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Aging research is on the move, with new research projects, new collaborations and new technologies driving progress. The Center for Healthy Aging (CEHA) is also on the move, staying abreast of all the latest scientific developments and remaining a prominent leader of the international aging research community.

Physically, the CEHA has also moved, and as of early 2017, most CEHA laboratories are now located in the Maersk Building in Copenhagen. With the opening of the Maersk Building, we brought many of CEHA’s partners together in a great facility that has all the latest technologies, workstations and equipment. CEHA is now ready to push outside of traditional boundaries in the context of a flexible, stimulating research environment. One that is optimized to support interdisciplinary collaboration among scientists from different fields of research. Being physically together in the Maersk Building has made the dynamic we have been striving to create at CEHA a reality. CEHA hopes now to continue moving ahead with new collaborations, among CEHA scientists and with scientists throughout the world.

Collaboration with research institutions and their scientists throughout the world is deeply rooted in the CEHA approach. In order to conduct excellent translational research, it is important that our research reaches those in our community who can reap its benefit. CEHA’s work on aging is timely and important, because the number of elderly aged over 80 is expected to increase 3-fold between now and the year 2050. Investing in the research that promotes health among the elderly is good for their quality of life and for socioeconomic benefit in general.

When CEHA brings its research to the community, the community also helps CEHA gain knowledge. The community is where our results take root and create impact for Danish citizens. Interactions between citizens, healthcare professionals, politicians, organizations, the business sector, municipalities and many other players are essential to CEHA. We reach out to them and they reach out to us. A good example is Keep Your Brain Healthy, a 2-year collaboration between CEHA, DGI (the second largest sports organization in Denmark with approx. 1.5m members) and the Danish Agency for Culture and Places. Research at CEHA and elsewhere shows that physical activity, mental stimulation and social interaction are important protective factors for brain health among the elderly. The Keep Your Brain Healthy project provides engaging and community-creating activities for retirement-aged seniors throughout Denmark. The project is a unique, innovative collaboration between club-life, the libraries and research.

Another example is a project on use of statins, cholesterol-reducing medication, that is taken by 600,000 Danes (10 per cent of the Danish population) to prevent cardiovascular disease. CEHA’s LIFESTAT project employed methods and knowledge from the health sciences, humanities and social sciences to analyze how statins influence the health, lifestyle and wellbeing of Danish citizens.
statin-users. LIFESTAT asked, “if statins cause muscle pain that make statin-users exercise less, which can increase risk of cardiovascular disease, are statin-users better off than those who do not take statins but exercise more?” Importantly, the LIFESTAT project showed that overall quality of life and lifestyle should be considered when deciding whether to take a statin to lower blood cholesterol, that this decision should not be based only the individual’s blood cholesterol level.

A third example is the CALM project (Counteracting Age-Related Loss of Skeletal Muscle Mass), which is investigating whether loss of muscle mass and function in the elderly can be prevented by increased consumption of protein and regular physical training. The CALM project compared the effects of protein ingestion and mild physical training separately and together and examined barriers that make it more difficult for the elderly to change lifestyle habits and follow recommendations, which can be a major challenge for researchers conducting lifestyle intervention research. The CALM project uses knowledge and methods from clinical trials, ethnological daily life studies, microbiology, sociological sensory and sociological studies and history, a unique and innovative approach for developing recommendations, lifestyle concepts and products. This helps remove barriers to creating successful interventions and could ultimately create greater opportunities for elderly individuals to live healthy, independent lives.

These projects and other CEHA projects enhance CEHA and its international reputation. CEHA researchers expect in the coming years to be significant players in the national and international aging research community. CEHA will continue to “roll up its sleeves” and work hard in coming years, reaching out for even greater benefit to the citizens of Denmark and other countries around the world.

Professor Lene Juel Rasmussen, Managing Director
Theme I
Community innovation for healthy aging
Perceptions of a meaningful and fulfilling life, and the ability to achieve this, are shaped by individual experiences and values across the lifespan as well as by larger structural and policy factors. Local communities are important settings to study, as they incorporate the many facets of everyday life that shape health behaviors and quality of life for diverse groups of older people. Such community factors include the availability and relevance of health promotion initiatives, spaces for interaction with others, leisure activities for diverse groups of older people, the built environment and social capital/networks within older populations and across generations.

There are also important social and structural differences within and between communities that affect people’s motivation and ability to engage in health promotion interventions, including differences in available services (level and types), health status, functional capacity, gender, education, (former) occupation, income, ethnicity, and formal and informal social relationships.

The rationale of Theme I is rooted in this recognition of the importance of focusing not only on individual knowledge and skills in health promotion initiatives, but rather contextualizing health and health behavior in the life course (time) and context (space) of people. An important contextual change is the 2007 Danish municipal reform, which enhanced the responsibility of municipalities for health promotion and challenged them to focus on citizen-oriented health promotion aiming at creating, shaping, and facilitating ways of aging healthily. We use this development to examine the impact of new policies and health technologies as applied in a given municipality in promoting health and wellbeing.

Health-promoting interventions to address healthy aging among heterogeneous populations need to engage local communities directly and hence require cross-disciplinary research and close collaboration between a variety of stakeholders such as civic organizations, municipalities, general practitioners, hospitals, and aging citizens themselves. Our studies focus on achieving an understanding of the actual doing of health – that is, the ongoing everyday practices, meanings and negotiations of health, and potentials for engaging older adults in health promotion through various intervention settings, strategies and collaborations. In other words, Theme I aims to understand how the heterogeneity of local communities influences the promotion of health and energy of aging citizens, and how healthy aging may be enhanced in community-based interventions.

The research in Theme I is based on the close collaborations between CEHA and six Danish municipali-
ties: Ishøj, Copenhagen, Vordingborg, Gentofte, Høje Taastrup and Nordfyn. These municipalities represent different organizational and institutional conditions and populations that differ by social class, ethnicity, age and health status. Some have been engaged since the beginning of Theme 1 whereas others have joined along the way through new collaborations.

We expect that the following perspectives and results will help promote healthy and active aging in the communities under study:

• Analysis of the concepts of healthy aging and lifelong energy;
• Mapping core ‘health and aging’ stakeholders in the four selected municipalities;
• Analysis of the various opportunities for and barriers to healthy aging and lifelong energy of individuals, population subgroups and at the community level in each municipality;
• Identify enabling and limiting contextual factors with regard to healthy aging and the maintenance of lifelong energy;
• Analysis and development of methods and tools for health promotion that are participatory and based on the involvement of various local stakeholders.

Another important aim of Theme I is to build sustainable academic networks across different disciplines, including health services research, anthropology, and ethnology, and with clinical researchers in other parts of CEHA, and to extend these to collaboration with societal partners primarily at the local community (municipal) level including NGOs and informal citizen groups but also across primary care and hospitals.

Specific aims of the theme are:

• To develop sustainable interdisciplinary academic networks to explore how new understanding of aging and the heterogeneity of local communities influences the ways in which health and energy are promoted in aging citizens;
• To explore the various opportunities and barriers to healthy aging and lifelong energy at the community level, and apply this knowledge in collaboration with societal partners;
• To identify innovative approaches to private-public collaboration in health and aging and devise new modalities for the active participation of aging individuals in shaping policies and services.

Organizational developments
In October 2017, Assoc. Professor Bjarke Oxlund left the management group of Theme I due to a career change and was replaced by Postdoc Nete Schwennesen.

Program performance
Maintaining close relationships with partner municipalities and engaging in interaction research projects are key achievements of Theme I. This has led to insights into the complexities, challenges, and opportunities of developing in-depth collaborative health and social care projects within municipal settings. This is manifest in the sub-projects contributing to the general themes of “changing ideas and values”, “changing social relations”, “social energy for older citizens”. These sub-projects have provided research results about policies to address a number of issues such as loneliness among the older; coordination of care through municipal/regional health houses; policies and practices of engaging the voluntary sector in developing health and older care and the implementation of welfare technologies in municipal and clinical contexts. Ethnographic studies have been conducted looking into the relations between the everyday life of older people, civil society and municipality. This work has centered on initiatives such as Cycling without Age, lunch cafés, local exercise associations, and asks how the professional and voluntary boundaries, continuity in community initiatives as well as citizen-involvement is challenged and developed through co-creation. Theme I has also developed a deeper insight into the challenges of providing healthcare to aging immigrants and ethnic minorities in Denmark and we are currently involved in several intervention studies exploring ways of providing diversity-sensitive health promotion and rehabilitation in collaboration with municipalities and stakeholders that are engaged in such activities.

Theme I has been successful in obtaining supplementary external research funding for a number of projects dealing with issues such as: Coordination of care between municipalities and regions; aging in the Arctic; digital rehabilitation in the context of dementia; quality
of life and social relations among older LGBT people; documenting effects of large-scale structural community changes and developing participatory interventions in ethnic diverse housing communities; identifying effects of diet interventions building on cultural backgrounds and social networks among older migrant women in deprived communities; documenting effects of targeted programmes to upgrade municipal rehabilitation for patients with Parkinson’s disease and exploring social inequality in cancer care programmes for older adults with colorectal cancer. Some of these add-on projects are short term, while others will continue beyond the termination of CEHA II. The success in obtaining external funding for research projects underlines the sustainability of the research theme. Engagement of a range of stakeholders in developing project proposals and securing funding has likewise been successful with collaborations with e.g. Høje-Taastrup municipality, Copenhagen municipality, the Alzheimer Association, the Parkinson Association, the Danish Heart Association, all five municipalities in Greenland, and Ishøj municipality.

Theme results for 2017
Examples of specific results from 2017 include:

• The study of policies for voluntary sector cooperation revealed a gap between policy formulations in the municipalities and awareness of policies within the community of voluntary associations. This suggests a need to rethink the inclusion of stakeholders in policy formulation and implementation.

• The study about municipal/regional health centers as loci for coordination shows that barriers remain despite co-location of health and social care actors. Diverging incentives, cultures and working conditions create problems in the relationships.

• The research on co-creation in Ishøj shows that user-involvement and continuity is both enabled and challenged by this new governance paradigm. The project has been presented to the city council, and has led to an increased collaboration between the administrative units in the municipality.

• An ethnographic study of the implementation of digital technologies in programs of physical rehabilitation for patients who have undergone hip replacement surgery, shows that the technology is embedded in a wider arrangement of care, which decides whether or not the technology comes to work as intended. A successful implementation requires that patients and health professionals are willing to adjust the technology, in order to make it fit with specific bodies.

• A qualitative study draws attention to socially isolated older men add to existing knowledge on the relation between ageing, masculinity and solitary living. The project concluded that social isolation can be considered a mode of social behavior, which is adopted in order to reclaim autonomy.

• An ethnographic study on how older people understand and construct a ‘good life’ found that social relations, continuity and an everyday life with work-related or recreational activities was desired, which however was challenged by transitions in old age, for example when the body started to fail and they had to give up meaningful activities. The study concluded that, quality of life depend on how well older people manage to mobilize individual resources as well as resources in their network and surroundings.

• A qualitative study among middle-aged and older men with cancer documented the role of masculinity in shaping coping with cancer and navigating healthcare. While gender shapes behaviour, results highlight the role of emotions and relationships for men with cancer.

• A multi perspective case-based qualitative study exploring interactions in clinical encounters between women with breast cancer and healthcare professionals showed how encounters are shaped by categorizations of patients’ social resources and ethnicity, and by the resource-constrained organizational context.

• A survey in a sample of Danish adults (N=9154) between the ages of 52–92 years found that loneliness was associated with increased risks of poor self-rated health, limited physical abilities and multiple diagnoses.

• In a survey investigating Danish medical teachers’ perceptions of cultural competence, we found acknowledgement of the importance of cultural competence and the need to implement cultural competence in the medical curriculum, training of teachers and strengthening the diversity sensitivity of the organisation.
• An intervention study exploring involvement of community pharmacists with ethnic minority backgrounds in medication reviews for ethnic minority poly-pharmacy patients highlighted the potential of involving professionals with diverse ethnic backgrounds in such interventions.
• In a review paper, we conclude that there is a need for attention to migration alongside other determinants of healthy aging, and for sensitive and comprehensive approach to policies, practices and research within the field of healthy aging to accommodate for the growing number of aging migrants in Europe.

Conclusions
Theme I builds on a framework that emphasizes the importance of social and cultural factors in the aging process – as humans interact in extended personal and professional networks over time. Thus, we pursue the CEHA II mission by exploring how this affects the opportunities for health-related behavior, health and wellbeing in the aging population, and creating a close connection between research and practical dissemination. The research performance in Theme I is now harvesting from the immense investment done in the first three years of CEHA II. The effort we have put into developing and consolidating the collaborations with municipalities and other stakeholders has given us the opportunity to be involved in and develop new collaborative and cross-disciplinary projects. The results from the research in Theme I emphasizes how aging and ‘the good old life’ is formed in and by political, social and cultural rationales and practices.

Selected publications
In 2017, CEHA published 181 publications. Our 10 most important publications (selected by Theme I Leaders) are listed below.


A complete list of publications is available at healthyaging.ku.dk/publications.

PhD dissertations in 2017


Maja Schøler: To be on lifecourse changes is far easier. An anthropological study on obese men’s experiences when changing lifestyle. October 2016.
Theme II

Life course aging processes:
Lifespan exposures and healthy aging
Life course aging processes: Lifespan exposures and healthy aging

Group leaders
Erik Lykke Mortensen, Professor
Rikke Lund, Assoc. Professor
Martin Lauritzen, Professor
Flemming Dela, Professor
Rudi Westendorp, Professor

Because aging takes place throughout the life span, life course studies are essential to understand. They facilitate understanding individual differences in aging, design of interventions optimized to stimulate an active life style, and use of innovative approaches to enable individuals and populations to age successfully. Since life course studies examine biological, behavioral and social factors and their impact on health, life course research is inherently interdisciplinary. Theme II life course studies include several interdisciplinary projects within CEHA, thus contributing to CEHA’s goal to conduct interdisciplinary research.

