

# Focusing Research

The Focus Areas of Freie Universität Berlin

**DynAge**





# Focus Area

## DynAge

Disease in Human Aging

Dynamics at the Level of Molecules, Individuals, and Society



- ▶ Focus Areas of Freie Universität Berlin . . . . . Page 6
- ▶ *DynAge*: an Overview . . . . . Page 8
- ▶ Current Fields of Research . . . . . Page 14
- ▶ A Look at the Research Activities . . . . . Page 20
- ▶ Regional, National, and Global Networks . . . . . Page 22
- ▶ Linking Experts Together – Providing Holistic Patient Care . Page 28
- ▶ Support for Students and Early Career Researchers . . . . Page 30

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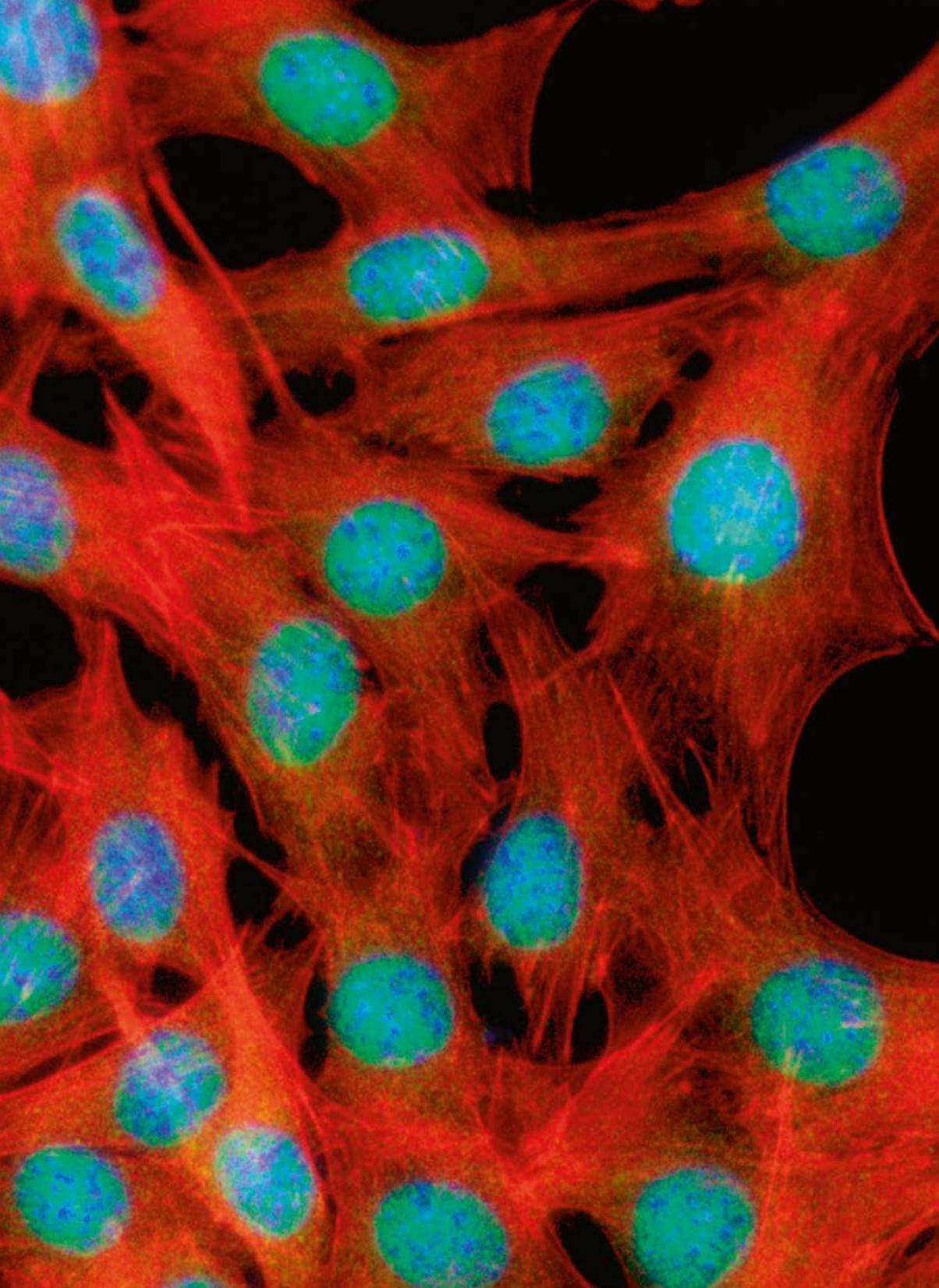
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## Focus Areas of Freie Universität Berlin

One special feature of the excellent, broad-based research performed at Freie Universität Berlin is the university's targeted formation of research platforms called Focus Areas.



*How do certain diseases arise, and how do they develop across different phases of the human life span? This is the topic of study within the DynAge Focus Area, which was established at Freie Universität in 2013.*

Photo: Fotolia.com, Dmitry Naumov

Within the Focus Areas, scholars and scientists from different subjects, disciplines, and institutions at Freie Universität work together over a longer period on complex research topics related to subjects of great importance to society.

The Focus Areas help to strengthen the areas of emphasis within the university's research activities and further develop these areas in cooperation with political, cultural, and economic players.

The Focus Areas can be arranged differently, depending on the specific disciplines, the issues currently being studied, and the individuals involved. The options range from platforms fostering the discussion of ideas – such as the Transregional Studies Salon series within the Center for Area Studies (CAS), one of the Focus Areas – to compact alliances dedicated to studying one key area of focus in current research activities, such as nanotechnology in the NanoScale Focus Area.

### Goals of the Focus Areas

- ▶ Taking up research trends and exploring them in interdisciplinary alliances
- ▶ Pooling skills and expertise to answer current research questions
- ▶ Initiation of new projects and solicitation of funding

### The Concept of the Focus Areas is Based on Three Key Principles

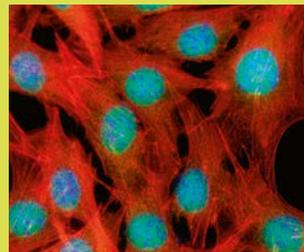
- ▶ Excellence in research across disciplines – for society, the political sphere, and the economy
- ▶ Networking and cooperative arrangements – regional, national, and worldwide
- ▶ Support for junior scholars and scientists – well structured, thorough, and comprehensive

## Structure and Organization of the Focus Areas

The Focus Areas are platforms for the development of research ideas stemming from interdisciplinary and interdepartmental initiatives. They represent the very highest level of quality in research activities – guaranteed by ongoing evaluations. Each Focus Area has at least one spokesperson. These people represent the Focus Area within the university and beyond.

