NUTRITION RESEARCH IS HEALTH RESEARCH
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To strengthen health research, DIfE participates in numerous national collaborative projects – here we take a closer look at these “beacon” projects.

Transfer research findings as soon as possible from lab to patient: In order to achieve this goal departments and research groups at DIfE collaborate closely – an example.

Assist personal career plans and support independent research – Find out what that means to us and get acquainted with two up-and-coming scientists.

How many third-party-funded projects were ongoing at DIfE? What were the top DIfE projects in the media? And overall, how many people work here? DIfE in numbers.

How does our nutrition affect the development of overweight, diabetes and aging, and what role does the psyche play?
The years 2017 and 2018 were marked by great events and changes. We celebrated our 25th anniversary, planned a new research building and prepared for the Leibniz evaluation in 2019. Professor Tim J. Schulz received one of the most prestigious awards worldwide, the Paul Ehrlich and Ludwig Darmstaedter Award for Young Researchers. We said farewell to a number of senior scientists and their teams – because new challenges beckoned or because they commenced their well-deserved retirement. On the other hand, we delightfully welcomed two new professors: nutritionist Kristina Norman and psychologist Soyoung Q. Park. A selection of other events including outstanding projects, activities, visits and more can be found in our timeline 2017/2018 beginning on page 14.

The topic of nutrition is increasingly becoming the focus of public interest. This is underscored, inter alia, by the current evaluations of the Global Burden of Disease Study. According to the study, poor dietary habits are responsible for more deaths than all other risks worldwide – including tobacco consumption. Among the factors that pose the greatest risk to health are high blood pressure, high blood glucose levels and overweight. All three factors can be influenced by diet. Particularly problematic is that associated secondary diseases, such as type 2 diabetes, are on the rise worldwide – increasingly also among the younger generations.

The aim of our scientists is to contribute to new approaches in order to halt these developments. The results of their research have been published in numerous national and international journals. Since 2017, 383 publications have resulted from the work at DIfE. Beginning on page 29 we present 13 selected scientific highlights.

An important component of the strategic concept of DIfE is the training of young scientists. We promote personal career plans with our PhD and postdoc programs and support talented young scientists in conducting autonomous and independent research. You will meet two exceptionally successful and talented young scientists in the interviews starting on page 56.

We wish you an enjoyable read!
ABOUT DIFE

The research at DIfE is centered upon human health. The different areas at the Institute work hand in hand and are led by Dr. Birgit Schröder-Smeibidl, administrative director, and Professor Tilman Grune, scientific director.

THE SCIENTIFIC AREA

Tilman Grune (back row, on the right) and the heads of the scientific departments (from left to right) Susanne Klaus, André Kleinridders, Soyoung O Park, Annette Schulmann, Tim J. Schulz, Matthias Schulze, Kristina Norman and Krasimira Aleksandrova.
Using mouse models, the Department of Experimental Diabetology identifies genetic variants and epigenetic changes, which with a corresponding diet lead to obesity, insulin resistance and type 2 diabetes. Furthermore, the department elucidates the underlying mechanisms of disease genes and tests dietary interventions with which the insulin resistance can be improved and the destruction of the insulin-producing beta cells in the pancreas can be inhibited. The focus is on learning more about the function of diabetes and obesity genes and on developing strategies for new therapeutic approaches.

"The discovery of (epi)genetic changes is important in order to identify signaling pathways that can be controlled by drugs, but also by nutrition and physical activity."

Department of Adipocyte Development and Nutrition

Head: Prof. Dr. Tilman Grune, Scientific Director

The Department of Adipocyte Development and Nutrition conducts research on the influence of aging processes and nutrition on the formation and function of adipocytes. On the one hand, the focus is on the assessment of the role of white adipocytes in the development of age-related diseases. Using mouse and cell culture models, the department also investigates the molecular mechanisms that lead to a decrease in brown adipose tissue in old age and thus promote the development of obesity. In contrast to white adipose tissue, brown adipose tissue has a high potential to dissipate energy in the form of heat. That is why it is a potential target for the effective treatment of obesity and other diseases associated with the metabolic syndrome.

"Why do older people often have an atypical accumulation of adipocytes in the bone marrow or muscles? In what way does this fat contribute to diseases of the musculoskeletal system? What mechanisms are involved? These are important questions that we need to elucidate in order to develop new therapies."