Theme II aims to increase knowledge of lifecourse exposures and individual differences in aging and to use this knowledge to design interventions that stimulate healthy and successful aging. Life course exposures are analyzed in several cohorts that have been followed for decades; data from these studies are linked to the national health and social registry databases in Statistics Denmark. Age-related cognitive decline is investigated in several cohorts covering young adulthood, late middle-age and late life. Finally Theme II researchers conduct physical activity interventions on older individuals in retirement age and evaluate the potential benefits and negative side-effects from use of cholesterol lowering drugs.

Background and hypotheses

Life course exposures: Aims: to analyze how life course exposures influence aging trajectories and determine individual differences in aging. Hypotheses: composite measures of negative factors (adversities and risks) and positive environmental factors will predict individual differences in aging trajectories in all major life periods: early prenatal, early postnatal, childhood, adolescence, young adulthood, midlife and late life.

Age-related cognitive decline: Aims: to characterize cognitive decline and identify early predictors of age-related cognitive decline. Hypotheses: indicators of risk for progressive cognitive decline can be detected in late midlife and onset and progression are influenced by a wide range of exposures over the life course.

Physical activity intervention: Aims: to evaluate the effects of physical activity and to evaluate compliance with high and low intensity physical activity interventions. Hypotheses: program adherence and long-term benefits will be greater for moderate intensity training and the overall effect on functional ability, physical function, cognitive function, health and disease preventions will be greater for low intensity than for high intensity physical activity interventions.
Cholesterol lowering drugs: Aims: to conduct interdisciplinary studies on a cohort of statin users to described the complexity of a medical issue from biological, humanistic and anthropological points of view. Hypotheses: statin-induced myalgia can be mitigated by supplementation with oral co-enzyme Q10; statin-users experience a loss of muscle function, disturbed glucose homeostasis and altered mitochondrial oxidative capacity. Physical training may mitigate these side-effects of statin-use.

Program performance

Life course exposures
Data from Copenhagen Aging and Midlife Biobank (CAMB) form the basis for a large number of projects on aging over the life course, including studies of social inequality in early aging, exposures to stress and outcomes such as allostatic load, low grade inflammation (LGI), physical function, and changes in cognition. These studies focus on both early aging and physical as well as mental health.

The detailed information on the CAMB cohort members from several data collection points across the life span (early life to midlife) have been merged with register based information from 1980-2017 from National Health and Social Registries. The full database base is now embedded in the Public Health Database and stored on a separate server in Statistics Denmark. Several new projects based on this facility have been initiated. They include not only CAMB projects, but also projects based on the large Danish Conscription Database with draft board information on 728,160 men and make it possible to conduct detailed analyses of the influence of body size, education and intelligence in early adulthood on health and disease, and aging processes over the life course.

Studies of the Copenhagen Perinatal Cohort focus on early growth and behavioral milestones as predictors of young adult personality and adult intelligence. Further analyses of associations of early growth and development with personality and intelligence in late midlife are being conducted. Several publications are anticipated.

Theme II researchers are also analyzing data from the Longitudinal Survey of Health, Ageing and Retirement in Europe, focusing on comorbidity, frailty and subjective health as predictors of mortality.

Age-related cognitive decline
Theme II is extending and expanding its prior studies of a CAMB subsample from the Metropolit Cohort under the Project name COLOSMA: Copenhagen Longitudinal Study of Male Cognitive Aging. Participants were selected on the basis of midlife cognitive functioning. Data collection on the The Life-Mabs study (Early Life Determinants of Midlife Development and Brain Structure) is expected to be complete by February 2018. The study includes detailed psychological assessment as well as MRI analysis on 300 selected members of the Copenhagen Perinatal Cohort with detailed information on early life exposures and young adult psychological, social and physical development. These data support analyses of stability and change in personality and health across the lifespan. A special feature of the study is the re-administration of the Wechsler Adult Intelligence Scale, which the participants first completed as young adults, allowing detailed analyses of cognitive changes from young adulthood to late midlife.

In 2018, data-collection on the Liko-15 (Lifestyle and cognition) project will be completed. The study is the first large scale study in which the Danish draft board intelligence test is administered to the same individuals at conscription and again in late midlife. The study focuses on the influence of lifestyle factors, mental health and physical disease on age-related cognitive decline. More than 2,500 55-65 year old men have participated in the follow-up, which includes the draft board intelligence test and a detailed questionnaires on demographics, lifestyle, health and disease.

Studies on the Glostrup 1914 cohort continue with analyses of cognitive function and MRI data. A graduate student is also pursuing PhD thesis work on the role of education in cognitive performance and cognitive decline through the life course. The associations between blood pressure, social networks and social relations on age-related cognitive decline are also being examined.

Physical activity intervention
The LISA (Live active – Successful Aging) study is a large scale randomized clinical trial involving 450 men
and women between the ages of 62 and 70. The trial examines whether physical activity interventions promote higher energy levels among participants and long-term program adherence to a physically active lifestyle. A collaborative paper describing the project has been published in 2017. (See page 33 below for more detail).

The Ubberup project focuses on factors that influence the capacity to maintain lifestyle changes after an 11-12 week physical activity intervention. The project has included 79 participants in a cross-sectional study arm and 61 participants in a longitudinal study arm. (See page 32 below for more detail)

**Cholesterol lowering drugs**
Studies of elderly individuals who receive statins as preventive medication are ongoing (LIFESTAT), including analyses of the metabolic profile in statin users and controls. Metabolic and physical data on participants will be used to study the mechanism underlying statin-induced myalgia. The analyses are expected to be complete in 2018. (See page 32 below for more detail)

**Theme results for 2017**
- Sixty-two projects, some complete and some ongoing, exploit the CAMB database, which has unique value as one of CEHA’s assets for life course studies of aging.
- The Danish conscription database, with data on 728,160 Danish men, has been the basis of several papers and several ongoing projects and analyses.
- Body weight at birth is associated C-reactive protein (CRP) later in life, independent of adult body weight.
- The accumulation of prenatal and early life stressors are associated with higher CRP and IL-6 in later life.
- Loneliness in midlife is not associated with decreased physical capacity.
- Socioeconomic status in childhood indirectly influences cognitive ability in midlife, when early life cognitive ability is taken into account.
- Retrospective assessment of hard physical labor and other features of the physical work environment, especially heavy lifting, can provide insight into exit from or absence from work.
- Cumulative occupational mechanical exposure in the work environment –such as lifting and kneeling– increase the risk of long term absence due to sickness.
- Male infertility is associated with increased level of interleukin-6.
- Ponderal index at birth is associated with CRP in later life independent of adult BMI. The findings suggest that prevention of weight gain in early adults may reduce inflammation in later life.
- High physical workload accelerates progressive loss mobility for individuals who are active or sedentary during leisure time.
- Relative cognitive decline is associated with higher peripheral blood mononuclear cells content of deoxythymidine-triphosphate (20%), but is not associated with altered mitochondrial bioenergetic parameters or mitochondrial ROS.
- Large scale twin studies suggest a modest inverse association between young adult intelligence and mortality until late midlife; shared genetics and shared environment only explain a small part of the association.
- Birth weight influences adult intelligence throughout the life course from young adulthood to midlife.
- Age at which developmental milestones are reached is associated with intelligence in young adults, especially for milestones related to language development and social interaction.
- Midlife cognitive ability and education predict tooth loss from age 50 to age 70.
- Calendar age encompasses most of the discrimination ability to predict mortality. The added value of comorbidity, frailty, and subjective health to mortality predictions decreases with increasing age.
- Low early-life cognitive ability increases the risk of dementia before the age of 78 years. The association is partly explained by shared family factors.
- Complex age-related changes in brain information processing underlies behavioral and EEG measures of visual short term memory and might be a marker of cognitive lifespan trajectories.
- Differences in cerebral rhythmic activity between alpha and gamma bands is associated with age and cognitive status, and provides a clinical tool that can be used to examine cognitive status in old age.
- Decreased activity of mitochondrial complex 1 and increased heterogeneity in size of mitochondria point
to declining mitochondrial quality control as an initial event in brain aging.

- Early sub-clinical cognitive decline is associated with reduced perfusion in the precuneus and posterior cingulate gyrus independent of regional atrophy and vascular risk factors
- Men with early sub-clinical loss of cognitive function have significantly shorter mean leukocyte telomere length than men with better preserved cognitive function, suggesting that preclinical cognitive changes may be associated with leukocyte telomere length.

Conclusions

Theme II researchers conduct observational epidemiological and clinical studies as well as intervention studies. During CEHA II, several comprehensive databases have been completed and proved critical resources for Theme II studies. For example, CAMB data have been the basis for more than 62 projects. The Glostrup neurocognitive project, COLOSMA, has been expanded, and has conducted a 5-year follow-up re-assessment with impressive participation. Data collection in Life-Mabs, the cross-disciplinary project integrating psychology and MRI studies, will be complete early in 2018. Data analyses are being conducted on the Liko-15 cognitive follow-up study and on the LISA and Ubberup intervention studies.

The basic hypothesis underlying the life course approach is that individual difference in aging to a large extent can be linked to biological factors and environmental exposures that occur in childhood, adolescence and young adulthood. Previous CEHA research and 2016-17 results have corroborated this hypothesis, demonstrating that early life exposures, stress and individual characteristics of young adults are predictive of physical and cognitive function, as well as morbidity (including dementia) and mortality in mid- and late life. These studies demonstrate substantial continuity across the lifespan, suggesting that individual differences in aging should be interpreted in this perspective and within the context of this continuity. The clinical neuroproject COLOSMA has provided important information on associations between cognitive function and biological and brain parameters, while recent epidemiological studies suggest important roles for psychological and socioeconomic factors and work environment as predictors of aging trajectories.

All major Theme II projects are cross-disciplinary, and as a result, a substantial part of Theme II publications is co-authored by researchers from several disciplines. Theme II researchers also collaborate closely with CEHA Theme I researchers, in studies that combine qualitative and quantitative analyses of aging and descriptive studies of aging from the perspective of older and elderly individuals. Collaboration between Theme II and Theme III researchers is extensive, especially in the effort to identify molecular biomarkers of aging.

Selected publications

In 2017, CEHA published 181 publications. Below, we list the 10 most important publications from Theme II. The papers were selected by the Theme Leaders.


Eriksen CS, Garde E, Reislev NL, Wimmelmann CL, Bieler T, Ziegler AK, Gylling AT, Dideriksen KJ, Siebner HR, Mortensen EL, Kjaer M. Physical activity as intervention for age-related loss of muscle mass and function: protocol for a randomised controlled trial (the LISA study). BMJ Open. 6(12): e012951, 2016.


A complete list of publications is available at healthyaging.ku.dk/publications.

**PhD dissertations in 2017**


**Tine Lovsø Dohlmann:** Role of mitochondria in statin induced myalgia. December 2017.

**Marianne Dalsgaard Kristensen:** Lipid stress and chronic low grade inflammation with obesity and weight loss – association with insulin sensitivity. September 2017.

**Sune Dandanell:** Physiological factors that influence weight loss maintenance after a lifestyle intervention. March 2017.

**Anna Horwitz:** Cognitive ability and steady-state evoked gamma response. March 2017.

**Katja Anna Hybel:** Executive function in childhood obsessive-compulsive Disorder. June 2017.

**Malene Maag Kristensen:** Influence of changes in levels of activity and weight loss on the expression of miRNAs in human adipose and muscle tissue. April 2017.

**David Rurik Martinsson:** Symptom patterns, co-morbidity and treatment outcome in child and adolescent Obsessive Compulsive Disorder. June 2017.

**Maiken Pontoppidan:** The effects of universally offered parenting interventions for families with infants. November 2016.

**Katja Linda Waller:** Late midlife sleep and circadian pattern: Associations with trajectories of cognitive development in adulthood. February 2017.
Theme III

Energy balance in humans:
What are the mechanisms underlying reduced energy?
Energy balance in humans: What are the mechanisms underlying reduced energy?

Group leaders
Lene Juel Rasmussen, Professor
Hocine Mankouri, Assoc. Professor/Ian Hickson, Professor
Michael Kjaer, Professor
Jorn Wulff Helge, Professor
Linda Hildegard Bergersen, Professor
Vilhelm Bohr, Professor
Simon Bekker-Jensen, Professor
Andres Lopez-Contreras, Assoc. Professor
Morten Scheibye-Knudsen, Assoc. Professor
Javier Pena-Diaz, Assoc. Professor

Aging is associated with a general decline in vitality. Theme III researchers aim to better understand the molecular, cellular and systemic mechanisms that are responsible for this decline. This knowledge will ultimately promote development of novel strategies to counteract age-associated loss of vitality.

Background and hypothesis
At the cellular and tissue levels, the reduction in vitality during aging correlates with an inability to adequately replace or repair ‘worn-out’ or damaged components. Theme III researchers aim to better understand the molecular and cellular mechanisms that are the principle causes of aging. An improved understanding of these mechanisms, coupled with the identification of reliable ‘early warning’ biomarkers associated with common pathological features of aging, will permit individuals to make informed lifestyle changes, that limit age-associated functional decline. Therefore, Theme III takes a highly integrated approach, examining biomedical, physiological and psychological aspects of aging in humans. Theme III also exploits CEHA’s unique access to and relationships with local Danish municipalities, and participates in outreach activities designed to engage the general public in CEHA’s aging research initiatives.

Theme III’s principal aims are:
1. To better understand the impact of nuclear and mitochondrial dysfunction on specific tissues and organs and the mechanisms that decrease vitality during aging;
2. To investigate the molecular and cellular basis for age-related cognitive decline and muscle dysfunction;
3. To study human premature aging disorders, as a model for exaggerated aging;
4. To better understand mechanisms underlying inherently unstable regions of the genome, how they are maintained over time, and their role in age-related diseases;
5. To identify novel early diagnostic and prognostic biomarkers of age-related tissue pathologies;
6. To establish novel mouse models for studying organ- and tissue-specific functions during aging;

Electron microscopy images of cellular organelles, including mitochondria (A, C), phagosomes (B) and the nucleus (D).
7. To examine the effects of physical training on muscle physiology, and how physical training interventions could be exploited to maintain or increase vitality during aging;
8. To identify novel and effective interventions that will promote healthy aging.