The three strategic centers of Freie Universität provide crucial support to the Focus Areas:

- ▶ **The Center for Research Strategy (CRS)** – formerly the Center for Cluster Development (CCD) – supports and monitors the initial development, management, and evolution of the Focus Areas.
- ▶ **The Center for International Cooperation (CIC)** supports the Focus Areas with regard to worldwide cooperative arrangements and international visibility.
- ▶ **Dahlem Research School (DRS)** offers advice and assistance for the Focus Areas with regard to measures in support of junior researchers.



*Research in a network: Within DynAge, diseases are studied from a molecular biological point of view as well as with regard to the role of the individual patient and the social impact.*

Photo: Agnieszka Denkis

*The Henry Ford Building at Freie Universität, lecture hall building and conference center.*

Photo: Bernd Wannenmacher



## DynAge: an overview

Several acute and chronic diseases occur very differently in different age groups. When and why do they arise at a certain stage of life? How differently do these diseases develop among younger and older patients – and what are the consequences from a medical standpoint, for patients, their social environment, and ultimately society at large?



*“Interdisciplinary work is absolutely crucial when it comes to answering the complex questions we ask within DynAge; our aim is to support this work.”*

Nina Knoll, Professor of Health Psychology at the Department of Education and Psychology at Freie Universität, Spokesperson for the Focus Area

Photo: Bernd Wannemacher

Questions like these are the subject of inquiry for the *DynAge* (“Disease in Human Aging – Dynamics at the Level of Molecules, Individuals, and Society”) Focus Area, a research platform that was formed in January 2013.

Within this organization, researchers from the natural sciences, humanities, and social sciences at Freie Universität team up with medical experts from Charité – Universitätsmedizin Berlin, the joint medical school of Freie Universität and Humboldt-Universität zu Berlin. They study processes associated with aging with a specific focus on four groups of diseases that are among the most widespread in Germany and other industrialized countries: cancer, cardiovascular disease, disorders of the musculoskeletal system, and cognitive disorders and depression. In light of the increasing age of the general populace, knowing how these things fit together is highly important.

### Goals of *DynAge*

- ▶ To initiate interdisciplinary research on aging-associated disease processes in humans and support this research with start-up financing
- ▶ To gain fundamental insights into the development and consequences of various diseases across a person’s entire lifespan
- ▶ To design early detection, treatment, and follow-up care for diseases in a way that is tailored to different age groups and individualized for specific patients
- ▶ To foster networking at the regional level between researchers at Freie Universität and Charité – Universitätsmedizin Berlin

## Research at DynAge

Research activities at *DynAge* build on earlier research done at Freie Universität and Charité on the topic of aging and health. They do not focus on age itself, but rather on the phases and processes involved in aging. One aspect that is new – and, so far, quite unique – is that *DynAge* joins a comparative approach to research and a consistently interdisciplinary philosophy.

The mechanisms by which certain diseases develop are studied for different age groups and over a person's entire lifespan. In the process, the diseases are investigated by experts from a wide range of disciplines – a disease's emergence and development from the molecular biology standpoint (the molecular level) to the role of the individual (the individual level) and his or her environment and beyond, including social consequences (the social level). Each project considers at least two of these three levels.



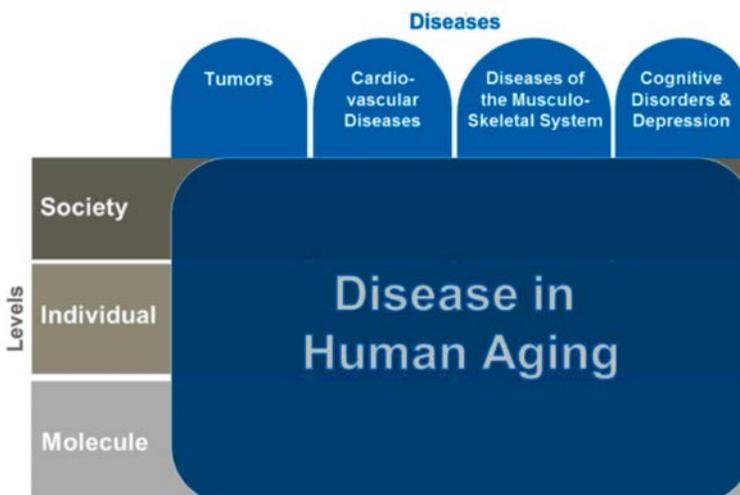
*“We aim to ensure that the subject of aging is given the necessary attention in research on the dynamics related to disease.”*

Ulrich Keilholz, Professor of Hematology, Medical Oncology, and Tumor Immunology and Director of the Charité Comprehensive Cancer Center, Spokesperson for the Focus Area

Photo: Bernd Wannemacher

The research matrix for this Focus Area: Within each project, researchers representing disciplines from at least two of the three levels work together on a question regarding one of the four groups of diseases studied.

Figure: DynAge





*The projects with different areas of emphasis complement each other, and researchers give each other new ideas and fresh motivation in the interdisciplinary teams. The researchers focus on specific details like the pieces of a puzzle with the overall aim of better understanding how mechanisms fit together.*

Photo: iStockphoto.com, Merve Karahan

### Disciplines of DynAge

To be able to investigate the various aspects of this research field, experts from ten departments at Freie Universität and 18 institutions at Charité work together within a network. More than 120 scholars and their teams have been cooperating in 18 projects and a total of 17 working groups since 2013. Most of them come from the fields of medicine, natural science and bioinformatics, the humanities and social sciences, business and economics, and psychology. Within each project, researchers representing disciplines from at least two levels of the DynAge matrix work together on a specific question.

DynAge benefits from a wealth of methodological approaches and technologies, forming a unique interdisciplinary platform. This specific dialogue offers opportunities for development of innovative ideas. The following research questions serve as examples of this.

- ▶ How can the progress of arthritis of the knee be slowed down? Experts from the areas of trauma surgery, radiology, anesthesiology, mathematics, biochemistry, and psychology are working together on this point.
- ▶ What are the crucial factors determining a person's well-being at an advanced age? This question is pursued by sociologists, working together with neuroscientists and medical specialists from the fields of psychiatry and psychotherapy.
- ▶ How can seriously ill tumor patients be given optimum support in the time remaining to them? This is the focus of study of oncologists working together with scholars of philosophy and theology and experts from the area of public health.