Department of Experimental Diabetology

Head: Prof. Dr. Annette Schümann

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"The discovery of (epi)genetic changes is important in order to identify signaling pathways that can be controlled by drugs, but also by nutrition and physical activity."

Department of Molecular Toxicology

Head: Prof. Dr. Tim J. Schulz

The Department of Molecular Toxicology investigates the relationships between nutrition and aging processes on the basis of cell cultures, mouse models, and human cohorts. The department investigates the redox-dependent degradation of endogenous proteins (proteolysis) as well as the occurrence of dietary and redox-dependent biomarkers during the aging process. The focus is on age-dependent changes in the pancreatic beta cells as well as in the cells of heart and skeletal muscles and their metabolic consequences.

"Insights on how we can maintain the functionality of cells during the aging process are of fundamental significance for a long and healthy life."

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Head: Prof. Dr. Kristina Norman
The Department of Nutrition and Gerontology, which was established in January 2018, studies the interrelationships between nutrition and body composition in old age on the basis of clinical and experimental human intervention studies. The focus is on body composition and muscle mass because it plays a crucial role in physical fitness/capacity and healthy aging. The aim is to develop innovative nutrition concepts for the preservation and increase of muscle mass and to better understand the complex mechanisms in age-associated sarcopenia.

Head: Prof. Dr. Soyoung Q Park
The Department of Decision Neuroscience and Nutrition investigates relationships between nutrition, brain function and metabolism. On the one hand, the department studies how consumer decisions are made in the brain and how these can be changed. On the other hand, it studies how what people eat or drink influences their decision-making and behavior. By studying psychological mechanisms, the department aims to develop approaches to influence eating behavior and food choice in a positive way. Soyoung Q Park took up her position as department head in December 2018.

Department of Decision Neuroscience and Nutrition

> As an integral part of everyday life, food can induce many different biochemical processes and even impact our actions and thinking.«

Department of Nutrition and Gerontology

> What we eat and drink has a major impact on the risk of type 2 diabetes, myocardial infarction and stroke. That is why it is important to maintain a healthy diet over the long term.«

Head: Prof. Dr. Matthias Schulze
The Department of Molecular Epidemiology evaluates the relationships between nutrition and lifestyle and the risk of cardiometabolic diseases, especially type 2 diabetes and its complications. Its research concept is based on the hypothesis that these diseases develop through an interaction of genetic factors and lifestyle characteristics. In particular, the following studies serve as a basis for research: the EPIC Potsdam Study and its further developments (EPIC-DZD, the NutriAct Family Study), the EPIC consortium, the RODAM Study and in future the GNC Health Study.

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Head: Prof. Dr. Kristina Norman
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> The preservation of muscle mass in old age is of great significance and important for functional performance, but also for metabolic health.«
In order to understand aging processes and the causes of obesity we must find out how the different organs of the body cooperate in the regulation of energy flow and metabolism.

Department of Physiology of Energy Metabolism

Head: Prof. Dr. Susanne Klaus

The Department of Physiology of Energy Metabolism investigates how the macronutrients proteins, fats and carbohydrates interact with substrate and energy metabolism. The work focuses on the interplay of important organs involved in the energy metabolism of the body, in particular the intestines, liver, adipose tissue and skeletal muscles. Based on animal models, the department aims to identify the physiological and molecular mechanisms involved in the development of obesity and age-associated changes in energy and substrate metabolism. Moreover, the researchers seek to characterize these mechanisms more precisely.

Insulin action in the brain is essential for a healthy metabolism and mental health.

Young Investigator Group Central Regulation of Metabolism

Head: Dr. André Kleinridders

The Young Investigator Group Central Regulation of Metabolism studies the interaction of nutrients and hormone-regulated signaling pathways in the brain. The focus is on the hormones insulin and leptin, which are released by the beta cells of the pancreas or by adipocytes. By means of cell cultures and mouse models, the group is investigating the molecular mechanisms that contribute to the development of insulin or leptin resistance in the central nervous system. The results should help to improve the treatment options for the metabolic syndrome as well as for neurodegenerative and neurological diseases, such as Alzheimer’s disease and depression.

Our epidemiological studies show how important nutrition and exercise are in old age to keep the metabolism and immune balance in a healthy range and thus prevent numerous diseases.