Program performance

Understanding how mitochondrial dysfunction affects vitality
The accurate repair of mitochondrial DNA damage, and recycling of defective mitochondria (a process known as ‘mitophagy’), is critical for healthy cells and healthy aging. Two DNA repair pathways – translesion DNA synthesis and base excision repair – are critical for optimal mitochondrial function and the prevention of age-related diseases. In addition, stimulation of mitophagy can remove dysfunctional mitochondria and inhibit age-related skeletal muscle atrophy in mice, and ameliorate the neurodegenerative pathology observed in the recombinant mouse model of a neurodegenerative disease known as Ataxia telangiectasia. Mitophagy stimulating agents include Tomatidin, which is abundant in tomatoes, and NAD+.

Understanding how accurate DNA repair promotes healthspan
As part of a long-term (on-going) study, we are analyzing the aging process in genetically-engineered mice that have an increased capacity to repair DNA damage, limit DNA replication stress, or activate DNA damage response pathways. The goal is to determine whether enhancement of endogenous protective mechanisms can delay aging in specific organs or tissues. We are also collaborating with Insilico Medicine Inc. to identify molecules that are able to directly stimulate DNA repair. At present, we have identified >10 novel lead molecules as possible DNA repair stimulators, and these are currently being tested further. Our research also combines in silico, in vitro and in vivo methodologies to identify molecular biomarkers of age-associated phenotypes. Using this strategy, we recently demonstrated that Woodhouse-Sakati syndrome is a (previously unassigned) premature aging syndrome. Work to elucidate the underlying defect for this disorder is on-going.

Understanding how dividing cells maintain genome stability
We are investigating how cells limit deleterious errors (mutations) during DNA replication. For example, we have shown how disruption of DNA replication fork movement causes mutations. Furthermore, we have characterised novel functional interactions between DNA repair factors, the DNA replication machinery, and chromatin remodelling factors. A better understanding of these factors, and their cooperative interactions, will reveal the mechanisms that promote genome stability throughout our lifespans.

Certain chromosomal regions are inherently unstable and difficult to maintain, most likely because they are difficult to replicate. For example, the protective caps on the ends of chromosomes, called ‘telomeres’, erode during each cell division cycle. Telomeres contain highly repetitive DNA sequences, and telomere shortening is implicated in cellular aging. We are characterizing factors that are critical for normal telomere regulation and stability, which include of RecQ helicases, mismatch repair proteins, and various nucleases.

Finally, we are examining how cells cope with an ‘unfinished S-phase,’ where incompletely replicated and/or unprocessed DNA structures interfere with chromosome segregation during mitosis. These experiments combine cell biological, molecular genetic and biophysical approaches to identify and understand the process of chromosome segregation.

How exercise protects against muscle aging
Lifelong athletes tend to have more skeletal muscle mass, less fat and connective tissue in the muscle, and a lower level of inflammatory markers in the blood than untrained individuals. We have shown that, in elderly individuals, skeletal muscle hypertrophy in response to strength training can be significantly influenced by high levels of inflammation. For example, elderly patients in the hospital responded less well to training when markers of inflammation were high. In addition, in elderly patients undergoing rehabilitation following a period with inactivity, more improvement in muscle mass can be attained when patients are treated with anti-inflammatory medications.

Our studies also demonstrate that myostatin, a strong skeletal muscle growth suppressor, is down-regulated
Results

- Translesion synthesis is required for optimal mitochondrial function and the prevention of age-related disease.
- The RECQ5 helicase cooperates with the MUS81 nuclease to suppress the instability of telomeres and fragile regions of the human genome.
- A stalled replication fork generates localized mutations, indicating how perturbation of DNA replication could drive the aging process.
- Tomatidin, a compound that is abundant in tomatoes, inhibits age-related skeletal muscle atrophy in mice by stimulating mitophagy.
- DNA polymerase beta levels decline during aging. This enzyme promotes mitochondrial DNA repair and homeostasis in brain cells.
- Ataxia telangiectasia (AT) is a progeroid disease characterized by progressive neurodegeneration. NAD+ stimulates mitophagy and DNA repair in cells and animal model systems. Treatment with NAD+ ameliorates symptoms in a mouse model of AT.
- Exonuclease 1 and DNA polymerase delta cooperate to limit DNA replication errors and ensure genome stability.
- Mismatch repair proteins cooperate with chromatin remodelling factors to protect against deleterious DNA repeats expansions linked to age-related neurological disorders.
- Maintenance of telomeres is regulated by the mismatch repair system in telomerase-deficient cancer cells.
- Patients with Woodhouse-Sakati syndrome demonstrate features of premature aging and a cellular DNA repair defect.
- Deletion of the DNA translocase PICH causes chromosomal instability and defective embryonic development in mice. Heterozygous female mice exhibit chimeric PICH expression and can be used to investigate the effects of moderate chromosomal instability in aging.
- Geriatric hospitalized patients have an impaired training response in regards to skeletal muscle growth with strength training the higher their circulating markers of inflammation are.
- One of the strong skeletal muscle growth suppressors – myostatin – is down regulated acutely after exercise when angiotensin II receptors are blocked in elderly individuals.
- Long term strength training of elderly males is not influenced by chronic administration of angiotensin II receptor blockers, and thus does not in this setting seem to promote muscle adaptation to training in elderly humans.
- Human fibroblasts exert a strong positive regulatory influence on myogenic precursor cells activity during in vivo skeletal muscle regeneration.
- The basement membrane of skeletal muscle plays a key role in the process of muscle regeneration.

Conclusions

Translesion synthesis is required for optimal mitochondrial function and the prevention of age-related diseases. Agents that stimulate mitophagy can prevent age-related skeletal muscle atrophy in mice. The abundance of DNA polymerase beta in mitochondria of brain cells declines during aging, and may correlate with disease-associated progressive neurodegeneration. NAD+ supplementation ameliorates symptoms or neurodegenerative disease by stimulating mitophagy and DNA repair. Exonuclease 1 and DNA polymerase delta cooperate to limit DNA replication errors and ensure genome stability, and repair...
proteins cooperate with chromatin remodeling factors to protect against deleterious DNA repeats expansions linked to age-related neurological disorders. Maintenance of telomeres is regulated by the mismatch repair system in telomerase-deficient cancer cells. Deletion of the DNA translocase PICH causes chromosomal instability and defective embryonic development in mice. Finally, heterozygous female mice exhibit chimeric PICH expression and can be used to investigate the effects of moderate chromosomal instability in aging.

Muscle hypertrophy can occur in response to strength training at any age, but in the elderly, high levels of inflammation can inhibit this effect. Although anti-hypertensive medication can stimulate muscle hypertrophy in response to exercise, chronic dosing with anti-hypertensive medication may not improve the outcome of strength training in healthy elderly individuals. This suggests that anti-hypertensive drugs do not directly influence skeletal muscle mass in elderly individuals. Muscle regeneration after injury or inactivity is positively regulated by fibroblasts, and the basal membrane plays a key role in muscle regeneration after injury.

Selected publications

In 2017, CEHA published 181 publications. Below, we list the 10 most important publications from Theme III. The papers were selected by the Theme Leaders.


A complete list of publications is available at healthyaging.ku.dk/publications.

PhD dissertations in 2017


Jon Durhuus: Cell and tissue-specific alterations in mitochondrial bioenergetics and mitochondrial function, August 2017.


Intervention studies and cross-theme projects
Selected intervention studies and cross-theme projects 2017

Digital rehabilitation and the reconfiguration of care arrangements: An ethnographic study of implementation in practice

Key CEHA researcher
Nete Schwennesen, Postdoc (Theme I)

In current years, innovative digital technologies have been designed and implemented in municipalities, in order to make processes of rehabilitation more cost-efficient and provide processes of ‘aging in place’. However, we know little about how technology, health professionals and patients work together to implement and support new infrastructures of care. An ethnographic study was conducted in collaboration with Copenhagen municipality, in order to 1) unpack the processes through which a remote monitoring technology for the promotion of home-training, was put to use in programs of physical rehabilitation. And 2) to identify barriers of implementation and how the process of implementation can be supported. The study illustrates that a new geography of responsibility was constituted, where responsibility for professional guidance was delegated to the technology, and patients were expected to produce and engage in data. In contrast to an instrumental image of technology, the study illustrates that the functionality of the technology emerged as an ongoing process evolving through encounters between technology, patients and healthcare providers. The collaboration led to a joint application for a three-year ethnographic study on the design and implementation of digital technologies in the field of dementia, care and rehabilitation, which was supported by the Velux Foundation.

Social relations and healthcare utilization among middle-aged and older people: an implementation and registry-based study in Denmark

Key CEHA researchers
Maria Kristiansen, Assoc. Professor (PI, Theme I)
Rikke Lund, Assoc. Professor (Theme II)
Anne Sophie Bech Mikkelsen, PhD Student (Theme I)

Another Theme I project explores the relationship between social relations and healthcare utilization among Danish middle-aged people by linking cohort data with data from Danish national registries. This is supplemented by qualitative data on individual and contextual factors affecting the implementation of a group-based life story intervention among frail older people living in nursing homes in Denmark. Preliminary findings indicate that healthcare professionals find the intervention more successful and relevant than the participants. The participants find it “nice enough” but with no new relationships as a result of the intervention and they had difficulties distinguishing it from other activities offered at the
nursing home. Preliminary findings also indicate barriers for successful implementation of the intervention; 1. Differences in physical capacity and cognitive function among participants, 2. Lack of time (for the healthcare professionals) and 3. Competing activities at the nursing homes. We expect the results to improve understanding of patient use of healthcare services, which could inform implementation of future interventions targeting frail older people in nursing homes.

Targeting multidimensional preventive home visits to older adults in disadvantaged multi-ethnic communities: a multi-methods implementation study

Key CEHA researchers
Maria Kristiansen, Assoc. Professor (PI, Theme I).
Abirami Srirarathan, Research Student (Theme I)

Theme I is exploring ways of working with community structures, facilities and resources through participatory approaches. Special emphasis has been placed on communities with ethnically-diverse and socioeconomically-disadvantaged populations. One example is a one-year intervention study designed and implemented in a collaboration between a municipality with two so-called “disadvantaged housing areas.” This collaboration involved the local housing organization voluntary associations and CEHA researchers. We explored innovative ways of recruiting participants and delivering preventive home visits to older adults with complex needs in ethnically-diverse communities. This study documented gaps between health promotion services developed for older adults in general and the complex health and social care needs of diverse and more disadvantaged groups. The effort highlights was to target interventions appropriately through language adaptation, alterations of content and modes of delivery. The intervention package developed is now streamlined in the municipality. The collaboration led to a joint application for a longitudinal and multi-method study into effects of large structural interventions using a 900 mill DKK restructuring of the same local community.

CALM project

Key CEHA researchers
Astrid Jespersen, Assoc. Professor (PI, Theme I)
Lars Holm, Professor (co-PI, Theme III)
Michael Kjaer, Professor (Theme III)
Tenna Jensen, Assoc. Professor (Theme I)
Aske Juul Lassen, Postdoc (Theme I)
Søren Reitelseder, Postdoc (Theme II).

With advancing age the incidence of frailty and disabilities increases, with negative impact on the lives of the elderly and on the health care infrastructure, causing higher health care costs. In the CALM project (Counteracting Age-Related Loss of Skeletal Muscle Mass) we focus on the age-dependent loss of skeletal muscle mass. This loss, termed sarcopenia, is caused by multiple factors, often starting in mid-life and is increasing thereafter. Sarcopenia can be delayed or slowed by interventions that include muscular resistance training and control of protein intake. CALM was launched in 2013 as one of 18 projects under the heading UCPH Excellence Programme for Interdisciplinary Research and is a research collaboration focusing on age-related loss of skeletal muscle mass and the effect of dietary protein and physical activity on health and lifestyle among older people. The CALM project explores the effect of increased protein intake and increased levels of exercise on skeletal muscle mass and function and on gut microbiota and metabolome. Other areas of interest and ongoing projects related to CALM include: Lifestyle changes in everyday life, Socio-cultural and historical paradigms of aging, and consumer studies and development of food prototypes including stakeholder involvement.

Identification of predictors for cognitive function

Key researchers
Martin Lauritzen, Professor (PI; Theme II)
Erik Lykke Mortensen, Professor (Theme II)
Lene Juel Rasmussen, Professor (Theme III)
Merete Osler, Professor (Theme II)
Rikke Lund, Assoc. Professor (Theme II)
Egil Rostrup, Chief Physician (Theme II)
Krisztina Benedek, Consultant (Theme II)

This research program explores the cumulative effect of morbidity on brain function at different life stages in Danish men born in 1953 and in animals. The primary aim is to identify factors that influence or predict cognitive function, especially as relevant to cognitive decline in middle or late life.

**Methods:** Cognitive test scores at a single point in time in midlife reflect individual differences in age-related decline, as well as inherent individual differences in cognitive ability/potential throughout life. Members of the Copenhagen Metropolit Cohort were cognitively-assessed as young adults at time of conscription. A subset of this cohort was also tested for cognitive function in midlife (i.e., CAMB 2009). These data, including MRI studies, structural findings and molecular data are being analysed in light of genetic risk factors for cognitive decline. The project involves a collaboration with the University of Oxford. A number of predictive markers for aging-associated cognitive decline have been identified.

**Progress and results:** We have examined cognitive performance of 191 Metropolit cohort males, without evidence of differences in IQ when cognitive function was assessed at draft board examination (baseline) but with important differences when they were 58 years old, and we have re-invited all the participants and re-examined the men in a 5-year follow-up study. In addition to the follow-up examinations, we have enlarged the cohort of test-persons to 319 individuals. Cognitive function was evaluated in 265 individuals and MRI and EEG data was also collected. These and other data were analysed, revealing differences in sleep quality, telomere length and structural and functional MRI when test-persons were stratified according to higher or lower cogni-
tive performance. In addition, we have shown that EEG correlates of visual short-term memory in older age vary with adult lifespan cognitive development and provide a clinical tool that can be used to examine cognitive status in old age. In animal model systems, we have identified unique features of brain repair mechanisms in astrocytes linked to aging and dysregulation of interneurons during normal aging. Very recent results show that decreased activity of the mitochondrial complex 1 and increased mitochondrial size heterogeneity; these observations suggest that lower mitochondrial quality may be an early sign of brain aging.