**Biochemistry** Pharmacy **Psychology** **Sociology** Philosophy Theology  
**Mathematics** **Bioinformatics** Law  
**Business and Economics** Veterinary Medicine  
**Oncology** **Muscle and Bone Research**  
**Neuropathology** **Orthopedics** Genetics  
 and Human Genetics Neuropathology Anesthesiology  
 Dermatology, Venereology, Allergology Trauma Surgery  
 Nephrology **Psychiatry and Psychotherapy** Vegetative Physiology

## DynAge: Facts and Figures

<b>Term of Funding</b>	January 1, 2013 – October 31, 2017
<b>Funding volume under the future concept of Freie Universität and based on funds of Charité</b>	1,120,000 €
<b>Number of interdisciplinary projects</b>	18
<b>Number of working groups involved</b>	17
<b>Scholars involved</b>	126
<b>Doctoral candidates</b>	21
<b>Freie Universität departments involved</b>	10
<b>Clinics / institutes / centers involved at Charité – Universitätsmedizin Berlin</b>	18
<b>Regional cooperation partners</b>	26
<b>National cooperation partners</b>	33
<b>International cooperation partners</b>	15

*More than 120 scholars and their teams have been cooperating in 18 projects within this research platform since 2013. The crucial factor is their dialogue on specific research questions across the boundaries of individual disciplines.*

Photo: Bernd Wannemacher





## Junior Professor at the School of Business & Economics

### Dr. Lauri Wessel, Professor

*“For junior scholars and scientists, it is important to form networks early on, raise their own profile, and gain experience with how to successfully apply for external funding. All three aspects are inherent in the involvement in the DynAge Focus Area. The interdisciplinary work done here is also good practice: You have to communicate your own subject to non-specialists on an understandable basis – in research and teaching activities.”*

Alongside the career benefits of participating, it is the subjects covered by the Focus Area that Lauri Wessel finds exciting. “The increasing prevalence of chronic diseases and the associated health management are highly relevant to society in social, medical, and economic terms,” says the 32-year-old junior professor.

Assuming that they agree, patients can receive better healthcare through a secure exchange of treatment-related data. This is the basis for innovative forms of organizing care like “Accountable Care Organizations” or “Integrated Care Networks.” All of them aim to integrate information and coordinate practices across different medical professionals. This can help to avoid redundant or unnecessary treatments as well as double medications. Such measures are crucial, especially for patients with chronic diseases such as asthma or diabetes. The quality of their treatments can be improved by using information systems. However, studies have shown that these systems are hardly catching on at all in practice. Why this is the case is part of what Wessel is studying at *DynAge*.

Wessel, a music fan and the founder of an online music magazine, actually embarked on his studies of business administration with the goal of entering the music industry with a business degree. He ended up deciding on an academic career at the Department of Information Systems at Freie Universität, where he completed his doctorate in 2013.

Wessel says his research subject is a “thrilling and motivating field,” adding that it is not geared toward simply placing a certain product on the market, but instead toward taking multifaceted interests, aspects, and disciplines into account. Take sociological questions, for example: How might different groups, such as medical practitioners and health insurers, be brought into the process of developing business models?

**His goals: to publish excellent work, work on socially relevant projects, do outstanding research, and communicate the importance of findings to players within academia and the research community and beyond.**



*Lauri Wessel's areas of focus are information systems, information, and organization. He does research on IT-based business models in the context of special forms of care and heads the Dahlem International Network Junior Research Group “Health IT and Business Model Innovation” to this end.*

*Lauri Wessel, Junior Professor of Business Administration at the School of Business & Economics.*

Photos: Bernd Wannemacher

## Current Fields of Research at *DynAge*

Research activities at *DynAge* focus on four groups of diseases: tumors, cardiovascular disease, musculoskeletal disease, and cognitive disorders and depression. Since the start of this Focus Area in 2013, specific aspects of each disease group have been studied by interdisciplinary teams across more than 18 projects.



Researchers within *DynAge* are working on biomarkers with the aim of detecting cancer earlier and being able to tailor examination methods to individual patients. Alongside purely medical subjects, patients' life goals and their wishes regarding treatment play a role – and those can vary widely according to the patients' age.

Photo: iStockphoto.com, Bialasiewicz



Arteriosclerosis, or hardening of the arteries, is a major contributor to cardiovascular disease in the aging population. Which substances play a role in the formation and development of these plaques is a line of inquiry at *DynAge*.

Photo: fotolia.com, Gina Sanders

### Cancer

Diseases involving tumors rank among the most common causes of death, especially in older patients. A number of the underlying disease processes still remain to be deciphered. One big challenge is early detection of tumors, where individual factors such as the patient's age, sex, and lifestyle have to be taken into account. One of the goals researchers are pursuing in this area is to identify new "biomarkers." These measurable molecules present in the human organism can be used as indicators of cancer. This information could be used to tailor examination methods to individual patients, detect tumors earlier, and develop more effective treatment methods.

To make further advances in treatment, the treatment goals and results for individual patients must be taken into account alongside other factors – and here as well, the patient's specific phase of life plays a role. *DynAge* looks at both age-related aspects of cancer treatment and the issue of how to support patients and their loved ones following a diagnosis of an incurable tumor to help them cope better with the time remaining in the patient's life and be able to prioritize their life goals.

### Cardiovascular Diseases

What mechanisms in the body are responsible for the emergence and development of vascular aging is an area that is still largely unexplored. One of the main factors contributing to cardiovascular diseases in the aging population is arteriosclerosis, or hardening of the arteries, which arises through an imbalance between the substances in the body that impede the formation of deposits in the blood vessels and those that promote it. Knowledge about these processes is still very limited. One *DynAge* project is working to identify and characterize previously unknown substances that play a particular role in arteriosclerosis.

## Degenerative Diseases of the Musculoskeletal System

The human musculature and skeleton are subject to a certain level of wear and tear resulting in limited functionality with increasing age. Diseases and disorders associated with this can lead to acute or chronic pain. To be able to develop preventive treatment methods for patients of different ages, it is important to understand how these diseases arise at the cell biological level – and how they develop further. Here as well, there are still significant gaps in scientists' knowledge.

Communication between cells is fundamental to many physiological processes. These processes also change in the course of a person's life. What the crucial factors are, and which ones could pose risks, is being studied at *DynAge*. The focus is on degenerative processes affecting the lumbar spine, which occur frequently and in different age groups and can lead to spinal stenosis, or narrowing of the spinal canal; to arthritis of the knee (see p. 20 – 21); and to muscular dystrophy, a hereditary muscle disease.