Senior Scientist Group Nutrition, Immunity and Metabolism

Head: Dr. Krasimira Aleksandrova

The Senior Scientist Group Nutrition, Immunity and Metabolism carries out epidemiological research to elucidate the role of nutrition for the metabolism and the immune system. In this context, the group focuses on the pathogenesis and progression of age-related diseases. To this end, it identifies new biomarkers such as cytokines, chemokines and adipokines in the context of chronic inflammation, colon cancer, cardiovascular disease, infirmity and total mortality. The group develops biomarker-based risk prediction models from this data and evaluates anti-inflammatory nutrition strategies.
The Department of Clinical Nutrition investigates the pathogenesis and development of the most common diseases of civilization such as obesity, fatty liver and type 2 diabetes. The focus here is on the interaction between the molecular regulatory mechanisms of the human metabolism and specific food ingredients or diets. The aim of the department is to provide a sound scientific basis for better nutrition strategies and individual dietary recommendations to prevent metabolic syndrome. Due to the retirement of its head, the department was closed at the end of September 2018 and is currently operating as a research group.

»Western diets are characterized by a high proportion of sugar, white flour, saturated fats, a lack of vegetables and fruit as well as a surplus of meat products. This is a fatal combination that promotes diet-related diseases worldwide.«

The Department of Epidemiology primarily investigates the influence of nutrition on metabolic processes and the risk of diseases such as cardiovascular disease, type 2 diabetes and cancer. It established the Potsdam Cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC) at DIfE and developed it further over the course of 20 years. The data of the EPIC Study are used to identify nutritional and metabolic factors which significantly contribute to the occurrence of diseases in the population. To this end, the department also focuses on the further development of statistical methods in the field of nutritional epidemiology. Due to retirement, the department was closed in December 2018.

»Nutrition research must meet high quality standards also with regard to communication so that the scientific results not only contribute to an increase in knowledge but also, as such, are perceived by the public.«

The Department of Gastrointestinal Microbiology investigates the effect of nutrition on development, composition and activity of the microbial community colonizing the intestine. It also investigates the role that gut microbiota plays in the development of obesity, inflammatory bowel diseases and colon cancer. One focus is on the intestinal bioactivation of non-nutritive, plant-derived food ingredients such as polyphenols. To this end, scientists in the department characterize the corresponding metabolic pathways and the responsible bacterial species. The department was closed in March 2019 due to retirement.

»A well-functioning microbiota contributes significantly to a healthy life. Through nutrition we can influence which microorganisms colonize our gut.«

In summary:

- The Department of Clinical Nutrition focuses on the interaction between human metabolism and specific food ingredients or diets.
- The Department of Epidemiology has established the Potsdam Cohort and focuses on the influence of nutrition on disease risk.
- The Department of Gastrointestinal Microbiology investigates the role of gut microbiota in diseases and the bioactivation of food ingredients.

»A well-functioning microbiota contributes significantly to a healthy life. Through nutrition we can influence which microorganisms colonize our gut.«
Department of Molecular Genetics

Head: Prof. Dr. Wolfgang Meyerhof
The Department of Molecular Genetics investigates the sense of taste on the molecular and cellular level, which has a decisive influence on food intake. It examines the structure, function and regulation of taste receptors and identifies new taste modulators. In addition, the department investigates how the information perceived by taste buds of the tongue are transmitted to the brain and processed. It also deals with the genetically determined variability of the human taste sensation and its significance for the formation of food preferences and dislikes. Due to retirement, the department was closed in September 2017.

Young Investigator Group Psychophysiology of Food Perception

Head: Dr. Kathrin Ohla
The Young Investigator Group Psychophysiology of Food Perception investigates how the human brain processes information about the taste, smell and appearance of food. The behavior and brain activity is measured by electroencephalography (EEG). The group also investigates how these different sensory information interact with each other and how they are translated into behavior, for example, in the acceptance or rejection of food. The Young Investigator Group was closed in December 2017.

EPIC Study

The European Prospective Investigation into Cancer and Nutrition (EPIC) is one of the largest long-term studies worldwide. The aim is to investigate the influence of nutrition on the development of cancer and other chronic diseases. Since 1994, DIFE has been responsible for the EPIC Potsdam Study with around 27,500 study participants.

Metabolic Syndrome

The metabolic syndrome is characterized by the simultaneous occurrence of severe overweight, high blood pressure, insulin resistance and altered blood lipid levels. People with metabolic syndrome have an increased risk of type 2 diabetes and cardiovascular disease.