Conclusions: We have identified potential markers of cognitive decline. Additional studies are underway to confirm the results, demonstrate reproducibility and to increase sensitivity and specificity of biomarker assays. Ultimately, we envision that these novel findings will lead to novel strategies or tools for diagnosing and preventing brain aging, thus promoting healthier late life years for the elderly.

**LIFESTAT**

**Key researchers**
Flemming Dela, Professor (PI; Theme II)
Christa Lykke Christensen, Assoc. Professor (co-PI from the Faculty of Humanities, UCPH)
Jørn Wulff Helge, Professor (Theme II-III)
Allan Krasnik, Professor (Theme I)
Lene Juel Rasmussen, Professor (Theme III)
Ian Hickson, Professor (Theme III)
Bjarke Oxlund, Assoc. Professor (Theme I)
Steen Larsen, Postdoc (Theme II-III)

**LIFESTAT** is an interdisciplinary project that leverages approaches and knowledge from medicine, the humanities and the social sciences to analyse the impact of statin use on health, life-style and well-being in a cohort of Danish citizens. The impetus for the study is the fact that 600,000 Danes take statins in order to lower blood cholesterol and reduce risk of cardiovascular disease (CVD). Nearly 40% of these individuals are being treated with statins based only their high blood cholesterol; in these individuals, statins are prescribed for the purpose of ‘primary prevention’ of CVD. However, the potential benefit of treatment with statins should be considered in light of evidence that statin-use has serious and prevalent side-effects, including skeletal muscle cell death, muscle pain, and low exercise tolerance, which in turn discourages adherence to recommended regimens for regular exercise. Furthermore, glucose intolerance (a risk factor for type 2 diabetes) can be seen as a side-effect of statin use.

**OBJECTIVE:** To study the biological consequences of statin use, focusing on muscle metabolism and function.

**APPROACH:** Three studies on approximately 150 patients: 1) Cross-sectional study on statin-users with and without myalgia and control subjects (not taking statins). 2) Eight week study of statin-users given or not given Co-enzyme Q10 supplement. 3) Eight week longitudinal study including a physical activity intervention (supervised cycling 3x per week for 8 weeks).

**METHODS:** Clinical and biochemical analyses to quantify insulin sensitivity and secretion, fitness and muscle strength, blood chemistry, muscle and fat metabolism, mitochondrial respiration and mitochondrial ROS.

**GOAL:** To identify potential mechanism(s) underlying statin-induced myalgia.

**STATUS:** Experimental procedures and data collection were complete at end of 2017. Data analysis is ongoing and should be finished in 2018.

**The Ubberup Project**

**Key researchers**
Jørn Wulff Helge, Professor (PI; Theme II-III)
Flemming Dela, Professor (Theme II)
Clara Prats, Assoc. Professor (Theme II-III)
Steen Larsen, Postdoc (Theme II-III)

This is a cross-disciplinary research project, including one cross-sectional subproject and one longitudinal subproject that aims to identify factors that influence adherence to a changed lifestyle after an 11-12 week intensive lifestyle intervention. The experimental part of the project ended in mid-December 2015. In the cross sectional subproject, 79 subjects were divided into three groups; those maintaining a clinical weight loss (>10%),
those maintaining a weight loss and non-maintainers for $4\frac{1}{4}$ to 7 years after the end of the lifestyle intervention. In the longitudinal subproject, 61 subjects were evaluated before the intervention, at the end of the intervention, and 3 months or one year after the intervention. At each evaluation, blood, muscle and adipose tissue samples were obtained and subsequently analysed.

Seven papers have been prepared, one submitted and two are in preparation. Results of the longitudinal study have not yet been published. Maintenance of lifestyle change is problematic; Recurrent application of intensive lifestyle interventions is shown to be an effective approach, even if it is not feasible on a large scale (i.e., to treat a large number of obese individuals). Our data indicate that increased daily physical activity is an effective approach for weight maintenance. Future focus will be on identifying barriers to successful and sustainable lifestyle change.

**Intervention project on physical activity**

**Key researchers**

Michael Kjær, Professor (PI; Theme III)
Erik Lykke Mortensen, Professor (Theme II)
Ellen Garde, Assoc. Professor (Theme II)

The LISA intervention study is currently recruiting participants, and to date, 450 individuals 62 to 70 years old have been enrolled. Of these, 380 completed a 1 year intervention with 82% compliance for participation in training sessions and 93% compliance at the 1 year follow-up. This level of compliance is high, considering that 50% of study participants are in constant treatment for chronic diseases, including hypertension, hypercholesterolemia and diabetes. The preliminary results suggest that heavy resistance training improved muscle mass and strength, whereas the medium intensity training had
less dramatic effect on muscle mass and strength. The control group participated at a high level in social activities (e.g. visits to art exhibitions, lectures on brain health, wine tastings) and small group activity (e.g. card playing, literature reading). Interestingly, a significant portion of healthy persons have detectable structural or vascular abnormalities on MRI brain scans. These data are being analyzed in detail and uploaded to a data base. MRI scans of thigh muscle and brain will be compared to community-based baseline data with specific focus on vascular risk factors. Questionnaire data, results of tests of cognitive function, muscle function, body composition and other clinical indicators will be assessed and analyzed. Some of the results will be considered in two doctoral dissertation PhD studies; one dissertation investigates the mechanical properties (i.e., stiffness) of connective tissue (tendon) in young and very old individuals; the other dissertation investigates the potential positive effect of strength training on inflammation, and whether this is influenced by adipose tissue. Preliminary conclusions suggest that strength training stimulates release of anti-inflammatory cytokines such as IL-6. The observations will be compared to the results of similar studies in animal model systems.
Communication and outreach platform
Communication and outreach platform

Group leader
Ken Arnold, Director

Aim and focus in 2017
CEHA’s communication and outreach platform has consolidated and expanded its established working practices, built on its successes, and further experimented with new efforts to bring healthy aging research into public awareness and conversation. Exploiting different media and methodologies, it continues to focus on individuals, interest groups, public authorities and health professionals in order to share the Center’s research interests and disseminate its results. Much of this work is built on a two-way model of communication, where listening, gathering and being informed by public perceptions and experiences is an important component of the activities. The program has three broad fields of activity:

1) Stakeholder involvement and engagement
In order to increase focus on the value CEHA creates in society and gain feedback from stakeholders, CEHA is in close dialogue with key stakeholders such as elderly organizations, patient associations, professional organizations for health professionals and pension funds. CEHA has invited key stakeholders at executive and dean level for round table talks and developed joint campaigns and events for Folkemødet (People’s Political Festival https://folkemoedet.dk/en/)

CEHA has also initiated a growing communication partnership with the largest organisation for older citizens in Denmark (DaneAge, PKA). In addition, CEHA participates in the 2-year activity and dissemination program Keep Your Brain Healthy as communication and knowledge partner with new and interesting stakeholders – DGI (Danish Gymnastics and Sports Associations) and Agency for Culture and Palace where the local public libraries are administrated (www.holdhjernenfrisk.dk).

2) Media work and interaction with citizens
CEHA continues to disseminate its research findings via printed and electronic means (social media and Center’s website). Distribution of this information through national and international mass media involves extensive contact with on-line and print journalists. The Center has also become a well know player among journalists and are often contacted as experts on various aspects of healthy aging.

CEHA also continues to uphold a strong presence through the Center’s website (incorporating news and richer content) as well as social media, with an especially active Facebook page and a lively Instagram feed. This work especially draws on the active participation of younger scholars at the Center. Some of this work has been particularly effective at disseminating the research process as well as its outcomes.

Innovative and dialogue-based events involving researchers, external stakeholders (including professionals and politicians) and the general public continue
to provide another strand of activity, much of which is integrated with CEHA's social media presence. Settings for these activities range from *Folkemødet* (People's Political Festival www.brk.dk/folkemoedet) through to Medical Museion’s magnificent auditorium. In 2017, much effort has been used on developing the activities, events and communication in the outreach program *Keep Your Brain Healthy*.

3) Using the museum as platform
The work at Medical Museion aims to provide experimental, self-reflexive and in-depth forms of public engagement with the issues and topics tackled by CEHA, aiming in particular to place them within a cultural context. Exhibition and events, as well as game-based installations, are used as points of departure, for interpreting aging-based topics for museum audience. This work has directly involved a range of CEHA researchers.

The major project launched this year has been the *Kintsugi* display, showcased in a room off the museum's reception space. Drawing inspiration from the traditional Japanese art of ‘fixing’ with golden glue, the museum displayed a range of its objects that highlighted various ideas of aging, damage and repair. The project has been used as a backdrop to various interactive workshops, and is now being developed for further national dissemination.
Results
For 2017, the communication program reports the following major results:
- Made communication partnerships with DaneAge (Ældre Sagen) and PKA.
- Participated at Folkemødet 2017 with 9 events.
- Outreach activities with the game Life on the line at Medical Museion and as part of an event at PFA.
- Placed researches as experts in media and other stakeholder events.
- Increased the visibility of CEHA in the press nationally from the baseline in 2012 of 156 articles in Danish media to 272 in 2017.
- Made communication projects for the cross disciplinary projects LIFESTAT and CALM, including a 24-pages publication in new paper format targeted GP’s and their patients (LIFESTAT).
- CEHA stakeholder communication has been highlighted as “best practice” at University of Copenhagen.
- Developed communications and activities for the outreach program Keep Your Brain Healthy, including a webpage.
- Culture night events at both Mærsk Tårnet and Medical Museion with more than 9,000 visitors in total Opening of exhibition Kintsugi at Medical Museion.

For details on specific activities, see pp. 75-81.

Conclusion
2017 has been a year of building on earlier projects and outcomes and developing new projects aimed at segmented audiences. We are well placed to develop this work further, building on increased impact across all key media.
In response to harmful environmental conditions, cells experience stress and mount stress responses. Stress responses maintain the fitness of cells during extended periods of chronic stress. This process is thought to be tightly linked to aging at the cellular and organismal level. However, the response to chronic stress is poorly understood, and basic research into its mechanism is needed.

CEHA is unique in that it provides a platform for integrated work on many aging-related topics. For example, CEHA researchers examine questions about societal challenges related to population aging and questions about acute and chronic responses of cells and organisms to stress. I joined CEHA as a group leader in 2017, and in coming years, I intend to expand my research focus to include studies of the biological aspects of stress responses in cells to higher level study of how these processes contribute to healthy aging.

Professor Simon Bekker-Jensen, Theme III.
Staff list

Complete staff list
● Paid by CEHA¹
○ Partly paid by CEHA²
○ Not paid by CEHA

Total
Paid or partly paid by CEHA: 100 persons
Not paid by CEHA: 148 persons

Definitions:
1 ● represents 1 person paid 1 full work year
   (37 hours per week in 12 months).
2 ○ represents 1 person paid part time in
   1-12 months or full time in less than 12 month.

Senior researchers
Theme I ○ Allan Krasnik, Professor
          ○ Karsten Vrangbæk, Professor
          ○ Susan Whyte, Professor
          ○ Astrid Jespersen, Associate professor
          ● Bjarke Oxlund, Associate professor
          ● Maria Kristiansen, Associate professor
          ○ Tenna Jensen, Associate professor

Theme II ○ Erik Lykke Mortensen, Professor
          ○ Flemming Dela, Professor
          ○ Hartwig Siebner, Professor
          ○ Jørn Wulff Helge, Professor
          ○ Martin Lauritzen, Professor

Theme III ○ Ian Hickson, Professor
          ● Lene Juel Rasmussen, Professor
          ○ Linda Hildegard Bergersen, Professor
          ○ Michael Kjaer, Professor
          ○ Peter Magnusson, Professor
          ○ Simon Bekker-Jensen, Professor
          ○ Vilhelm A. Bohr, Professor

○ Merete Osler, Professor
○ Peter Magnusson, Professor
○ Poul Jennum, Professor
● Rudi Westendorp, Professor
○ Åse Marie Hansen, Professor
○ Charlotte Juul Nilsson, Associate professor
○ Clara Prats, Associate professor
○ Ellen Garde, Associate professor
○ Kisten Nabe-Nielsen, Associate professor
○ Rikke Lund, Associate professor
○ Steen Larsen, Associate professor
○ Trine Flensborg-Madsen, Associate professor
○ Ulla Christensen, Associate professor
○ Helle Bruunsgaard, Senior researcher
○ Egill Rostrup, Chief physician
○ Maarten Pieter Rozing, Assistant professor
○ Birgitte Fagerlund, Consultant
○ Krisztina Benedek, Consultant
○ Niklas Rye Jørgensen, Consultant
Abigail Mackey-Sennels, Associate professor
Andres Lopez-Contreras, Associate professor
Christopher Tiedje, Associate professor
Claus Desler, Associate professor
Hocine Mankouri, Associate professor
Javier Peña Diaz, Associate professor
Katja Heinemeier, Associate professor
Lars Holm, Associate Professor
Mansour Akbari, Research associate professor
Jesper Løvind Andersen, Senior researcher
Peter Schjerling, Senior researcher
Anna Bizard, Assistant professor
Kata Sarlos, Assistant professor
Mani Paramasivam, Assistant professor
Mauro Sbroggio, Assistant professor
Morten Scheibye-Knudsen, Assistant professor

Post docs
Theme I
Andreas Rudkjøbing
Aske Juul Lassen
Christian Elling Scheele
Henrik Hvenegaard Mikkelsen
Kamilla Nørtoft
Marie Ertner
Mikka Nielsen
Nete Schwennesen

Theme II
Cathrine Lawaetz Wimmelmann
Christian Couppe
Gunhild Tidemann Christensen
Iris Wiegand
Jolene Lee Masters Pedersen
Lene Rask
Margit Kriegsbaum
Markus Waser
Michael Simon Nixon
Søren Reitelseder

Theme III
Attila Balint
Chloé Yeung
Costanza Montagna
Daniela Bakula
Guido Keijserz
Jakob Aggergaard
Jin Zheng
Jon Durhuus
Julie Courraud
Manika Singh
Maxim Tollenære
Melanie Blasius
Monika Bayer
Özgun Ozer
Rahul Bhowmick
Rene B Svensson
Roshan Singh