## Cognitive Disorders and Depression

People display great differences in the development of emotional and cognitive abilities across their lifespan. Why do older people tend to suffer less from depression than younger ones, although their living circumstances are often tougher? Sociologists and medical researchers have teamed up to tackle this question, with an eye to how the genetic makeup of the approximately 500 study participants interacts with their behavior in contexts such as social networks.

By contrast, the number of surgeries performed on members of the older population is on the rise – and with it, so is the risk of postoperative cognitive dysfunction (POCD), especially after major surgery. Impairment of cognitive function after an operation can be significant and pass quickly, or it can be a lasting condition. Similar symptoms can also arise following electroconvulsive therapy (ECT), which is sometimes used to treat depression. How POCD arises and how it could be treated has remained unclear so far. This is where another *DynAge* project comes in. The goal is to better understand the neurobiological processes involved in the occurrence of POCD and to be able to judge a patient's individual risk of suffering this kind of cognitive dysfunction before the patient undergoes surgery or ECT.



*Bones and muscles are subject to a certain degree of wear over a lifetime. For better approaches to prevention, it is important to understand how these diseases arise at the cell biology level. Researchers within DynAge are working on this.*

Photo: fotolia.com, itsmejst



*Older people often report subjective cognitive impairment (SCI), but this is not necessarily an indicator of the onset of dementia. An "SCI score" developed at DynAge aims to enable early diagnosis.*

Photo: iStockphoto.com, shapecharge

## THREE LEVELS OF STUDY

The diseases associated with aging are studied at three different levels – from a disease’s emergence and development from the molecular biology viewpoint to the role of the individual patient and his or environment and beyond, to the effects on society at large.

### LEVEL 1: MOLECULAR

**This level is geared toward fundamental research on molecular biological processes that are involved in the development of diseases.**

Many physiological processes are based on the transmission of signals within and between cells. The crucial factor in this is the interaction between proteins and ligands – a kind of link that “docks” with certain receptors. Ligands can be other proteins, nucleic acids, lipids, or small molecules. Aging, cellular stress, mutations, or diminished repair mechanisms can adversely affect the interaction between proteins and ligands – and thus also various biochemical pathways and the transmission of signals between the cells. Depending on a person’s age, the dynamics and consequences of this imbalance can have different effects. The researchers’ goal is to understand general mechanisms in molecular detail. Knowledge regarding this is important in other areas as well, such as in pain therapy for inflammatory diseases or to treat loss of muscle mass in the elderly.

*Fundamental research activities within DynAge study which biological processes are involved in the development of diseases. The goal is to understand general mechanisms in molecular detail – which is relevant for various reasons, including for new treatment methods and pain therapies.*

Photo: iStockphoto.com, DragonImages



## LEVEL 2: INDIVIDUAL

**Individual biomedical and behavior-related factors are the focus here.**

A long life increases the chances that a person will be able to spend a longer period not working. On the other hand, some people who live to an advanced age also have to cope with health and functional impairments for a long time.

To ensure that patients do not just live longer, but also enjoy good quality of life in the process, it is important for scientists to know what factors accelerate or delay disease processes at different stages of life. Many of these factors are related to individual lifestyle and individual behaviors. These include risk behaviors such as smoking, lack of exercise, an imbalanced diet, or failing to take medications properly. When do people change behaviors that have an impact on their health, what are the consequences, how do these factors change over a lifespan, and how do they interact with the changes affecting biological processes over time? The emergence, severity, course, and consequences of diseases can vary dramatically depending on a person's age. With this in mind, another goal for research teams is to develop possible solutions and approaches with an eye to prevention, diagnosis, and treatments tailored as specifically as possible to age groups or individual patients and their distinct needs.

*The way a disease or health condition emerges and progresses often varies according to a person's age. Within DynAge, researchers are working on developing new approaches to prevention, diagnosis, and treatment that are tailored as specifically as possible to age groups and to individual patients and their distinct needs.*

Photo: iStockphoto.com, Ivan Bliznetsov



### LEVEL 3: SOCIETY

**At this level, researchers consider phenomena that affect society at large as the average age of the population rises.**

Demographic change is one of the biggest social challenges facing Germany and Europe. An aging population on the whole has profound and far-reaching consequences for the healthcare sector, but also for the social market economy, the social insurance system, and the labor market. Researchers within *DynAge* analyze the scope of the effects and the limits that apply to controlling and shaping these consequences.

Individual aspects are explored through various projects. The idea of “integrated care” is to give patients access to better care while at the same time reducing healthcare costs – through stronger links between specialist disciplines, treating physicians, and hospitals. However, this concept has hardly caught on at all in practice so far; *DynAge* is studying why.

The modern healthcare system would be unthinkable without medical guidelines. They help to make medical decisions and play an important role in safeguarding patients’ interests. But how are these guidelines developed, who is involved, and what role does lobbying play? All these are questions studied within *DynAge*.

The areas of inquiry in this context also include issues such as how to relieve the burden on those who are taking care of family members with chronic age-related diseases and conditions.

*Researchers within DynAge are studying the effects of population aging on society at large and on the healthcare sector specifically.*

Photo: iStockphoto.com, Andreas Herpens



## Junior Research Group Leader at the Department of Mathematics and Computer Science

### Max von Kleist, PhD

*“The DynAge Focus Area offers an excellent platform for dialogue between scientists and scholars at Freie Universität and physicians and medical researchers at Charité. I work closely with my colleagues at the Benjamin Franklin Campus. We meet up and talk to each other – that might sound trivial, but this form of dialogue is found hardly anywhere else. We look at a specific research question from our respective disciplinary perspectives and are able to develop completely new approaches for it.”*

When and why do specific medical treatments work – and how can they be improved? Max von Kleist is interested in medical and biological questions, and in mathematics and computer science. When Freie Universität first began offering the program in bioinformatics, in the year 2000, he signed up right away. To von Kleist, the subject’s special appeal lies in the ability to combine application-related research in the life sciences with the theoretical use of data in computer science.

Bioinformatics researcher von Kleist sees himself as a builder of bridges – between disciplines and also between their specific cultures. “We translate concepts from medical researchers using specially developed computer programs,” he says. This makes it possible to combine large datasets, visualize and test hypotheses from various experts based on mathematical models, and simulate processes. The goal of this fundamental research is to better understand processes and be able to optimize existing treatment strategies or develop new ones. The Institute of Bioinformatics that was opened in 2013 at the Department of Mathematics and Computer Science offers optimal conditions for this research.