«The sense of taste is so far the least explored sense in humans and animals – despite its unique role in the assessment of the composition and quality of our food.»

«Our research shows that bitter receptors – apart from their function as taste sensors – are also involved in the regulation of multiple physiological processes.»
The Human Study Center (HSZ) supports scientists in the planning, organization, and implementation of epidemiological, experimental, and clinical studies on humans in compliance with all data protection laws and regulations and ethical standards. In addition to expertise, it also provides the premises and personnel for the studies. The Human Study Center also manages the biobank, where the collected biological samples are prepared and stored for later laboratory analyses.

Max Rubner Laboratory
Scientific Director: Dr. Anja Voigt (l.)
Veterinary Management: Dr. Christine Krüger (r.)
The Max Rubner Laboratory (MRL) is the experimental animal facility at DIfE. Here special mouse and rat strains have been established and characterized to analyze the causes of nutrition-related diseases. Modern animal husbandry rooms, measuring equipment and technical facilities form the basis for a high animal welfare standard and enable specific investigations. The Animal Welfare Officer advises the researchers on aspects of animal welfare law as well as on the application and implementation of animal experiments in the sense of the 3R concept. According to this, animal experiments should be replaced as far as possible by alternative methods (Replace). The number of animals (Reduce), and their stress and discomfort (Refine) should be limited to an absolute minimum.

Mice also suffer from genetically determined obesity and type 2 diabetes. Therefore, they represent a useful model for research into causes and prevention.

Human Study Center and Biobank
Head: Dr. Manuela Bergmann
The Human Study Center (HSZ) supports scientists in the planning, organization, and implementation of epidemiological, experimental, and clinical studies on humans in compliance with all data protection laws and regulations and ethical standards. In addition to expertise, it also provides the premises and personnel for the studies. The Human Study Center also manages the biobank, where the collected biological samples are prepared and stored for later laboratory analyses.

In addition to the EPIC Potsdam Study, we were able to successfully continue the NutriAct Family Study and the NutriAct Intervention Study. Thus, the Human Study Center is steadily evolving.

The GNC Health Study is a veritable treasure trove of epidemiology. We are very excited to see what insights the first analyses will bring.

GNC Study Center Berlin-South / Brandenburg
Head: Dr. Sylvia Gastell
The GNC Study Center Berlin-Süd / Brandenburg, which has been run by DIfE since 2015, is located in Berlin-Steglitz. It is one of 18 study centers of the GNC Health Study nationwide and examines a total of 10,000 subjects between the ages of 20 and 69 years. Blood, urine and stool samples are collected from the study participants, who undergo extensive tests and are asked about their lifestyle. After four to five years, the second major round of examinations will take place. For further information, see page 72.
Top-level research at DIfE would not be possible without the staff of the administration and the technical infrastructure. They apply for and manage funds, search for and find suitable experts and ensure smooth processes at the workplace.

**Administrative Units**
- Research Management/Technology Transfer (FMTT)
- Budget and Accountancy (HRW)
- Information Technology (IT)
- Human Resources and Social Services (PSW)
- Planning/Building Service (P/Bau)
- Facility Management/General Services (T/B)
- Central Procurement/Contracting Office (ZBV)

»**With our new laboratory and office building, we are constructing rooms according to the highest scientific standards, especially for the Human Study Center. We are thus creating optimal conditions for the research campus Nutrition and Health in Potsdam-Rehbruecke.«

Dr. Birgit Schröder-Smeibidl, Administrative Director

↑ Birgit Schröder-Smeibidl (front left) with the unit heads (front row from left to right): Bärbel Ozierenski (PSW), Frank Uschkoreit (P/Bau), Anja Krüger (HRW) (back row from left to right) Mario Rudolph (T/B), Wolfgang Lux (IT), Marion Krause (ZBV) and Maria Löwinger (FMTT).
2017 AND 2018 IN RETROSPECT

Who came to visit DfE? What kind of projects and collaborations have been initiated? And what events did DfE participate in? In this timeline, we look back on the most important events of the last two years.

January 13th

State Secretary Visits DfE

Dr. Ulrike Gutheil, Brandenburg state secretary, and Dr. Claudia Herok, chair of the Board of Trustees, both from the Ministry of Science, Research and Culture in Brandenburg, visit DfE to learn about the status of research projects and collaborations as well as the new building and the planned research campus.