PhD students
Theme I
Anders Møller
Amy Clotworthy
Anne Sophie Bech Mikkelsen
Malene Bødker
Nanna Hilm
Sofie Rosenlund Lau

Theme II
Andreas Ziegler
Anja Birk Kuhlman
Ann-Sofie Andersen
Anna Horwitz
Annesofie Thorup Olesen
Antonius Giannipoulis
Christian Eriksen
Dinne Skjærlund Christensen
Else Foverskov
Emilie Just-Østergaard
Gitte Lindeved Petersen
Kazi Ishtiaq Ahmed
Kiyana Zarnani
Marie Grønkjær Pedersen
Nayome Rey Calvo
Nelly Richard
Sasmita Kusumastuti
Stine Dam Søndergård
○ Stine Harrsen Bachkati
○ Thomas Morville
○ Tine Lovsø Dohlmann

Theme III  ○ Aiste Aleliunaite
○ Adam Jørgensen
○ Anders Karlsen
○ André Brannvoll
○ André Venegas
○ Ann-Sofie Andersen
○ Ann-Sofie Olesen
○ Anna Constanze Vind
○ Anne Theil Gylling
○ Antonis Giannipoulis
○ Cecilie Jæger Leidesdorff
○ Daniela Alosi
○ David Pladevall
○ Despoina Sakellariou
○ Ditte Søgaard
○ Divya Achuthankutty
○ Eliene Albers
○ Jane Hübertz Frederiksen
○ Karina Fabricius Husted
○ Kayya Achanta
○ Lorenza Garribba
○ Maxim Tollenaere
○ Mette Flindt Heisterberg
○ Michael Petr
○ Nikolaj Mølkjær Clausen
○ Paull Calderon Cifuentes
○ Peng Song
○ Peter Tran
○ Rasmus Bechshøft
○ Sharath Anugula
○ Shunlei Duan
○ Thomas Lau Hansen
○ Wei Wu
○ Zhiquan Li

○ Nanna Hauge Kristensen
○ Simon Meggers Matthiasen

Theme II  ○ Andrea Krause
○ Kenneth Mertz
○ Magnus Asping

Theme III  ○ Balázs Vári
○ Cathrine Nordgaard
○ Goda Snieckute
○ Kenneth Mertz
○ Niklas Warming
○ Signe W. Jørgensen
○ Sune Dandanell Jørgensen

Guest researchers
Theme I  ○ Tiago Moreira, Doctor

Theme II  ○ Alan Gow, Associate professor
○ Victor Illera Domoinguez, Visit. PhD student

Theme III  ○ Despoina Sakellariou
○ Elif Dik, Erasmus student
○ Karsten Scheibye-Alsing

Bachelor/Master students
Theme I  ○ Josefine Laura Loop
○ Julie Rosenkvist Nissen
○ Maria Mickiewicz Larsen

Theme II  ○ Anna van Halling Laier
○ Camilla Vestergaard Hansen
○ Cathrine Heikamp Lissau
○ Christina Jensen
○ Eva Gjerlevsen Nielsen
○ Inês Duran Rodrigues
○ Jonas Jørgensen
○ Karoline Maise Chrøis
○ Maria Dahl
○ Maria Özden
○ Marie Louise Bergmann

Theme III  ○ Andreas Blaaholm Nielsen
○ Frederikke Hall
Pregraduate research students
Theme II
- Amalie Kimmø Børresen
- Anne Sophie Heinrichsen
- Bo Hornshøj Kelly
- Frederikke F. H. Nielsen
- Ida Cintin de Aguiar
- Linea Gerdes
- Lise Bluhme Mikkelsen
- Maria Hansen
- Signe Regnersgaard
- Sofie Drevsholt Jørgensen

Theme III
- Stine Dahl Vest

Molecular biologists
Theme II
- Christina Neigaard Hansen
- Søren Lindemose

Lab technicians
Theme II
- Ann-Marie Sedstrøm
- Jeppe Bach
- Micael Lønstrup
- Regitze Kraunsøe

Theme III
- Anja Sisko Jokipi-Utzon
- Anne Marie Bundgaard
- Camilla Brink Sørensen
- Frederick Luk
- Joan Hansen
- Kenneth Jakobsen
- Malgorzata Clausen
- Theresa Wass
- Thomas Beck

Secretaries
Theme II
- Eva Jepsen
- Jacqueline van Hall
- Susanne Birk Rasmussen

Theme III
- Elin Erichsen
- Else Pedersen
- Maria Bækgaard Kjær

Other key persons
Theme I
- Janne Sørensen, Project coordinator
- Mads Torbenfeldt Christoffersen, Research support officer

Theme II
- Drude Molbo, Database manager

Theme III
- Marie Reinert, Student assistant

Communication and outreach platform
- Anne Bernth Jensen, Event curator (maternity leave from June 1st 2017)
- Annika Holme, Social media curator (until April 30th 2017)
- Bente Vinge Pedersen, Deputy
- Gitte Insellmann Frandsen, Communication and press officer
- Ken Arnold, Director
- Louise Vesth Alsing, Event curator (maternity cover from May 15th 2017)
- Mark Justesen Pedersen, Communication consultant
- Signe Flyvbjerg Nielsen, Event coordinator

CEHA administration
- Hanne Lærke Kracht, Secretary
- Line Damberg, Academic office (until August 1st 2017)
- Nynne Agergaard Reecmann, Academic officer (from October 5th 2017)
- Pia Nygaard, Academic officer (from September 15th 2017)
- Tina Gottlieb, Head of administration
Internationalization and networking
Internationalization and networking

IARU – International research cooperation
One of CEHA’s important international platforms is the prestigious International Alliance of Research Universities (IARU), an alliance that includes the University of Copenhagen. The association between CEHA and IARU is a cornerstone in the efforts to internationalize CEHA and a very valuable networking opportunity for members of CEHA, who arrange meetings and workshops and utilize IARU as a mechanism for enhancing collaboration and future research activities, mainly through the IARU Aging, Longevity and Health (ALH) initiative. The other IARU members are Yale University, University of California at Berkeley, Swiss Federal Institute of Technology in Zurich (ETH), University of Cambridge, University of Oxford, National University of Singapore, Australian National University, Peking University, University of Tokyo and the University of Cape Town.

Since 2014, the ALH initiative has been led by a Steering Committee. The aim is to increase engagement across IARU campuses and to promote joint activities and funding opportunities for IARU ALH participants. The Committee intends to meet once per year and is chaired by Tokyo University until mid 2018. The Committee members in 2017 were:

- Professor Lene Juel Rasmussen, University of Copenhagen
- Professor Kaarin Anstey, Australian National University
- Professor Ho Teck Hua, National University of Singapore
- Professor Xiaoying Zheng, Peking University
- Professor Junichiro Okata, The University of Tokyo (represented by Professor Hiroko Akiyama) (Chair)
- Dr. Louise Lafortune, University of Cambridge
- Professor Sarah Harper, University of Oxford
- Professor William Satariano, University of California, Berkeley

IARU: Scientific ALH conference
On 26-28 September, University of Oxford hosted the 4th ALH Graduate Student Conference (GSC), Emerging Researchers Conference: Demography, Ageing and Health. The conference provided an opportunity for graduate students and postdoctoral researchers from IARU universities and beyond to network and present research to an international research community within the ALH area. It provided an opportunity to disseminate among a growing international research community drawn from Europe, Africa, Asia, North America and Australia. The Conference was a joint conference on the twentieth anniversary of the establishment of the Oxford Institute of Population Ageing. The conference programme combined international keynote speakers with themed sessions, paper presentations, multi-disciplinary group work and poster presentations.
Paper presentation sessions were held under the headlines:

- Biology of aging and cognition and the brain
- Work and retirement
- Health and care
- Experiences of aging
- Family and intergenerational relationships
- Cross perspectives on aging

A paper from the conference is in preparation.

Six multi-disciplinary PhD student working groups were formed. Their tasks were to design cases and possible research questions/solutions to a number pre-defined societal challenges within the aging society. At the end of the conference, the working groups presented the outcome in a plenary session.

Conference participants came from University of Oxford, Australian National University, University of Tokyo, Peking University, University of Cambridge, University of Cape Town, and University of Copenhagen. The conference webpage is available at http://www.ageing.ox.ac.uk/events/view/321

**IARU ALH Steering Committee Meeting**

In conjunction with the IARU conference in Oxford, the 4th ALH Steering Committee Meeting was held in on the 28th September, 2017. The ALH Steering Committee elected the University of Oxford to act as Committee Chair for the next period (mid 2018-mid 2020), and Cambridge will consider taking on the role of Committee Chair from 2020-2022. In order to expand the network, the Committee decided to approach IARU universities not currently represented on the Steering Committee. The Committee intends to explore the possibility of holding the 2018 Graduate Student Conference and a research event in Singapore.

Detailed information on IARU ALH can be found at: www.iaruni.org/research-initiatives/aging.

**IARU – CEHA summer course**

CEHA hosted the 7th annual summer course on Interdisciplinary Aspects of Healthy Aging from 3 – 21 July 2017 at the University of Copenhagen. The summer course gives students the opportunity to learn and use research methods from other disciplines, and to develop new projects with guidance from summer course teachers. For instance, summer course students draft a grant application as their examination paper. This requires use of and or consideration of interdisciplinary methods relevant to aging research and provides hands-on experience in pursuing aging research as an integral part of the working/learning process during the summer course.

During the last years, experienced CEHA researchers have developed, participated in and improved the summer course. This year, CEHA Postdoc Jolene Lee Masters Pedersen and Assistant Professor Maarten Pieter Rozing (both Theme II) implemented the course programme, mainly with lecturers from CEHA, but also Profes-
EIT Health

In 2014, the European Institute of Innovation and Technology (EIT) launched a call for Knowledge and Innovation Communities (KICs), as part of the larger European Union (EU) initiative, Horizon 2020. The aim of KICs is to encourage stakeholders in education, technology, research, business, and entrepreneurship to establish excellence-driven partnerships and provide innovative solutions to tackle the grand challenges (health, climate, bio economy, etc.) facing the EU. The winning consortium – the EIT Health – today consists of more than 50 core partners (and their 90 associate organizations), including leading businesses, public partners, research centers, and universities from nine EU countries (including University of Copenhagen).

The goal of EIT Health is to promote entrepreneurship and develop innovations in healthy living and active aging, providing Europe with new opportunities and resources to improve quality of life and healthcare. This will be achieved by delivering products, services, and concepts designed to improve quality of life and contribute to the sustainability of healthcare across the EU. EIT health evolves around three programmes to support new ideas: 1) Accelerator for business development, 2) Campus for education activities and 3) Innovation Projects.

During the first three years of EIT Health, CEHA has been involved in several activities in the Campus Programme.

EIT Health Summer Course

Since 2016, CEHA has offered the summer course Innovating Solutions for Aging Population. The aim of the course is to contribute to the education of professional health innovators and entrepreneurs at an international level. Developing this course was CEHA’s first activity within the EIT Health. The course is developed together with the Copenhagen Business School (CBS), the pharmaceutical company Novo Nordisk A/S, and the innovation and entrepreneurship hub SUND Vækst – the latter a collaboration between CopenRehab/Faculty of Health and Medical Sciences and the Municipality of Copenhagen. In 2017, the course gathered 19 Danish and international students, including students from the EIT Health and the IARU partner universities.

The course focus on developing innovation for economic sustainability. It consist of two parts: a series of online lectures on the Coursera platform (1449 learners from June 2016-December 2017) followed by a 2-weeks on-campus course at the University of Copenhagen in August 2017. Professor Rudi Westendorp from CEHA coordinated the course together with Professor Finn Valentin and Lecturer Palle Høy Jakobsen from CBS, and all three taught and supervised the online and on-campus part. Among the presenters were researchers from CEHA and academics from Erasmus University Rotterdam, Copenhagen Business School, Novo Nordisk, Steno Diabetes Center and the Danish company DigiRehab, as well as from the Department of Public Health and the Faculty of Science at the University of Copenhagen. In December 2017, the online course was updated with the title Business Models for Innovative Care for Older People – and course content was reorganized and learning objectives added to improve students learning outcomes.
BRIDGE: – Bridging innovation, didactics, faculty, students and enterprise

In 2017, the CEHA’s EIT Health Summer Course was part of the BRIDGE initiative. BRIDGE is a shared EIT campus initiative involving Copenhagen University, Copenhagen Business School, Uppsala University, Erasmus University Rotterdam, Management Centre Innsbruck and public and private partners. The diverse partners have expertise in health, economics, policy and innovation.

The aim of BRIDGE is to share and implement best pedagogic and digital-didactic practices, organize a sustainable network for faculty exchange on pedagogics and handling interdisciplinary groups, as well as establishing connections to local academic education offerings on health and innovation. Each campus (Copenhagen, Gotland and Rotterdam) hosted a summer school, with 52 participants in total. Best practice from the summer schools and experiences from the BRIDGE collaboration will be deployed to teachers through the Teachers Training programme (TTP). A TTP workshop took place in the fall of 2017 aiming at encouraging novel pedagogic approaches and integration of innovation and entrepreneurship in teaching.

EIT Campus projects: Healthy environments and citizen-involvement

Professor Rudi Westendorp was partner in the development of the joint MOOC Healthy Ageing in 6 Steps: Let your environment do the work in collaboration with Leyden Academy on Vitality and Ageing and Delft University of Technology. This MOOC focuses on how to make choices and adjustments to lifestyle and environment that promote healthier, happier and longer lives. With more than 8,500 participants from 140 countries enrolled in 2017, the MOOC is considered very successful.

In addition, Rudi Westendorp has been involved in the campus project Towards citizen-centered active ageing and well-being (CCenter) coordinated by the University of Barcelona and in collaboration with Newcastle University and Leyden University. This project aims at increasing awareness among older people of their rights as citizens. The course offers innovative ways of training professionals from an interdisciplinary perspective, focusing on health, autonomy, personal care, ethics and law – to avoid the risks of exclusion and discrimination of the aging population. The consortium plans to continue the development of training activities in an EIT context in 2018-2019 with an increased focus on health care- and citizen perspectives.