Even before he had finished his degree program, von Kleist did research at the Institute of Medical Virology at the University of Zurich. After that, he moved on to a Swedish pharmaceutical company. For his dissertation, he studied drug resistance in HIV at the Hamilton Institute, in Ireland, and MATHEON, in Berlin. Now 35 years old, von Kleist has been heading a junior research group at the Institute of Mathematics since 2011. He has been working on a project for prevention and treatment of arthritis of the knee at DynAge since 2013.



*Bioinformatics researcher Max von Kleist sees himself as building bridges between disciplines. He combines applied research in the life sciences with the theoretical use of data in computer science.*

Photo: Bernd Wannemacher

**His goal: a professorship in applied mathematics or bioinformatics.**

## A Look at the Research Activities

The many different research projects within the *DynAge* Focus Area are dominated by interdisciplinary cooperation between researchers. The project of this Focus Area that is outlined below is one of many examples showing just what this work can look like and what possibilities the joint research activities can offer.

### When the Strongest Joint in the Body Becomes Weak

It starts out with knee aches and pains when climbing stairs, and later on even a short walk becomes an ordeal: Arthritis of the knee is one of the most common degenerative disorders of the musculoskeletal system. If too much or too little pressure is placed on the cartilage in the joint, it can degenerate and cease to perform its cushioning and lubricating functions. The bones rub against each other, causing severe, chronic pain.

How patients can be motivated to get appropriate exercise in spite of the pain, what role exercise plays with regard to the knee across different ages, and what processes take place at the molecular biology level are being studied in the *DynAge* project “PrevOP” (Prevention of Progression of Stage 2–3 Knee Arthritis through Mechanical Stimulation Using a Vibration Training Unit [Galileo]). “Early prevention is the key to avoiding pain medications and surgeries,” says Wolfgang Ertel, a professor of trauma surgery at Charité – Universitätsmedizin Berlin and director of the Department of Traumatology and Reconstructive Surgery at the Benjamin Franklin Campus. Together with Professor Dieter Felsenberg, the head of the Center of Muscle and Bone Research, which is also located on the Benjamin Franklin Campus, Ertel is focusing on muscle exercise using a vibration unit developed specifically for medical purposes.

The device makes it possible to develop muscle extremely rapidly, an effect that has been tested in settings including in space medicine studies performed by the European Space Agency (ESA). “The more exercise the surrounding muscle has received, the less susceptible the bone is to osteoporosis,” Felsenberg says. “We are now studying the interactions between muscle and cartilage with an eye to slowing or even halting the degeneration of cartilage in the knee joint,” he adds.

The researchers’ hypothesis is that the better the muscle is trained, the higher the supply of nutrients not only to the bone but to the cartilage as well. In patients with arthritis and the cartilage damage that goes with it, Felsenberg says, the supply of nutrients to the cartilage is always disrupted. “The cartilage always needs to be massaged, which distributes nutrients and cell information,” he points out.



*Professor Dieter Felsenberg, head of the Center of Muscle and Bone Research at the Benjamin Franklin Campus of Charité – Universitätsmedizin Berlin.*

Photo: Bernd Wannemacher

Ertel and Felsenberg plan to work with other researchers from the Focus Area to find out how, exactly, this supply to the cartilage occurs. They are moving into uncharted territory with this line of inquiry. “We know from a number of studies how important exercise is to joints,” Ertel says. “But what we don’t know is which messengers ensure that the stem cells that regenerate the cartilage are produced.”

This is now being studied in the project supported by *DynAge*, which is scheduled to run for four years and to receive a total of 4.3 million euros in funding from the German Federal Ministry of Education and Research (BMBF). Study participants will be required to do various things, including undergoing two orthopedic “mini-interventions,” the orthopedist says. “A sample of muscle tissue will be taken from the calf once, and another time we will take a sample of cartilage and joint capsule tissue.” The tissue samples will go to Professor Petra Knaus, of the Institute of Chemistry and Biochemistry at Freie Universität, who is investigating the connections between biomechanical and biochemical signals with her team. Based on the data gleaned from the samples, Stephan Zachow, of the Zuse Institute Berlin (ZIB), and Max von Kleist, of the Department of Mathematics and Computer Science at Freie Universität, will create three-dimensional models of things like the cartilage covering the joint (see page 19).

The approximately 240 participants in the study will be asked to exercise under a doctor’s supervision as many as three times a week and then spend another year afterwards following an exercise regimen on their own. Will their motivation last that long? That is where the health psychologists on the team headed by professors Nina Knoll and Ralf Schwarzer come in. They are studying what overall conditions must be created to keep patients on the ball when it comes to exercise. Ertel is confident: “People who are in pain and then see that with regular exercise, their pain diminishes, exercise voluntarily,” he says.



*Wolfgang Ertel, professor of trauma surgery and director of the Department of Traumatology and Reconstructive Surgery at the Benjamin Franklin Campus.*

Photo: Bernd Wannemacher



*The knee carries the heaviest load of all of the joints in the body – which means that signs of wear set in here, in particular as people age. How arthritis of the knee could be halted with a special exercise regimen, and what role the supply of nutrients to the joint plays, is being studied by researchers from the fields of medicine, biochemistry, psychology, and mathematics.*

Photo: iStockphoto.com, Jan Otto

## Regional, National, and Global Networks

This Focus Area is a platform for regional, national, and international interdisciplinary research projects. *DynAge* maintains an outstanding network within the Berlin-Brandenburg scientific and research community.

### Research for Health across the Boundaries of Individual Disciplines

One of the goals of *DynAge* is to connect and support outstanding research groups in the Berlin area from various disciplines that are relevant in terms of research on aging and the four disease groups studied within the Focus Area.

One special feature of this Focus Area is the close, multifaceted cooperation it involves between notable scholars and scientists from ten departments at Freie Universität and experienced physicians and medical experts from Charité. They pool their expertise on matters of health in an aging society, certain diseases, and treatment and support for patients in various age groups.



*Networking for the benefit of the patient: DynAge forms a platform for experts of different disciplines.*

Photo: iStockphoto.com, Pogonici

### Funding for New Ideas

*DynAge* offers physicians and researchers an opportunity to develop new ideas, and with them, interdisciplinary research initiatives within the selected *DynAge* projects that receive start-up financing for a year. Proposals for further funding are then submitted on the basis of the cooperative initiatives launched during this period, with the aim of further pursuing specific lines of inquiry.

