderdommen i kulturhistorisk perspektiv)

10/10 2010 Mandag Morgen (mm.dk) – *Where is the greatest need for research into aging?* (Hvor er behovet for aldringsforskning størst?)

10/10 2010 Mandag Morgen – *Greater understanding of the age code creates optimism* (Større forståelse af aldringens gåde skaber optimisme)

11/10 2010 TV2/Lorry

13/10 2010 BT – *Get a healthy old age* (Få en sund alderdom)

13/10 2010 gigtforeningen.dk – *Michael Kjær receives "Dronning Ingrids Forskerpris 2010"* (Michael Kjær belønnes med Dronning Ingrids Forskerpris 2010)

14/10 2010 Sjællandske – *Lecturer receives award* (Foredragsholder blev prismodtager)

19/10 2010 Dagens Medicin – *Michael Kjær receives "Dronning Ingrids Forskerpris 2010"* (Michael Kjær belønnes med Dronning Ingrids Forskerpris 2010)

20/10 2010 Randers Amtsavis – *Get a healthy old age* (Få en sund alderdom)

20/10 2010 bt.dk – *Get a healthy old age* (Sådan får du en sund alderdom)

20/10 2010 Dagbladet Ringkjøbing-Skjern – *Get a healthy old age* (Få en sund alderdom)

20/10 2010 Viborg Stifts Folkeblad – *Get a healthy old age* (Få en sund alderdom)

20/10 2010 Dagbladet Holstebro-Struer – *Get a healthy old age* (Få en sund alderdom)

20/10 2010 Lemvig Folkeblad – *Get a healthy old age* (Få en sund alderdom)

22/10 2010 Weekendavisen – *The new world is old* (Den nye verden er gammel)

24/10 2010 Mandag Morgen – *Physical activity does wonders against aging* (Fysisk aktivitet vidunderpille mod aldring)

27/10 2010 City Avisen – *Foreign professors live in Christianhavn* (Kloge hoveder i Heerings Gaard)

30/10 2010 P1 Radio – *Science World* (P1: Videnskabens Verden)

Oct. 2010 Humanist – *How do we get health out of the laboratories and into the living rooms?* (Hvordan kommer sundhed ud af laboratorierne og ind i stuerne?)

Oct. 2010 DR2 TV, Viden om – *Technologies and training* (Teknologier og træning)

08/11 2010 BT – *13 signs of diabetes* (13 tegn på diabetes)

14/11 2010 Mandag Morgen – *Consistency in health care is the way to healthy aging* (Sammenhæng i sundhedsvæsenet er vejen til sund aldring)

14/11 2010 Mandag Morgen (mm.dk) – *Should doctors refuse medication to physically inactive people?* (Bør læger nægte medicin til fysisk inaktive?)

18/11 2010 Berlingske Tidende – *Mummies reveal cancer was a rare disease in antiquity* (Mumier afslører kræft var en sjælden sygdom i oldtiden)

19/11 2010 Børsen – *Elderly people will in the future have more opportunities* (Fremtidens ældre vil vælge til og fra)

20/11 2010 Randers Amtsavis – *Mummies reveal cancer was a rare disease in antiquity* (Mumier afslører kræft var en sjælden sygdom i oldtiden)

20/11 2010 Dagbladet Ringkjøbing-Skjern – *Mummies reveal cancer was a rare disease in antiquity* (Mumier afslører kræft var en sjælden sygdom i oldtiden)

22/11 2010 Viborg Stifts Folkeblad – *Mummies reveal cancer was a rare disease in antiquity* (Mumier afslører kræft var en sjælden sygdom i oldtiden)

23/11 2010 Århus Stiftstidende – *Mummies reveal cancer was a rare disease in antiquity* (Mumier afslører kræft var en sjælden sygdom i oldtiden)

27/11 2010 Politiken – *Too little family time afflict both young and elderly people* (For lidt tid til familien plager både unge og ældre)

28/11 2010 Mandag Morgen – *Researchers want to debunk the myth that elderly people are weak and homogenous* (Forskere efterlyser opgør med aldersgrænse-samfundet)

28/11 2010 Mandag Morgen – *Get rid of old age!* (Afskaf alderdommen!)
28/11 2010 Mandag Morgen (mm.dk) – *What should replace the standard age limits?* (Hvad skal erstatte faste aldersgrænser?)
30/11 2010 Lolland-Falsters Folketidende – *Elderly people want leisure rather than money to stay in their job* (Ældre vil have fritid frem for penge for at blive i jobbet)
01/12 2010 Ritzaus – *It revolves around time* (Det drejer sig om tidens tand)
02/12 2010 Ritzaus – *He is spending his life researching in aging* (Livet bruges på aldringens gåde)
03/12 2010 Jyllands Posten – *60 years today* (60 år i dag: Aldersforskeren)
03/12 2010 Kristeligt Dagblad – *It revolves around time* (Portræt: Tidens tand knækkes)
03/12 2010 Thisted Dagblad – *Focus on aging* (Fokus på aldring)
03/12 2010 Nordjyske Stiftstidende Vendsyssel – *Focus on aging* (Fokus på aldring)
03/12 2010 Nordjyske Stiftstidende Himmerland – *Focus on aging* (Fokus på aldring)
03/12 2010 Nordjyske Stiftstidende Aalborg – *Focus on aging* (Fokus på aldring)
03/12 2010 Fyens Stiftstidende – *Born for something great* (Født til noget stort)
03/12 2010 Midtjyllands avis – *60 years* (60 år)
03/12 2010 Bornholms Tidende – *It revolves around time* (Det drejer sig om tidens tand)
03/12 2010 Vejle Amts Folkeblad – *It revolves around time* (Det drejer sig om tidens tand)
03/12 2010 Fredericia Dagblad – *It revolves around time* (Det drejer sig om tidens tand)
16/12 2010 KU.dk – *Sleep disorders are expensive* (Søvnlidelser koster kassen)
17/12 2010 videnskab.dk – *Sleep disorders are expensive* (Søvnlidelser koster kassen)
18/12 2010 Dagbladet Køge/Ringsted/Roskilde – *Strong seniors must take care of themselves* (Stærke seniorer skal klare sig selv)
20/12 2010 Sjællandske – *Strong seniors must take care of themselves* (Stærke seniorer skal klare sig selv)
23/12 2010 WebMD – *Family stress linked to Angina Pectoris*
23/12 2010 CNN Health – *Family demands, worry linked to chest pain*
23/12 2010 Ärzte-Zeitung.de – *Familiäre Sorgen gefährden das Herz*

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