Other international networking

ABRAHAM
CEHA is active in the network Alliance for Biology of Ageing Research And Healthy Ageing Multidisciplinary biobanking approaches (ABRAHAM), which was created in 2010 and includes researchers, companies, governmental institutions, and patients/citizens. ABRAHAM aims to create a transatlantic network with partners from the EU, the USA, and Canada to enhance integration in the field of biobanking and basic aging research in order to contribute to the goal set by the European Commission to add two extra healthy years to life by 2020. This collaborative effort harmonizes, standardizes and exchanges data and materials from biobank and cohort studies, facilitates shared use of infrastructures, facilities and expertise, and enables exchange visits of personnel to participating institutes exploring options for new projects and/or pilot studies.

The network builds on several existing projects, some of which involve transatlantic partnerships that focus on aging-related issues, such as genome stability and metabolism, and systems biology. The founding partners are: the University Medical Center Groningen (The Netherlands), University of Copenhagen (Denmark), University of Newcastle upon Tyne (United Kingdom), Mayo Clinic (Minnesota, USA), and McGill University (Montreal, Canada), all of which have extensive collaborations with industries in the food, pharmaceutical and medical technology sectors as well as experience in human clinical trials. Since 2013 CEHA has, together with the ABRAHAM network, co-organized the 3rd-7th Annual Alliance for Healthy Aging Conference series, the EU Marie Curie ITN MARRIAGE, as well as several EU research and infrastructure applications.
MouseAge
CEHA is also part of MouseAge – a European network (COST action) developed for preclinical testing of interventions in mouse models of age and age-related diseases. A key requisite to develop new interventions for age-related conditions and promote healthier aging is the availability and use of mouse models for preclinical research studies. There is currently a lack of such models and a need for standardized methodologies to test and evaluate interventions. Therefore, to improve the quality of European aging research, a coordinated interdisciplinary action is needed to standardize methodologies and guidelines for animal welfare, and to define endpoints. A centralized model for storing and disseminating information about these models and technologies is also needed.

This Action proposes to set-up a highly interactive and flexible European network, which will create a critical mass of cross-disciplinary scientists, clinicians and industrial partners to reach consensus on ways to test preclinical interventions in aging mice. It will consolidate current best practice across leading European institutions and researchers, maximize resource efficiency, and provide a platform to help train the next generation of scientists. More information: www.cost.eu/COST_Actions/bmbs/Actions/BM1402

An important element of the BRIDGE triplet summer schools is the final pitch-event where students present their innovation to the course organizers and invited stakeholders. Here we see Professor Rudi Westendorp together with the winning team in Copenhagen, awarded for their idea to improve the DigiRehab technology. The winning ideas are following channeled to the local EIT accelerator(s).
Educational activities
An important goal for CEHA is to educate the next generation of aging researchers. To this end, CEHA scientists make a concerted effort to provide high quality educational resources to CEHA students/trainees, and to recruit junior and senior scientists with appropriate research interests and/or expertise to the CEHA faculty. CEHA’s educational programs include undergraduate and graduate level courses on aging as well as opportunities for postdoctoral studies under the mentorship of CEHA faculty. Selected examples are described below.

**Selected PhD dissertations**
Below, examples of dissertations from the Themes are described. Complete lists of dissertations are available above (pp. 12, 20, 26).

**Empowering the elderly? A qualitative study of municipal home-health visits and everyday rehabilitation**
Amy Clotworthy, CEHA Theme I, November 2017.

Based upon 15 months of ethnographic fieldwork in a Danish municipality, this work provides an in-depth look at the real-life encounters between municipal health professionals and aging citizens in order to describe how the Danish state’s political goals and health policies influence the provision of in-home health services for the elderly. By investigating how the goal of eldercare in Denmark has shifted from providing help to enabling self-help, the dissertation describes how both health professionals and citizens navigate the political discourses that frame their relational encounter. The analysis elucidates how home-health visits and ‘everyday rehabilitation’ programmes can be understood as social, material, and cultural interactions that are more than simply sites of health promotion, or the dissemination of political rhetoric. Amy Clotworthy suggests that a more caring response to neoliberal conceptualisations about individualism and self-responsibility may produce an alternative form of empowerment; a form of collaboration and connectivity that could have a positive effect on both citizens and health professionals – and ultimately, perhaps, Danish society.

**Late Midlife Sleep and Circadian Pattern: Associations with trajectories of cognitive development in adulthood**

In this thesis, the relationship between sleep and cognitive aging were examined in either cognitively improved (n = 97) or impaired (n=92) men based on comparison of cognition in young adulthood and late midlife. Evidence of lower self-rated sleep quality and altered circadian rhythm with earlier timing of the nocturnal melatonin peak was observed in the group with cognitive decline. Moreover, there was a trend towards lower sleep ef-
iciency and more wake up after sleep onset in cognitively impaired men, and some correlations between subjective and objective measures of sleep and cognitive test performance in the combined sample. Neither sleep structure, nor subjective levels of daytime sleepiness, sleep latency, or levels of melatonin and cortisol differed between (otherwise healthy) men with different cognitive trajectories in midlife. Thus, the results suggest that self-rated sleep quality and the timing of the melatonin rhythm may be early markers of cognitive decline in midlife.

Non-canonical mismatch repair as a risk factor for trinucleotide repeat expansion diseases
Sara Thornby Bak, CEHA Theme III, September 2017.

In this thesis, Dr. Bak focused on identifying factors that promote expansion of certain DNA repetitive sequences which is associated with neurological and neuromuscular disorders. The most common of these DNA repetitive sequences are trinucleotide repeats (TNRs) and their expansion is the underlying cause of diseases such as Huntington's disease, Myotonic Dystrophy and Friedrich ataxia among others. The causes and factors involved in the age-related pathological expansion of these sequences remain poorly known. Dr. Bak identified a new factor, the chromatin remodeler SMARCAD1 that regulates the stability of such sequences in conjunction with the DNA repair mechanism, Mismatch Repair (MMR). Her results suggest that the chromatin barrier and chromatin remodelers act as differential elements that influence the engagement of MMR in promutagenic TNR expansion. Her work contributed to the understanding of the mechanisms that lead to the age-related pathogenic expansion of such sequences.

PhD courses
CEHA researchers also taught or contributed to several PhD courses, for example:

- **Aging from a cross-disciplinary perspective**, organized by the Network for Young Scholars, Course leader Assoc. Professor Claus Desler (Theme III), lectures delivered by senior and junior researchers from all CEHA themes (Themes I-III).
- **Matrix Biology – Physiology and function of extracellular matrix**, organized by Assoc. Professor Katja Heinemeier, Postdoc Chloé Yeung (Theme II and III), lectures i.a. delivered by Senior Researcher Peter Schjerling (Theme III).
- **Mitochondrial Physiology – From Organelle to Organism**, organized by Assoc. Professor Steen Larsen, Professor Flemming Dela, Professor Jørn Wulff Helge, Professor Lene Juel Rasmussen, Assoc. Professor Claus Desler (Theme II and III).
- **Advanced Social Epidemiology**, **Life course epidemiology in aging**, Assoc. Professor Rikke Lund (Theme II).
- **Matrix Biology – Physiology and function of extracellular matrix**, organized by Assoc. Professor Katja Heinemeier, Postdoc Chloé Yeung (Theme II and III), lectures i.a. delivered by Senior Researcher Peter Schjerling (Theme III).
- **Matrix Biology – Physiology and function of extracellular matrix**, organized by Assoc. Professor Katja Heinemeier, Postdoc Chloé Yeung (Theme II and III), lectures i.a. delivered by Senior Researcher Peter Schjerling (Theme III).
- **Advanced Social Epidemiology**, **Life course epidemiology in aging**, Assoc. Professor Rikke Lund (Theme II).

Post graduate level
Selected examples:

- **Intelligence and life years – the cross field between different research areas and institutions**, Presentation at conference on aging (Dansk Gerontologisk Selskabs Nationale Konference 2016), Postdoc Gunhild Tideman Christensen (Theme II).
- **LIFESTAT – living with statins**, published popular science newspaper, distributed to 3000 general practices in Denmark, Professor Flemming Dela et al. (Theme II).
- **LIFESTAT** Final Symposium, Professor Flemming Dela et al. (Theme II).
- **The aging patient**, Assoc. Professor Ellen Garde (Theme II).
- **Alcohol and the development of the intellectual functions**, Presentation at conference (Den Nationale Alkoholkonference 2017), PhD Student Marie Grønkjær Pedersen, Professor Erik Lykke Mortensen (Theme II).
- **Physical activity and musculo-tendinous connective functions**, Presentation at conference (Den Nationale Alkoholkonference 2017), PhD Student Marie Grønkjær Pedersen, Professor Erik Lykke Mortensen (Theme II).
tissue, lecture at Mt Sinai Medical School, Icahn, New York, Professor Michael Kjaer (Theme III).

- *Exercise in a rheumatological perspective*, Course part 3, Residents in training for Rheumatology, Professor Michael Kjaer (Theme III).
- *Effect of exercise on the tendon and muscle connective tissue*, Course for specialists in Rheumatology, Danish Society for Rheumatology, Professor Michael Kjaer (Theme III).

**Master level**

Selected examples:

- *Ethnicity, migration and aging*, Elective course in Gerontology, Public Health, UCPH, Assoc. Professor Maria Kristiansen (Theme I).
- *Complex interventions*, Elective course in Intervention and Evaluation, Public Health, UCPH, Assoc. Professor Maria Kristiansen (Theme I).
- *Life course and the entanglement of life, death and aging*, Anthropology of Health, Course manager, coordinator and lecturer Postdoc Nete Schwennesen (Theme I).
- *Introduction to Health Care Systems*, Innovation in Health Care, Course coordinator and primary lecturer Professor Karsten Vrangbæk (Theme I).
- *Advanced Health Promotion and Disease Prevention in Old Age*, Public Health, UCPH, PhD Student Sasmita Kusumastuti (Theme II).
- *Gerontology – about the complex issues in dealing with older patients*, Elective course for MSc Medicine, UPCH, Course leader and lecturer Assoc. Professor Charlotte Juul Nilsson (Theme II).
- *Life Course Influences on Health and Aging. Epidemiology and Theory*, MSc Public Health, UCPH, Course leader Postdoc Jolene Lee Masters Pedersen (Theme II).
- *Aging human skeletal muscle: changes at the cellular level and implications for functional adaptation to exercise training*, Lecture at course in Nutrition and Physical Activity for the Improvement of Health in the Aged, MSc in Human Nutrition, UPCH, Assoc. Professor Abigail Mackey Sennels (Theme III).
- *Activation and role of satellite cells with strength training and in muscle regeneration*, Lecture at course in Physiological Adaptations to Strength Training, MSc in Human Physiology, UCPH, Assoc. Professor Abigail Mackey Sennels (Theme III).
- *Muscular adaptations to strength training: Changes in muscle size, fiber area and fibertype distribution (MHC expression)*, MSc Course Physiological Adaptations to Strength Training, Department of Biology, UCPH, Senior Researcher Jesper Løvind Andersen (Theme III).
- *Course in Ethical Dilemmas in Medicine – Role of Film and Literature*, Department of Clinical Medicine, UCPH, Organizer Professor Michael Kjaer (Theme III).

**Pre graduate level**

Selected examples:

- *Cultural analysis*, BA course, Ethnology, Assoc. Professor Astrid Pernille Jespersen, Postdoc Aske Juul Lassen (Theme I).
- *Ethnological Methods A*, Postdoc Kamilla Nørtoft (Theme I).
- *Psychology and Health Communication*, BSc Public Health Science, UCPH, Course leader Assoc. Professor Trine Flensborg-Madsen (Theme II).
- *Pre graduate course in Gerontology*, Medicine, Associate professor Ellen Garde (Theme II).
- *Medical Psychology*, BSc Medicine and Psychology and Health Communication, BSc Public Health, UCPH, Professor Erik Lykke Mortensen (Theme II).
- *Gerontology – health and everyday life in old age*, Elective course for BSc and MSc in Public Health Science, UCPH, Course leader Assoc. Professor Charlotte Juul Nilsson (Theme II).
- *Social medicine and rehabilitation*, BSc Public Health Science, UCPH, Course leader Assoc. Professor Charlotte Juul Nilsson, Assoc. Professor Ulla Christensen (Theme II).
- *Training, disease progression and chronic illness*, Lectures, Cand Scient San, UCPH, Professor Michael Kjaer (Theme III).
- *Exercise physiology*, Lectures, Medicine, UCPH, Professor Michael Kjaer (Theme III)
- *Genetic Medicine by Anna Vind and Cathrine Nord-
gaard, 20 hours teaching, Professor Simon Bekker-Jensen (Theme III).

- *Medical anatomy and embryology*, Department of Cellular and Molecular Medicine, UCPH, Assist. Professor Morten Scheibye-Knudsen (Theme III).

CEHA researchers also supervise bachelor and master level students who are affiliated with various departments at the University of Copenhagen.

**Other dissemination activities**

Selected activities outside the university, such as lectures and presentations at public and private hospitals, societies, associations, organizations, general public, etc. are:

- *Health and quality of life: Key challenges and preliminary recommendations*, Presentation at the PFA conference regarding the recommendations from the think tank The New 3rd Age, Postdoc Aske Juul Lassen (Theme I).

- 8 presentations at the Peoples Political Festival, Bornholm, Postdoc Aske Juul Lassen, Professor Karsten Vrangbæk (Theme I).

- *Præstø Multicenter: One center, many users*, Presentation at Præstø Multicenter for employees and center administration, Research Assistant Anja Steinmejer (Theme I).

- *From knowledge to practice: Invention studies – What is it and what can they be used for?* Seminar for collaborating municipalities, Senior and Junior Researchers from Theme I.

- *Fractures and interaction at the welfare of senior citizens*, Rapport and workshop at Ishøj Municipality in collaboration with CoRe, Research assistant Cammilla Bundgaard Toft, Postdoc Aske Juul Lassen, Assoc. Professor Astrid Pernille Jespersen (Theme I).

- *Growing older without feeling old*, Presentations at compulsory continuous education for general practitioners in Central Denmark Region, Professor Rudi Westendorp, Assist. Professor Maarten Rozing (Theme II).

- Lundbeck Foundation Lecture in Aarhus and Copenhagen, Assoc. Professor Ellen Garde (Theme II).