With this concept, this Focus Area offers a strong basis for raising external funds. Ten externally funded projects have been initiated since the *DynAge* Focus Area was first started, in 2013. The full funding amount, about seven million euros, comes from various funding agencies, including the German Federal Ministry of Education and Research (BMBF), the German Research Foundation (DFG), and the Berlin Institute of Health.

## Charité – Universitätsmedizin Berlin

Charité – Universitätsmedizin Berlin is the joint medical school of Freie Universität and Humboldt-Universität zu Berlin. It is one of the leading university medical centers in Europe and the clinical facility with the strongest research activities in Germany.

The research emphases established within *DynAge* build on this medical expertise and the cooperative relationships associated with it.

In order to best organize teaching, research, and patient care, 17 CharitéCenters were established. These centers house 130 clinics and institutes in four main locations: Benjamin Franklin Campus (CBF), Berlin-Buch Campus (CBB), Charité Mitte Campus (CCM), and Virchow Klinikum Campus (CVK).



*The Benjamin Franklin Campus in Berlin-Steglitz was created in the 1960s with U.S. funding as Europe's first major hospital complex.*

Photo: Stephan Töpfer



*Patients who participate in empirical research projects are required to sign a statement of consent. Are these documents – termed “informed consent” materials – formulated in a way that is appropriate to the target group and appropriate for the patient’s age in the first place? This is among the questions studied at DynAge along with cooperation partners.*

Photo: fotolia.com, Stasique Photography

## Regional Cooperation Partners

The more than 100 members of *DynAge* work on emerging lines of research together with colleagues at other universities and outstanding partner institutions not affiliated with academia. The Berlin location offers an extensive network of specialists from a wide range of different disciplines, from molecular biology to public health.

The large local metropolitan area and the large numbers of patients associated with it represent advantages in terms of research activities. This makes it possible to register and study numerous cases and specific variants of the four disease groups studied by the Focus Area. The outstanding regional infrastructure offers state-of-the-art technologies for this.

The Berlin-Brandenburg scientific and academic region, with its numerous research institutions and medical facilities, enjoys an outstanding international reputation as a hub of activity in the life sciences. The high proportion of associations, organizations, and businesses involved in healthcare that are based in the German capital and the close physical proximity to state and federal government and policy makers are important factors in the social aspects of the research done at *DynAge* – and, in turn, for transferring the results of that research to the wider society.

The *DynAge* regional network includes researchers at the University of Potsdam, the Max Planck Institutes, the Zuse Institute Berlin (ZIB), and the Fraunhofer Society. *DynAge* members work on the social aspects of their research with various other partners, including the German Institute for Economic Research (DIW) and the German Institute of Urban Affairs (Difu).

## National Cooperation Partners

Researchers at *DynAge* maintain extensive cooperative relationships throughout Germany with colleagues from the field of research and experts from other areas of the healthcare sector.

This applies, for example, to the nationwide German project “Bea@Home,” in which researchers from *DynAge* are involved. The project is developing and testing a new concept to allow patients who require artificial respiration over a longer period to be cared for at home instead of in hospital settings. The project team is working toward this goal with various partners, including the German Institute of Applied Nursing Research (dip), in Cologne, and various companies in the healthcare industry.

In terms of research on medical guidelines, for example, there is an exchange with the Association of the Scientific Medical Societies in Germany (AWMF), in Düsseldorf. It forms the umbrella organization for about

170 scientific societies from all fields of medicine, drafts recommendations and resolutions, and represents the interests of the scientific medical sector vis-à-vis the political sphere.

DynAge also has other cooperative relationships with partners including the Public Health Foundation, based in Hamburg, the universities in Göttingen, Siegen, and Würzburg, the technical universities in Dortmund and Munich, and the Hannover Medical School. There is an especially close working relationship in the field of cancer research (also see p. 28 – 29) with the German Cancer Research Center (DKFZ), in Heidelberg.

- 1 Berlin Institute of Health
- 2 German Medical Association
- 3 Federal Ministry of Health
- 4 German Managed Care Association
- 5 ClinPath GmbH
- 6 Cluster Health Care Industries Berlin-Brandenburg (HealthCapital)
- 7 German Institute of Human Nutrition Potsdam Rehbrücke
- 8 German Institute of Urban Affairs
- 9 German Institute for Economic Research (DIW Berlin)
- 10 Gematik mbH
- 11 Gemeinsamer Bundesausschuss
- 12 Helios Hospital Emil von Behring
- 13 Humboldt-Universität zu Berlin
- 14 Competence Center E-Health, Fraunhofer FOKUS
- 15 Konrad-Zuse-Zentrum für Informationstechnik Berlin (ZIB)
- 16 KV Telematik GmbH
- 17 Leibniz-Institut für Molekulare Pharmakologie
- 18 Max Planck Institute for Molecular Genetics
- 19 Max Planck Institute for Human Development
- 20 Max Delbrück Center for Molecular Medicine
- 21 Melito AG
- 22 Siemens AG
- 23 University of Potsdam
- 24 German Association on Digital Health
- 25 Regionalmanagement Berlin SÜDWEST
- 26 Brandenburg Economic Development Board

Cooperation partners of DynAge in the Berlin-Brandenburg region



## International Cooperation Partners

The major focus of research at *DynAge* is on studies in the Berlin-Brandenburg area and in Germany – especially at the societal level. The increasingly multicultural composition of the population is taken into account in the process. International analyses regarding the four disease groups and other factors such as demographic shifts in other countries are considered on a comparative basis.

Within their respective projects, the members of *DynAge* make new ties with well-known colleagues around the world while also contributing to *DynAge* as a research platform through their existing networks and years of cooperation projects. This enables dialogue on the latest research while also offering insight into social discourses on the topic of inquiry that are currently taking place in other countries. So far, the Focus Area has maintained scientific and scholarly cooperative relationships with universities in Europe, the United States, and Asia.

Working with experts from the Department of Public Health at the University of Copenhagen and the Norwegian Centre for Integrated Care and Telemedicine, based in Tromsø, for example, business and economics scholars at *DynAge* do research on questions related to individualized patient care using new IT systems. Further aspects related to these topics are explored in cooperation with Johns Hopkins Hospital, in Baltimore, the School of Business at Aalto University, in Helsinki, and Vrije Universiteit Amsterdam. Together with partners at the University of Osaka, *DynAge* experts on cancer research are working on topics such as developing tumor vaccines.