March 1st

Brandenburg Health Campus – Starting Signal for Scientific Networking

As partner of the collaborative research project “Cardiovascular Health in Non-Metropolitan Regions of Brandenburg” within the Brandenburg Health Campus, DfE can contribute its expertise in nutrition and health research to the study and treatment of cardiovascular disease in old age. For this purpose, funds totaling 489,700 euros have been provided for a period of two years.
April 3rd

Visit of a Romanian Delegation

Representatives of the Regional Development Agency Centru visit DIfE. The basis for a possible cooperation is supported by the application of SUSFOOD 2 for EU funding. DIfE’s experience in technology transfer is of particular interest for the Romanian delegates.

April 5th

Potsdam Diabetes Self-Help Group Visits DIfE

15 members of the Potsdam self-help group (pump, type I and type II) of the Brandenburg State Association of the German Diabetic Federation (Deutscher Diabetiker Bund vom Landesverband Brandenburg e.V.) visit the Department of Experimental Diabetology to learn about the latest findings of diabetes research.

April 27th

Leibniz President Matthias Kleiner at DIfE

The Board of Directors and senior scientists of DIfE welcome Professor Matthias Kleiner, president of the Leibniz Association and present their recent findings in nutrition research at the Institute. Afterwards, Kleiner exchanges ideas with national and international doctoral students and young DIfE researchers.

May 1st

European Joint Project FAME Launched

The international three-year joint project “Fatty Acid Metabolism – as a Marker for Nutrition and Cardiometabolic Health” (FAME) receives a grant of 300,000 euros from the EU Joint Programming Initiative “Biomarker”. FAME is coordinated by Professor Matthias Schulze, head of the Department of Molecular Epidemiology. In the project, based inter alia on existing biological samples and data on nutrition and phenotypes of cohort studies, researchers identify new lipid metabolism biomarkers for cardiovascular and metabolic diseases.

May 13th

5th Potsdam Day of Science

DifE scientists inform visitors of the research camp on the grounds of the Science Park in Potsdam-Golm about the topic “The Big Three: Fats, Proteins and Carbohydrates”. In interactive games, the camp attendees learn important facts about the macronutrients. A special highlight: a TV shoot for an RBB documentary about the DifE–German Diabetes Risk Score®.

May 24th – 27th

Diabetes Congress in Hamburg

Professor Annette Schürmann, head of the Department of Experimental Diabetology, and Professor Dirk Müller-Wieland host the 2017 Diabetes Congress in Hamburg. The focus is on improving the comprehensive care of diabetes patients with multimorbidity and developing new therapeutic strategies and measures to prevent diabetes.
June 21st – 23rd

OCC and SFRR-E Hold a Joint Meeting in Berlin

Under the leadership of Professor Tilman Grune, scientific director of DIfE, the joint annual meeting of the Oxygen Club of California (OCC) and the Society of Free Radical Research-Europe (SFRR-E) takes place in Berlin. A total of 350 scientists and 43 national and international speakers discuss the topic Metabolic Stress and Redox Regulation.

June 14th

DAK Company Run Potsdam

52 employees take part in the DAK Company Run and successfully complete the five-kilometer route along historic places in Potsdam. The DIfE team participates in the run for the eighth time.

July 6th

Food Industry Dialog Days

At the Food Industry Dialog Days in Berlin, DIfE and the NutriAct competence cluster conduct various taste and smell tests with visitors. The Dialog Days are organized by the Cluster Food Industry Brandenburg, in which DIfE also participates and to which it contributes its scientific expertise.
September 19th

A Quarter Century of Nutrition Research

DIfE celebrates its 25th anniversary together with more than 400 guests. The anniversary celebration begins with a scientific symposium. An official ceremony and a big summer party round off the program. Among the prominent guest speakers are Dr. Martina Münch, Brandenburg science minister, Professor Oliver Günther, president of the University of Potsdam, Dr. Renate Loskill of the Federal Ministry of Education and Research, and Professor Matthias Kleiner, president of the Leibniz Association.

August 29th

INRA Visits DIfE

Leading scientists of the French agriculture research institute Institut national de la recherche agronomique visit DIfE accompanied by a delegation of the Leibniz Association and members of the French Embassy. The focus is on an exchange of information and experiences regarding current research approaches in the field of food and nutrition research.