- Active Senior Brain Health program at Helsingør Municipality, Assoc. Professor Ellen Garde (Theme II).

- 10 year Anniversary Crown Princess Patron for “HjerneSagen”, Assoc. Professor Ellen Garde (Theme II).

- *Physical activity and aging*, Lecture at “Herreklubben” for 150 males (60+) in Helsingør, Professor Michael Kjaer (Theme III).

- Presentation at conference Seniors and medicine in Copenhagen, The Danish Health Authority, Professor Rudi Westendorp (Theme II).

- The smallest components of the body and aging, Presentation at Folkeuniversitetet, Assoc. Professor Claus Desler, Professor Lene Juel Rasmussen (Theme III).

- Molecular models of aging, SOSU C, Assoc. Professor Claus Desler, Professor Lene Juel Rasmussen (Theme III).

- How to prevent atrophy in aging muscles? Symposium, Center for Team Sports, UCPH, Professor Michael Kjaer (Theme III).

- The smallest components of the body and aging, Presentation at Medical Museion, Assoc. Professor Claus Desler, Professor Lene Juel Rasmussen (Theme III).
Major grant and prize in 2017
Major grant

Additional grant for citizen science oriented project in Taastrup
Assoc. Professors Rikke Lund and Maria Kristiansen from CEHA received additional funding of DKK 8.8m from Nordea-fonden for a mixed-methods longitudinal study entitled “Health, Wellbeing and Social Relations in a Changing Community”. The aim of the study is to investigate changes in well-being, health and social relationships in a larger social housing community in Høje Taastrup municipality. The community is undergoing large-scale (900 mill. DKK) changes over the coming years in both the built environment/housing, recreational areas, infrastructure and institutions. The 3-year longitudinal study spans the period before and during these structural changes to the community. In the observational parts of the study, annual surveys, social network analysis and qualitative interviews will be used to explore effects of structural changes on health, well-being and relationships from the point of view of middle-aged and older adults living in the community. Parts of the observational study will be administered in up to 10 languages. In the intervention part of the study, healthy aging interventions based on the initial need assessment and user-involvement will be developed and evaluated in close collaboration with the community and key stakeholders from the municipality, volunteer organizations.
Prize

Professor Martin Lauritzen
awarded brain research prize

In December 2016, Professor Martin Lauritzen from CEHA was awarded the Niels A. Lassen Prize for his research into the regulation of brain blood flow, molecular mechanisms contributing to migraines and studies of other acute brain diseases. His research has contributed to new understanding of the mechanisms by which the supply of glucose and oxygen in brain is regulated. The studies help explain normal brain function and normal brain aging.

The prize is granted by the Niels A. Lassen foundation, which was established in 1999 in memory of Professor Niels A. Lassen (1926-1997), who was one of the 20th century's most prominent brain and circulation researchers in Denmark.
Internal communication and selected joint activities
CEHA is a network of scientists who conduct research in seven departments at the University of Copenhagen (KU). CEHA scientists are affiliated with each of the three KU Faculties, Humanities, Social Sciences and Health and Medical Sciences, and three hospitals in the Greater Copenhagen Area (Hvidovre, Glostrup, Bispebjerg). In May 2017, most CEHA laboratories were relocated to the 2nd and 3rd floors of the newly-constructed Mærsk Building. This 15-story building with state-of-the-art facilities designed for interdisciplinary research is enhancing CEHA’s ability to conduct cutting-edge research and will renew and extend opportunities for interaction and collaborations among CEHA researchers. CEHA will continue to purse bench-to-bedside translational research as well as human-to-mechanism back-translational research. The Mærsk building will also bring greater coherence and increase citizen involvement. In the new facility, CEHA faculty and staff will also interact with non-CEHA faculty and staff who pursue research in biology, applied physiology, neuroscience, behaviour, anthropology, economics, and ethnography.

CEHA’s complex organizational structure demands high level and efficient internal communication. To this end, CEHA researchers meet frequently to discuss ongoing and proposed joint projects. Detailed descriptions of cross theme projects were described above (see pp. 29-34).

CEHA hosts frequent scientific events, including workshops, seminars, retreats and meetings that are of general interested to University of Copenhagen scientists in and outside of CEHA (see below). Joint PhD projects and cross-disciplinary PhD courses are also important contributions to CEHA research environment (details on pp. 60).

The Network for Young Scholars (NYS) is of great importance to CEHA. In NYS, young scholars are collaborating closely to share their experiences and promote their professional growth and career goals in the field of aging research in CEHA and at University of Copenhagen. From the beginning of their careers, they interact in many scientific settings and share activities with peers from other disciplines developing an open- and cross-disciplinary mind set. A selection of NYS activities is described on pp. 70-72.

These activities are supported by frequent e-mail communications and by announcements on the CEHA website.

Selected joint activities

CEHA retreats and SAB meetings
Every year, CEHA holds 1-2 retreats, during which CEHA scientists share data on ongoing projects, accomplishments, concerns and identify areas of shared interest and opportunities for collaboration.

The fall retreat usually coincides with the annual meeting of the CEHA Scientific Advisory Board (SAB; see below p. 87). The latest combined CEHA retreat and SAB meeting took place on 4-5 December, 2016. The program, which was planned by the Steering Commit-
International site visit
On the 4-6 January 2017, a six member Committee of expert scientists conducted, at the request of Nordeafonden, a comprehensive review of CEHA's activities at the mid-point of the second of two 5-year terms of support from the Foundation. The programme followed the same structure as the combined CEHA Retreat and SAB meeting of 2016 described above.

Members of the Site Visit Committee were:
• Dr. Karen Bultitude, University College London, UK
• Dr. Rachel Cooper, MRC Unit for Lifelong Health and Ageing at UCL, UK
• Professor Paul Higgs, University College London, UK
• Professor Hans Einar Krokan, Chair, Norwegian University of Science and Technology, Norway (Chair)
• Professor Janet M. Lord, University of Birmingham, UK
• Assoc. Professor Camilla Palmhej Nielsen, DEFACTUM, Aarhus University, DK

The Committee, chaired by Professor Hans Einer Krokan, submitted a very positive report on the 12th February, 2017, concluding that “CEHA is positioned very strongly towards the future as a world class, leading-edge institute for the study of human aging. Given the urgency to address many societal concerns about population aging in Denmark and worldwide, there is strong justification, and perhaps even a strong imperative, to continue to support and invest in CEHA.”

Steering Group meetings
The Steering Group represents all three CEHA Themes as well as the Communication and Outreach Platform. The Group meets regularly (approx. 8 times a year and ad hoc, if needed) in order to update each other on research activities, discuss financial issues, recruitment, strategic planning and outreach. See p. 87.

CEHA-BRIC seminars
Throughout 2017, CEHA and the Biotech Research & Innovation Centre (BRIC) held or sponsored research seminars on important topics in biological sciences. This seminar series features international speakers, who are at the forefront of their respective fields. The seminars focused on research findings and/or technologies of major significance and impact in the biological and biomedical sciences.

The CEHA-BRIC seminars included:
• Maintaining genome stability in vertebrates: lessons from a cell-free system
  Speaker: Vincenzo Constanzo, IFOM – THE FIRC Institute of Molecular Oncology, Italy.
• Novel insights into KRAS signaling provide therapeutic strategies in lung adenocarcinoma
  Speaker: David Santamaria, Institut Européen de Chimie et Biologie (IECB), France.
  Host: Andres Lopez-Contreras, CEHA. 1 December 2016.
• The impact of DNA damage and nutrition for preserving health
  Speaker: Jan Hoeijmakers, Department of Molecular Genetics, Erasmus MC, the Netherlands.
• Molecular control of mRNA metabolism in cytokine-driven inflammation
  Speaker: Michael Kracht, Rudolf-Buchheim-Institute of Pharmacology, University of Giessen, Germany.
  Host: Simon Holst Bekker-Jensen, CEHA. 8 June 2017.
• Identifying the multidimensional controllers of aging
  Speaker: Stuart Maudsley, VIB-UAntwerp Center for Molecular Neurology Gebouw V, Belgium.
  Host: Morten Scheibye-Knudsen, CEHA. 26 October 2017.

Network for Young Scholars
The Network for Young Scholars (NYS) was established in 2010 by a group of CEHA PhD students and postdocs. The vision was to build a platform for young researchers in the center to promote research training, educational activities, and social networking in an interdisciplinary...
context. Since the start, shifting steering group members have organized the activities including Academic Fridays, conferences, and PhD courses.

**NYS Steering Group 2017**
- Claus Desler, Assoc. Professor, Theme III
- Jakob Agergaard, Postdoc, Theme III
- Sasmita Kusumastuti, PhD Student, Theme II
- Nynne Reeckmann, Academic Officer, CEHA Administration

Over the years, the focus of NYS has shifted towards developing high quality interdisciplinary PhD courses in the field of aging. In 2015, the NYS Steering Group decided to focus on developing PhD courses, based on the recommendation of CEHA management. Since then, the courses have been given with the approval of – and financed by – the Graduate School of Health and Medical Sciences at the Faculty of Health and Medical Sciences. The courses primarily target CEHA PhD students, but are also open to all students at the University of Copenhagen and to students from other universities in Denmark and other countries.

In 2017, the NYS Steering Group organized a three-day PhD Course *Aging from a Cross Disciplinary Perspective*, with introductory lectures on aging presented by CEHA researchers in the fields of biology, physiology, medicine, social sciences, and humanities. Fifteen students with background in molecular biology, public health, and humanities attended the course.

**NYS and PAIAR**

At the CEHA site visit in January 2017, the Committee was “impressed by the Network of Young Scholars (NYS) and their initiative, originality, and commitment to the field of aging. The SVC [the panel] commends CEHA for supporting NYS”. As a result of the positive feedback, the CEHA management and the NYS Steering Group decided to form an autonomous entity concentrating solely on the continuing development of high standard
international interdisciplinary aging PhD courses, while at the same time reintroduce an increased focus on research training and social networking to be offered to PhD students and postdocs. To avoid confusion, it was decided that the entity focused on PhD courses would be renamed PhD Academy for Interdisciplinary Aging Research (PAIAR), while the entity focusing on an interdisciplinary network for CEHA PhD and Postdoc retains the name Network of Young Scholars (NYS).

PAIAR will be managed by Claus Desler, Sasmita Kusumastuti, Jakob Agergaard and Nynne Reeckmann, with a continued aim to establish a catalogue of self-sustainable, high quality, and internationally recognized PhD courses within the field of aging and interdisciplinarity. While, in the effort to reintroduce NYS, Professor Tom Kirkwood has agreed to supervise and advise the young researchers on how to develop the network further.

In November 2017, Professor Kirkwood facilitated a workshop for PhD students and postdocs to explore and discuss the potentials in an interdisciplinary network for young researchers. Output from the workshop will form the starting point for establishing a NYS steering group and activities in 2018.
Selected communication and outreach activities
CEHA’s communication platform takes a strategic approach to communicating with the general public and stakeholders with an influence on how in future the population can live healthily in old age. Nationally, but also globally, the political focus is on ensuring that more people can stay active in old age with a high level of vitality and quality of life. This is why CEHA’s communication focuses on healthy living and old age in future. Our aim is for knowledge about healthy aging to remain on the agenda and for the Center’s research to form the basis for research-based recommendations to the authorities and decision-makers.

Greater stakeholder involvement and commitment
In order to increase the focus on CEHA’s value-adding processes in society and to get feedback from stakeholders and citizens, Ulla Wewer, Dean of the Faculty of Health and Medical Sciences, invited director-level key stakeholders from elderly organisations, patient associations and professional organisations to round table discussions. Furthermore, we are developing a budding communication partnership with DaneAge, PKA and the Faculty of Health and Medical Sciences (SUND). CEHA is also a participant as a communication and knowledge partner in Keep Your Brain Healthy a two-year activity and communication project.

Communication partnership with DaneAge, PKA and SUND
Target group: Heads of communication in selected organisations.
Objective: To communicate learning and to challenge prejudices in an aging society.

CEHA and SUND wish to develop collaborations with selected stakeholders. We have established a trust-based communication partnership in which the partners jointly develop objectives, ideas and joint documentation to focus on opportunities and challenges in an aging population. The aim is for the partnership to jointly communicate knowledge, challenge prejudices and strengthen a shared commitment and responsibility for playing an active role in future changes in society. During 2017, two communication activities took place within the framework of the partnership.

Joint video campaign on Facebook leading up to the People’s Political Festival
Target group: Organisations’ Facebook followers.
Objective: To draw attention to different aspects of being a senior, and to challenge habitual thinking and prejudices about what life’s third age can include.

The Working Life’s Third Half campaign was intended to set the scene and introduce the agenda for the parties’ respective Facebook channels before holding a joint
Joint event at the People’s Political Festival
Target group: Stakeholders.
Objective: To provide new perspectives on contentment, dreams and opportunities after the official retirement age.

The joint event with DaneAge and PKA “Third age – what do seniors dream about?” used inspirational seniors to give examples of how people can take an active approach to life’s third age. Four seniors gave their views on what seniors dream about, how they keep their dreams alive and what individuals can do. Hosted by Sebastian Dorset, a well-known Danish stand-up comic, there was the opportunity to meet the researchers and stakeholders who all had stands.

People’s Political Festival 2017
Target group: Stakeholders (secondarily citizens).
Objective: To strengthen relations with stakeholders by co-producing and running events to boost involvement and generate debate.

The Center for Healthy Aging participated for the third time in the People’s Political Festival. This year we worked closely with two of our stakeholders in a communication partnership (see above for more details). We also hosted five other events. The format required intense dialogue between researchers and stakeholders before the Festival. Senior executives at the following stakeholders took part: Danish Regions, Danish Health Authority, [1]Heart Foundation, Danish Cancer Society, Danish National Council for Volunteering and Danish Seniors. The general public were involved in several of the Center’s events by way of direct debate in small groups with researchers and invited stakeholders. Researchers, stakeholders and participants were all highly enthusiastic about this event format since it provided the involvement in dialogue and debate with participants that we wished for. Researchers also participated in nine events in other pavilions, including the Danish Health Authority and Danish Seniors.