*DynAge* regularly hosts researchers from all over the world, who give talks and presentations or participate in one of the Focus Area's working groups. The 10th International Conference on Bone Morphogenetic Proteins (BMPs) brought 240 participants from 26 countries to Freie Universität. The event was hosted by *DynAge* member Professor Petra Knaus of the Institute of Biochemistry (first row, second from left).

Photo: Neil Meshraqi



## Research Associate at the Department of Mathematics and Computer Science

### Dr. Pooja Gupta

*“At Freie Universität and within the DynAge Focus Area as a multidisciplinary platform, I am able to do research freely and independently on various aspects and topics. Numerous cooperative relationships with colleagues from other disciplines have developed. We receive highly motivational support from the professors within the working groups, and we are willing to work hard for our results, too.”*

“I always wanted to be a scientist,” says Pooja Gupta. She was inspired by doctors in her family, and her parents supported all of her plans. Gupta studied botany, chemistry, and biochemistry in her hometown of Allahabad, in northern India. She moved to Berlin in 2009 and earned a doctorate in bioinformatics at the Department of Mathematics and Computer Science at Freie Universität. During this time, she also spent three years working as a research associate at the Institute for Bee Research in Hohen Neuendorf (LIB) and, from 2013 to 2014, at the Zuse Institute Berlin (ZIB).

Gupta has been a research associate within the applied mathematics working group headed by Professor Christof Schütte since 2014, working closely with the team led by Professor Petra Knaus, a biochemist. Their work focuses on the specific molecular family known as bone morphogenetic proteins (BMPs). They act as signaling substances within the body and play a role in processes such as treating bone fractures and tumors. Based on data gleaned from biochemical experiments, Gupta develops models that can be used to simulate the many possible processes involved in the use of BMPs. Gupta’s research is supported by the Dahlem International Network PostDocs funding line of Freie Universität, which provides funding to junior scholars and scientists. The factors that are helpful in her work include not only knowledge from different disciplines, but also skills related to the different cultures and jargons across various areas. “The transfer is easy for me,” says Gupta, 31. “I can ask specific questions in areas that might not necessarily be among my own specialties, but where I do have a basic understanding – and that way, I can share in developing interdisciplinary approaches to finding solutions.”

**Her goal:** to engage in good research on molecular processes and share this knowledge through later teaching activities as well.



*Pooja Gupta studied botany, chemistry, and biochemistry, earning her doctorate in bioinformatics. Gupta, who is originally from India, has been doing research at Freie Universität since 2009.*

Photo: Bernd Wannemacher

## Linking Experts Together – Providing Holistic Patient Care

An example from cancer research shows how cooperative research initiatives interlock and complement each other at the local, regional, national, and international levels, and how this may help researchers to develop possible answers to unresolved questions of our time, benefiting patients.



The DynAge projects related to cancer are based on cooperation with the Charité Comprehensive Cancer Center (CCCC). Patients learn details about their disease here, while physicians in private practice can coordinate the accompanying treatment at the Oncology Center. The liaison office of the European Organisation for Research and Treatment of Cancer (EORTC) was established at the CCCC in 2013.

Photo: Bernd Wannemacher

The DynAge projects related to cancer are based on close cooperation with the Charité Comprehensive Cancer Center (CCCC). This integrative cancer center forms the umbrella organization for all clinics and institutes at Charité that deal with oncology. The goal is to provide patients with holistic care through specially trained professionals. The CCCC, which was founded in 2008, receives funding from German Cancer Aid as a top oncology center and is certified by the German Cancer Society.

The basis for the comprehensive, state-of-the-art medical treatment offered by the center is innovative research projects and clinical studies with partners such as the German Cancer Research Center (DKFZ), part of the Helmholtz Association. The goal is to ensure that new research findings can be applied as soon as possible – which is one reason the CCCC also maintains close relationships with general practitioners and medical specialists, hospitals, follow-up care facilities, self-help organizations, and hospices in the Berlin area and beyond.

Patients learn details about their disease, the various treatment options available to them, points of contact, and possibilities for self-help. The CCCC doctor's portal allows physicians in private practice to coordinate the accompanying treatment at the Oncology Center. At the local level, the CCCC is a member of organizations such as Tumorzentrum Berlin e.V., the umbrella organization for Berlin's tumor centers, and at the international level, it belongs to the Organisation of European Cancer Institutes.

In 2013, the liaison office of the European Organisation for Research and Treatment of Cancer (EORTC) was established at the CCCC (also see p. 33). It forms the umbrella for all EORTC study centers in Germany. The EORTC, based in Brussels, is considered one of Europe's most important organizations in the field of cancer research. The goal of the approximately 2,500 members from more than 300 European institutions is to improve standards in the treatment of cancer in Europe, where there are sharp differences between Member States. Language barriers, red tape,

and lack of interconnectivity represent not insignificant hurdles to international research and the use of new medications and effective treatment strategies – unlike in the United States, for example. The U.S. National Cancer Institute (NCI) supports the analysis center in Brussels and maintains its only branch outside the United States there.

Via these different areas of cooperation, the members of *DynAge* are involved in a worldwide network with other renowned experts. Patients and junior scholars and scientists benefit from the knowledge about the latest developments in the field of cancer research that is present here.

## Workshops, Conferences, Public Events

To foster dialogue at the regional and national level, the Focus Area organizes a one-day workshop each year at which projects are presented and current issues are discussed. This event reaches out to all members and cooperation partners and to specialists in the field who are interested in the subjects covered.

Specific aspects of the research done within *DynAge*, such as biochemical signal transmission in cruciate ligaments, are also explored in special interest workshops.

At the international level, *DynAge* members are involved in organizing international conferences, and they participate in meetings and congresses in specific areas and organize lecture and presentation series with prominent guest speakers.

The work and results of *DynAge* are communicated to the public through activities such as talks at Urania Berlin, the Long Night of Science, and other large-scale events such as Berlin Life Science Day.

The lecture series “... dass es ein Ende mit mir haben muss... Vom guten Leben angesichts des Todes” (“... that I have to come to an end... On living well in the face of death”), held as part of the Open Lecture Halls public lectures of Freie Universität, generated an excellent response. In it, members of *DynAge* offered an illuminating look at the end of life from philosophical, theological, and medical perspectives, together with guests from other fields in historical and cultural studies.