November 14th

Guests from Colombia

A 10-member scientific delegation from Medellin, Colombia, a city of more than 2.5 million inhabitants, and a representative of the Colombian Embassy in Germany exchange ideas with DIfE about current research topics and about the joint research project NutriAct.
**November 17th**

**Outstanding Commitment for Trainees**

The federal network “Vocational Training without Borders” honors DIfE for its commitment to its trainees to enable training stays in foreign countries. Since 2011, seven trainees have gathered international experience through internships in other countries, e.g. in Sweden, England and Malta.

**December 13th**

**Master’s Students from Jena Visit DIfE**

23 Master’s students from the Jena Institute for Nutrition Sciences of Friedrich Schiller University Jena, accompanied by their professor Michael Glei, visit DIfE and exchange ideas with DIfE doctoral candidates.
March 10th

**Funding for European-Latin American Research Project**

Scientists of the Department of Molecular Toxicology are partners in a three-year transnational research project “High Fat Diet, Microbiota and Neuroinflammation in the Progression of Alzheimer Disease” and receive a grant of 100,000 euros. The project strengthens the cooperation of the EU with Latin America.

January 1st

**New Department: Nutrition and Gerontology**

The nutritionist Kristina Norman accepts the joint appointment of the Faculty of Science of the University of Potsdam and DIfE to a W2 professorship “Nutrition and Gerontology” and becomes head of the new Department of Nutrition and Gerontology at DIfE. Norman and her research team study how age-associated changes in body composition affect metabolic processes and physical capacity.
March 22nd – 23rd

Workshop – Dietary Proteins of the Future

By 2050, up to 50 percent more food will be needed for the world’s population. In order to find solutions for sustainable food security, DIfE, together with nutrition and agricultural scientists, climate researchers and agricultural technicians from the Leibniz Research Alliance “Sustainable Food Production and Healthy Nutrition”, is conducting the two-day workshop “Dietary Proteins of the Future”. The focus is on traditional and alternative protein sources.

April 26th

Future Day for Boys and Girls in Brandenburg

14 boys and 10 girls aged 12 to 17 are given the opportunity to take a closer look at the training vocations offered by DIfE and get a view behind the scenes of a nutrition research institute.

May 1st

Start of the 2nd Funding Period of the GNC Health Study

To continue the GNC Health Study, DIfE is to receive a grant of almost 4.2 million from the federal government, the state of Brandenburg and the Helmholtz Association until March 2023. The GNC Health Study conducts research on chronic diseases such as diabetes in order to improve prevention, early detection and treatment.
May 29th

Artists Exchange Ideas with Nutrition Researchers

In a speed dating session, 15 students of the Visual Communication course at the University of the Arts Berlin exchange ideas with five young DIfE scientists. The background to the visit is an art project on the subject of “Eating and Drinking”.

June 1st

BMBF Approves 2nd NutriAct Funding Period

The Federal Ministry of Education and Research decides to continue funding of the Competence Cluster NutriAct for another three years with 6.4 million euros. In interdisciplinary cooperation the cluster project contributes to improve the health status of the “50+” population group.

May 16th

Emeriti of the University of Potsdam Visit DIfE

Dr. Birgit Schröder-Smeibidl, administrative director of DIfE, welcomes theemeriti professors of the Faculty of Science of the University of Potsdam. The visitors obtain comprehensive insight into the administrative, scientific and animal experimental work of DIfE.
June 26th

Come and Enjoy! – Opening of the Caricature Exhibition

Professor Tim J. Schulz, head of the Department of Adipocyte Development and Nutrition, gives the opening speech for the exhibition “Come and Enjoy! – Caricatures Thematizing Nutrition” at the Brandenburg State Center for Political Education. Twelve caricaturists humorously dedicate their works to a variety of topics related to nutrition.

June 29th

Department Proton Therapy of Helmholtz-Zentrum Berlin Visits DIfE

Dr. Birgit Schröder-Smeibidl welcomes researchers of the Department of Proton Therapy for Ocular Tumors from Helmholtz-Zentrum Berlin and gives them insight into the research work at DIfE.

June 30th – July 1st

City for a Night

Under the motto “Lights on!”, DIfE participates in the “City for a Night” in Potsdam’s Schiffbauergasse and brings “light into the food jungle”. In addition to insights into the research work of DIfE, interested visitors also learn about various forms of nutrition.
August 27th

Art Inspired by Science

Dr. Violetta Andriolo, a young scientist in the Department of Epidemiology, unveils her sculpture “Us opens” across from the DIfE main building. With the sculpture, which is a gift to the municipality of Nuthetal, the 34-year-old physician aims to highlight the importance of transformation for a healthy life.