At the Festival, communications officers tweeted from events and posted on Instagram and Facebook. After the festival, the Third Half of Working Life video campaign was followed up with photos and texts on inspirational seniors on Facebook and Instagram.

Participation in PFA Pension’s aging game
Target group: PFA and their members.
Objective: To strengthen relations with PFA Pension and communicate knowledge about seniors.

The Center for Healthy Aging and Medical Museion took part in PFA Pension’s first Seniors Day, an event for more than 800 senior members of PFA Pension. The center of the activity was the game Life on the Line from the Medical Museion’s Aging Room. Visitors passed by all day long and played with and against each other on health and longevity, whilst also learning something new about research into aging healthily and about the Center for Healthy Aging.

Researchers as experts in the media and with other stakeholders
More and more of the Center’s researchers are being used as experts by stakeholders and in the media. For example, postdoc Aske Juul Lassen, Theme I, participated in 2017 in the Third Age Think-tank set up by PFA Pension. As part of the appointment of Denmark’s first Minister for the Elderly, he was interviewed as an expert on a radio programme and also took part in the live TV debate on national TV during the local government election campaign in the autumn of 2017.

Communication input for LIFESTAT and CALM programmes
Two major interdisciplinary programmes (see also pp. 30-32) – LIFESTAT (analysing the effect of statins – cholesterol-reducing medicine) and CALM (investigating whether the loss of muscle mass and muscle function can be countered by a high protein diet and physical exercise) have funding from the University of Copenha-
gen’s star programme for interdisciplinary research. Both were completed in 2017 and led to an extra focus on communicating their results.

**LIFESTAT: Newspaper and column in Municipal Healthcare**  
*Target group:* General practitioners and other healthcare professionals.  
*Objective:* To communicate the results of the project.

LIFESTAT – headed up by Professor Flemming Dela (Theme II). Learning from the project has been shared with general practitioners and their patients, also in a newspaper with 14 articles distributed to all GPs in the country by year-end 2017. One of the articles in the paper was also rewritten as a column in Dagens Medicin’s newsletter – Municipal Healthcare.

**CALM: White paper, Peoples’ Political Festival, column in Municipal Healthcare**  
*Target group:* Local government administrative personnel.  
*Objective:* To communicate the results of the project.

The CALM project co-headed by Assoc. Professor Astrid Pernille Jespersen and with participation of among others Postdoc Aske Juul Lassen, both Theme I. The results and recommendations of the project were communicated in a white paper to municipal administration personnel. Aske Juul Lassen presented the recommendations of the project at the People’s Political Festival 2017 with one of Theme I’s important municipal alliance partners – Per Tostenæs, Head of the Healthcare and Elderly Center, Ishøj Municipality. Some of the project’s conclusions were also communicated in a column in Dagens Medicin’s Municipal Healthcare newsletter.
Greater interaction with citizens
CEHA’s communication platform takes a strategic approach to communicating knowledge of healthy aging to the general public. In order to reach the target groups, research is communicated on many platforms and using different formats. Seniors’ perspectives and views on aging are routinely involved either directly or via senior organizations. Below are just a few of the many events and arrangements with which the Center for Healthy Aging has been involved. An overview is provided at pp. 82-83.

Keep Your Brain Healthy
Target group: Seniors aged 55-70 (secondarily, project stakeholders).
Objective: To make seniors aware of CEHA’s know-how.

CEHA is involved as the science and communication partner in implementing the Keep Your Brain Healthy project which is a collaboration between DGI (Danish Gymnastics and Sports Associations), the Agency for Culture and Places and CEHA. We use activities in reaching out to citizens around the country to learn about the brain. For example, Assoc. Professor Ellen Garde (Theme II) gives lectures nationwide and to date, seven libraries have run very varied activities and DGI had provided SMART Training to seven groups. In Keep your brain healthy, citizens are motivated to act for themselves and also given tools by way of knowledge and specific activities. In addition to the activities, the project ran an initial, very well-attended workshop for selected stakeholders and developed a visual design, launched a website www.holdhjernenfrisk.dk and produced the first of a series of videos.
Culture Night at SUND – Medical Museion and Mærsk Tower

Target group: Citizens

Objective: To communicate research and develop event formats

At the annual Culture Night in Copenhagen, the Center attended the joint Culture Night event at the new Mærsk Tower that houses the Faculty of Health and Medical Sciences (SUND) and the Medical Museion.

More than 7000 people visited the Mærsk Tower and the three different experiences provided by the Center for Healthy Aging. 1) A “Test Yourself” stand with a sit-up/down test and a grip strength test. More than 300 people, young and old, children and adults took up the challenge during the evening. 2) Two guided tours of the Mærsk Tower visited the molecular biology lab while communicating research into healthy aging in general and especially research at the cellular level led by Assoc. Professor Claus Desler Madsen, Theme III. A total of 40 individuals took part in the two guided tours which was the maximum number. 3) A display stand of The Brain When We Get Old was on loan from the Medical Museion, where Culture Night visitors could read more about brain research over the years and lift the lid of a Lego brain.

The Medical Museion received a total of 2063 Culture Night visitors. The focus that was on connections between the brain and gut and the countless bacteria living in and on us. A new display, Mind the Gut, gave visitors insights into their own complex bodies. Assist. Professor Morten Scheibye-Knudsen, Theme III, reported on how a high-fat diet could possibly reduce the symptoms of early aging.
Kintsugi Exhibition at the Medical Museion

Target group: Museum visitors.

Objective: To communicate an alternative view of aging.

In the Aging Room at the Medical Museion, CEHA museum staff have developed a new exhibition, *KINTSUGI – Golden body repairs* in collaboration with Professor Rudi Westendorp, Theme II. The exhibition investigates how medical science and technology endeavour to repair the fragile body. Living our lives gives us scratches. Sometimes small cuts, other times larger wounds and fractures. We can be patched up and go on living and the repairs bear witness to the lives we have lived. The inspiration comes from the Japanese Kintsugi tradition, in which scratched and fragmented ceramics are repaired with visible lacquer and gold dust. The new exhibition investigates whether Kintsugi could be a metaphor for the repairs our bodies undergo throughout life.

The exhibition has formed the framework for diverse activities. One activity was developed for children aged 4-10: *Toy Kintsugi – New life for broken toys*. Children and their parents or grandparents were invited to a repair shop where there was equipment to make beautiful and different repairs to toys that had been brought in.

CEHA’s communication as “best practice”

CEHA has set new standards for how a research center can work to communicate research and on lobbying, for example by way of audience-involving campaigns on the social media and by participation in the People’s Political Festival. The Center is used internally by the University of Copenhagen as ‘best practice’. For example, Pro-Rector Lykke Friis emphasized the work of the Center in her annual speech to all communication staff at the university.

The way the Center works with stakeholders was also used at an inspiration workshop at an internal seminar for University of Copenhagen communication personnel. One of the Center’s event formats was presented at the same seminar. The University of Copenhagen had its own pavilion at the People’s Meeting for the first time.
in 2017. This decision was inspired by the major efforts made by the Center for Healthy Aging and SUND at the People’s Festival 2016.

The staff of the Medical Museion have also described their work on display texts for the KINTSUGI Exhibition – ‘Golden body repairs’ in an article in MiD magazine for museum communicators in Denmark. This was about the process involved in display texts, and how this can inspire other museums.

An overview of 2017 events is available on the following pages.
2017

CEHA’s Event wheel
– an overview

- Exhibition
- Lecture
- Activity
- Keep Your Brain Healthy
- Meeting
- Lecture series

- Two presentations for stakeholders, Rødovre & København – March
- Two presentations at stakeholder events, København & Aalborg – April
- Lecture aimed at a patient organization, København – April
- Kintsugi repair shop at Designmuseum Denmark – May
- Test of Kintsugi kids’ activities, Medical Museion – April
- Evening consultation, Medical Museion – March
- Lecture for health professionals, København – March
- Three citizen directed lectures, Medical Museion – March
- Test of pilot project on volunteering, Medical Museion – May
- Test of Kintsugi kids’ activities, Medical Museion – April
- Evening consultation, Medical Museion – March
- Lecture series at the Danish University Extension, København – March
- Two lectures at the Danish University Extension, Århus & København – March
- Two presentations for health professionals, Rødovre & København – March
- Two lectures at the Danish University Extension, Århus & København – February
- Three lectures at the Danish University Extension, Århus, Emdrup & Aalborg – January
- Keep Your Brain Healthy stakeholders meeting – May
- Kintsugi repair shop at Designmuseum Denmark – May
- Test of pilot project on volunteering, Medical Museion – May
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Management
Management

CEHA management operates within the Department of Cellular and Molecular Medicine, Faculty of Health and Medical Sciences at the University of Copenhagen. CEHA administrative duties are carried out by the Managing Director, the Vice Director, a Steering Committee, and administrative staff. The Managing Director reports to the Dean of the Faculty of Health and Medical Sciences, Dr. Ulla Wewer, who is ultimately responsible for all CEHA activities. Advisory capacity is provided by CEHA’s International Scientific Advisory Board.

CEHA Steering Committee
The CEHA Steering Committee provides internal oversight for research activities, financial issues, recruitment, strategic planning and outreach. The Chair of the Steering Committee is the Managing Director, Professor Lene Juel Rasmussen (Theme III), and the Committee members are the Vice Director, Professor Rudi Westendorp (Theme II), the leaders of the three research themes, and the leader of the communication and outreach platform, Professor Ken Arnold. The Committee meets approximately eight times per year.

CEHA Steering Committee members:
• Managing Director, Professor Lene Juel Rasmussen (Theme II; Chair)
• Vice-director, Professor Rudi Westendorp (Theme II)
• Assoc. Professor Astrid Pernille Jespersen (Theme I)
• Professor Karsten Vrangbæk (Theme I)
• Professor Erik Lykke Mortensen (Theme II)
• Professor Martin Lauritzen (Theme II)
• Professor Michael Kjær (Theme III)
• Professor Ian Hickson / Assoc. Professor Hocine Mankouri (Theme III)
• Professor Ken Arnold (Communication and outreach)

Meetings in 2017: 2 February, 7 March, 4 April, 2 May, 13 June, 12 September.

The CEHA Steering Committee organized:
• The international site visit on 4-6 January 2017 (see p. 76)
• Three CEHA III strategy seminars on the 9th May, the 29th August and the 16th October 2017, respectively.

International Scientific Advisory Board
The International Scientific Advisory Board (SAB) is appointed for the period of 2014-2018. It includes eight distinguished scientists, representing broad scientific expertise relevant to CEHA research.

The role of the SAB is to provide advice about strategic planning, recruitment, feasibility, progress and development of the Scientific Program. The Board proposes criteria for evaluating scientific progress and success, assists in establishing suitable external domestic and interna-
national collaborations, 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 Board meets once a year in Copenhagen, and the latest SAB meeting took place 1-2 December, 2016 (see also p. 69-70). The SAB reports to Dean Ulla Wewer.

The SAB members are:
- Professor Boo Johansson, Göteborg University, Sweden (Chair)
- Professor Sarah Lamb, Brandeis University, US
- Professor Dr Ulrika Winblad, Uppsala University, Sweden
- Professor Erik Boddeke, University of Groningen, Netherlands
- Professor George Brooks, University of California, Berkeley, US
- Professor Tone Tønjum, Oslo University, Norway
- Professor Jan Vijg, Albert Einstein College of Medicine, US
- Dr. Erinma Ochu, University of Manchester, UK.

Internal Advisory Committee
The members are:
- Dean of the Faculty of Health and Medical Sciences, Professor Ulla Wewer MD DMSci (Chair)
- Managing Director, Professor Lene Juel Rasmussen, PhD (Vice Chair)
- Professor Vilhelm Bohr, MD DMSci, Lab Molecular Gerontology NIA/NIH, US (International PI, Biomedicine)

Departmental Chairs from:
- Dept. of Neuroscience
- Dept. of Cellular and Molecular Medicine
- Dept. of Public Health
- Dept. of Biomedical Sciences
- Dept. of Clinical Medicine
- Dept. of Anthropology
- The Saxo Institute (Ethnology).

Deans from:
- Faculty of Humanities, Professor Ulf Hedetoft
- Faculty of Social Sciences, Assoc. Professor Troels Østergaard Sørensen.

CEHA Administration and Secretariat
CEHAs administrative staff manages logistics and helps coordinate research activities and programs. The secretariat is centrally located in the Mærsk Tower, Faculty of Health and Medical Sciences. In 2017, it includes: Tina Gottlieb, Head of Administration, Nynne Agergaard Rheeckmann, Academic Officer, Pia Nygaard, Academic Officer, as well as one part time secretary, Hanne Lærke Kracht.

The CEHA Secretariat also includes part of the Communication and Outreach Platform staff: Gitte Inselmann Frandsen, Communication and Press Officer; Signe Flyvbjerg, Event Coordinator; and Mark Justesen Pedersen, Project Employee. The other half of the Platform staff is organized under the Medical Museion headed by Director Ken Arnold: Bente Vinge Pedersen, Deputy; Annika Holme, Social Media Curator (until 30 April 2017); Anne Bernth Jensen, Event Curator (maternity leave from 1 June 2017); Louise Vesth Alsing, Event Curator (maternity leave from 15 May 2017).
The mission of CEHA is to improve our understanding of healthy aging and processes underlying disease and compromised functioning in aging. The population aging and increasing longevity make this mission vital, both scientifically and for associated societal and cultural challenges. Given the complex interactions in the aging process, the multidisciplinary approach of CEHA is also vital to form a knowledge base for future interventions. Denmark is ideal for aging research given the availability of high quality nationwide health registries, well-organized public health and excellent molecular biology environments. CEHA has made impressive progress since its founding in 2009. This has made possible the recruitment of outstanding scientific personnel. CEHA has identified three research themes, each taking a multidisciplinary approach. These themes address innovations in organization of public health and social care; the life course of aging processes; as well as molecular aspects of genome maintenance and energy balance during aging. This approach has resulted in excellent scientific publications, strong scientific presentations, as well as public-outreach. This has given CEHA an excellent position for future international leadership in aging research.

Professor Hans Krokan, Norwegian University of Science and Technology, Norway. Chair of international site visit panel in January 2017.