*Scientists and researchers explain their work and findings to interested members of the public through talks, presentations, and other events.*

Photo: Christian Arlt

## Support for Students and Early Career Researchers within *DynAge*

Extensive cooperation between the Focus Area and the departments involved provides a comprehensive education for outstanding junior scientists and scholars. Intensive support and supervision and the opportunity to participate in interdisciplinary networks open up a wide range of prospects for early career researchers.

### Research-Oriented Teaching Activities

The future development concept of Freie Universität includes the “Research-Oriented Teaching” program. With this as a basis, *DynAge* developed the “*DynAge* Research Workshop,” a pilot project in which groups of outstanding students have been involved in various research projects of the Focus Area on a regular and systematic basis since the 2013/2014 winter semester. With support and supervision from experienced scholars and scientists, they work on a selection of issues, studying them empirically and presenting their findings at the Focus Area’s annual workshops.

### Doctoral Study, Research, Teaching – the Career Path Model

Through its career path model, Freie Universität seeks to provide junior researchers at various stages of their professional development with more certainty in planning their careers – especially with an eye to the often-difficult transitions from doctoral candidate to postdoc and from postdoc to professor. The model is implemented through the work of the university’s three strategic centers – the CRS, CIC, und DRS (see page 7).

The Center for Research Strategy (CRS) offers sustained, systematic support for junior researchers across three different funding lines, combined with central tasks in strategic support for research. Under all three programs, a position at the university is set up for the researchers receiving support.

### Dahlem International Network Postdocs

This funding line addresses young researchers at Freie Universität who have received their doctoral degree within the last three years. The two-year funding period is meant to support academics in their professional development and prepare them for the next stage in their careers, such as heading a junior research group or taking on a junior professorship.



*Research and networking: DynAge offers young researchers insight into the current status of research and contact with leading experts.*

Photo: Bernd Wannemacher

A six-month-long stay at a university abroad or a local non-university institution is a mandatory part of the program.

Dr. Pooja Gupta is a Dahlem International Network PostDoc Fellow at DynAge (see page 27).

#### Dahlem International Network Junior Research Groups

This specific form of junior research group brings together the position of a junior professorship with the task of developing a working group. It is aimed at advanced postdocs, who can then earn leadership experience at an early stage, even beyond independent research, and gradually grow into the tasks that come with a full professorship, such as teaching classes. The crucial factor is for applicants to have an innovative research topic with a high potential for networking.

The *DynAge* junior research group focuses on the topic “Health IT and Business Model Innovation.” It is headed by Junior Professor Dr. Lauri Wessel (see page 12–13).

*The future development concept of Freie Universität provides for multiple funding lines for junior scholars and scientists in order to support them over the various phases of their careers.*

Photo: Bernd Wannemacher





*Dahlem Research School (DRS) has a special fellowship program for post-docs with international experience.*  
Photo: DRS

### Dahlem International Network Professorships

This funding line offers experienced young researchers an opportunity to teach and conduct research independently through the creation of temporary W2 professorships. The decisive factor here is that the areas of focus in their research activities must fit or supplement existing or potential profile areas of Freie Universität.

*DynAge* is supported via the temporary professorship with the academic focus “High-performance Computing in Molecular Dynamics.” It enables closer cooperation between groups working on theory and medicine.

### Researcher Development Program of Dahlem Research School

As part of the career path model, Dahlem Research School (DRS) offers a training option for young scholars who have completed a doctorate and wish to become full professors. The Researcher Development Program encompasses the fields of career management, teaching, and leadership and management.

## Pointing the way forward: the POINT support program in the Focus Areas

In 2011, Dahlem Research School (DRS) launched a special aid program for postdocs: Postdoc International, or POINT. Each year, the program makes it possible for currently 20 outstanding researchers from other countries to spend up to 24 months pursuing research projects in the Focus Areas at Freie Universität. Each POINT fellow's objective is to get his or her project ready to apply for aid and then to raise funding for the project.

The fellows are integrated into the research networks existing within the Focus Areas. They participate in an individualized weeklong orientation program and in the DRS qualification program.

For further information, please visit  
[www.fu-berlin.de/en/drs/drs\\_fellowships](http://www.fu-berlin.de/en/drs/drs_fellowships)  
or contact us via email: [fellowship-drs@fu-berlin.de](mailto:fellowship-drs@fu-berlin.de)

## Research Associate and Medical Coordinator at the Charité Comprehensive Cancer Center

### Susen Burock

*“Tumor biology varies by age and by the type of cancer. In breast cancer, for example, middle-aged and elderly patients have better chances of survival, while those under 60 have better prospects with colon cancer. To be able to prevent cancer better, detect it earlier, and treat it on a more targeted basis, we need more wide-range, comparable studies of cancer at different stages of the aging process. And we need to link together the specialized knowledge from various disciplines to arrive at a better understanding of connections. DynAge offers a good basis for this, along with the network to be able to develop new research approaches.”*

Susen Burock knew she wanted to become a medical doctor back in elementary school. During her studies of medicine at the University of Ulm – including numerous night shifts spent providing bedside care in a hospital setting – she decided to pursue cancer research and treatment options for tumor patients. She worked as an assistant surgeon at Sankt Josef-Hospital, in the city of Bochum, from 2004 to 2006, and later moved to the Department of Surgery and Surgical Oncology at the Robert-Rössle-Klinik, in Berlin’s Buch district.

The Charité Comprehensive Cancer Center (CCCC) was founded in 2008, and Burock has been the Medical Coordinator there since 2014. She also heads the first liaison office of the European Organisation for Research and Treatment of Cancer (EORTC) in Germany, which was established at Charité in 2013. The goal of this nonprofit organization, which is headquartered in Brussels, is to improve standards in the treatment of cancer in Europe (see page 28 – 29).

Currently, as a physician and coordinator of the CCCC, Burock also consults with patients who are participating in clinical trials. At 38, she sees day-to-day work in oncology as a valuable challenge. “We all know that life is finite. The important thing is for us to take care of people who are severely ill, and I think it is also nice when I can follow patients on a longer part of their journey.” Burock thinks the doctor-patient relationship is the crucial factor: “You just have to ‘click’ with each other.”

**Her goal: to make a contribution to improving prevention, early detection, and treatment of cancer in Germany and Europe.**



*Susen Burock specializes in the treatment of tumor patients and is dedicated to cancer research at the European level. For her doctoral thesis, she did research from 2012 to 2014 at the EORTC in Brussels. Based on thousands of documented cases of the disease, she studied the role of age in cancer.*

Photo: private collection

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Institute of Bioinformatics

**Professor Dr. Charlotte Kloft**  
Institute of Pharmacy

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