August 27th – September 24th

Exhibition “Healthy Aging – Various Interdisciplinary Facets of a Phenomenon”

The Leibniz Research Alliance “Healthy Aging” and the Association “proWissen Potsdam e.V.” open the exhibition “Healthy Aging – Various Interdisciplinary Facets of a Phenomenon” at the WIS in the Educational Forum Potsdam. WIS means Wissenschaftsetage, “exhibition floor of science”. In 16 posters, the inexorable process of biological aging is thematized. Among these are three DIfE posters on the topics of sarcopenia, micronutrients and nutrition in old age.

July 1st

Focus Area DynAge Goes into the 7th Funding Round

Three proposals with DIfE participation receive funding in the Focus Area DynAge. DIfE researchers cooperate with scientists of FU Berlin and Charité – Universitätsmedizin Berlin and study age-related disease processes.

2018
October 8th – 9th

International Workshop DAME

The Department of Epidemiology, in cooperation with the working group on nutritional epidemiology of the German Society for Epidemiology, leads the international workshop “Dietary Assessment and Measurement Error” (DAME) at DIfE. Participants discuss the future of nutrition survey instruments and the possibilities for statistical evaluation of the collected data.

November 8th

NutriAct Annual Meeting and Kick-Off of the 2nd Funding Phase

Brandenburg’s Science Minister Dr. Martina Münch and Professor Oliver Günther, president of the University of Potsdam, open the fourth annual NutriAct conference and kick-off event of the second funding phase. Numerous experts give lectures about the topics of food selection, product development and Future Food.

December 1st

New Department: Decision Neuroscience and Nutrition

The psychologist and brain researcher Soyoung Q Park accepts the joint appointment of a W3 professorship of DIfE and Charité – Universitätsmedizin Berlin. From the beginning of 2019, she plans to build up the new Department of Decision Neuroscience and Nutrition at the Institute. The new department strengthens the Research Focus III “Biological Foundations of Food Preferences and Dietary Behavior.”
Research Focus Areas at DIfE
Researchers at DIfE are investigating the influence of nutrition on the body. The aim of their work is to develop new strategies for the prevention and treatment of diet-related diseases and to create a scientific basis for dietary recommendations. The scientists are working to determine the bases for these recommendations by means of a combination of experimental and applied research using cell cultures, animal models and studies with human cohorts. Thus, the insights gained on the molecular level can be verified in epidemiological study populations or in intervention studies, and then be transferred to humans by means of translational research. Here the focus is on three questions of particular relevance to the public:

1. How does our nutrition affect the development of obesity and its consequences, especially type 2 diabetes?

2. What role does nutrition play for a long and healthy life, especially in the second half of life?

3. How do physiological and psychological processes influence our food preferences and dietary behavior?

Use of a robot for automatic pipetting of reaction mixtures for DNA replication.
More than half of the adults in Germany are overweight and almost a quarter are even obese. Especially the consequences of severe overweight are problematic: the World Health Organization regards obesity as one of the main causes of cardiovascular diseases and diabetes as well as certain types of cancer. In Germany, currently more than seven million people have type 2 diabetes, and the trend is rising. The affected individuals react inadequately to the hormone insulin, which leads to elevated blood glucose levels. This can cause strokes, heart attacks, retinal damage, kidney damage and neuropathy. The life expectancy and quality of life of people with type 2 diabetes are significantly reduced. Lifestyle factors play an important role, but are only a contributing factor for the development of the disease. The aim of the scientists within Research Focus I is to elucidate the causes of obesity and type 2 diabetes as well as to develop protective and preventive nutrition strategies.

Main Objectives of Research Focus I

1. Identification of gene variants and epigenetic changes, which in interaction with defined dietary patterns lead to the development of obesity, insulin resistance and type 2 diabetes

2. Elucidation of the regulation of normal and pathological fat storage

3. Decoding the regulation of energy turnover and the role of gut bacteria in the development of obesity
Changes in the epigenetic code favor fatty liver

Obesity, the metabolic syndrome and type 2 diabetes are complex metabolic diseases which develop due to the interaction of genetic and epigenetic factors and the influence of lifestyle. About one fourth of the population has fatty liver – often undetected – which is not due to alcohol consumption. One of the adverse consequences of fatty liver is that it significantly increases the risk of type 2 diabetes. The underlying molecular mechanisms of non-alcoholic fatty liver disease are still poorly understood.

In order to identify epigenetic marks contributing to fatty liver, the Department of Experimental Diabetology, headed by Annette Schürmann, carried out a genome-wide screening on mice. The researchers observed that in animals with a tendency to overweight the DPP4 gene showed reduced methylation at certain sites. Due to this epigenetic alteration, the liver produced more of the enzyme DPP4. Notably, the research team discovered the change in methylation before the mice developed fatty liver. This is an indication that the changes in the epigenetic code are the cause and not the result of fatty liver.

Together with colleagues from Sweden and France, the DIfE research team succeeded in transferring the results from the animal model to humans. Thus, further analyses showed that people who have an increased expression and at the same time a decreased DNA methylation of the DPP4 gene in the liver are more often affected by fatty liver than those with low DPP4 levels. Furthermore, in the plasma of insulin-resistant patients and patients with fatty liver, the DPP4 activity was increased, as could be shown in a collaborative project with colleagues from the University of Tübingen. In addition, the department also carried out feeding experiments with genetically modified mice whose liver cells produced more DPP4. If the animals were fed a high-fat diet, they quickly developed a high body weight, insulin resistance and fatty liver, in contrast to “normal” animals.

Further experiments showed that amino acids – i.e. the building blocks of proteins – increase the amounts of DPP4 in liver cells. Correspondingly, a low-protein diet in mice reduced the DPP4 levels due to changes in the epigenetic code. The results clearly show that dietary components can trigger epigenetic changes that can influence the function of organs like the liver.

Original Publications


DNA Methylation

DNA methylations belong to the so-called epigenetic changes. They act like a step-adjustable gene switch, via which the production of the corresponding proteins is increased or decreased, which may impact the metabolism. In contrast to the DNA sequence, epigenetic changes react strongly to external factors such as nutrition or stress.

DPP4

DPP4 stands for dipeptidyl peptidase 4. The enzyme cleaves intestinal hormones such as glucagon like peptide 1 (GLP1). GLP1 causes the pancreas to release more blood glucose-lowering insulin into the blood. The gut hormone also increases the feeling of satiety and thus protects against overweight. With the cleavage by DPP4 the protective effect of GLP1 is lost.
Mediterranean Diet Is Health Promoting – Not Only for People in Southern Europe

New analyses of the large long-term study European Prospective Investigation into Cancer and Nutrition (EPIC)-Potsdam show that a Mediterranean diet – even outside the Mediterranean area – can reduce the risk of type 2 diabetes. Furthermore, with a diet containing vegetables, fruits, olive oil et cetera, people can probably also reduce their risk of heart attack.

This is the result of a study by scientists of the Department of Molecular Epidemiology together with colleagues from the NutriAct competence cluster.

According to current scientific knowledge, the Mediterranean diet consisting of plenty of vegetables, fruit, nuts, seeds, fish, legumes, cereals, olive oil and a little meat, dairy products and moderate alcohol consumption protects against cardiovascular diseases, type 2 diabetes and cancer. However, it was not yet clear whether the diet, which is socially and culturally influenced by the Mediterranean region, could also reduce the risk of chronic diseases within Germany. Matthias Schulze and his team investigated whether the positive effects of the Mediterranean diet also occurred among the Potsdam participants of the EPIC Study, despite cultural differences.

The scientists evaluated the data of around 27,500 people. Study participants who adhered relatively strictly to the diet had a 20 percent lower risk of developing type 2 diabetes compared to those who only ate a partial Mediterranean diet. Moreover, the researchers observed that people who followed the Mediterranean diet had a lower risk of heart attack.

In addition to the Mediterranean diet, the interdisciplinary team also investigated the influence of the Nordic diet on chronic diseases. This diet consists of foods common in northern Europe such as apples, pears, berries, root vegetables, cabbage, wholemeal rye bread and cereal flakes. It also includes fish, dairy products, potatoes and regionally typical vegetable fats. The epidemiologists did not observe any clear relationships to chronic diseases. Nevertheless, their results suggest that people who follow this kind of diet may be less likely to suffer a heart attack.

In Germany, currently more than seven million people have type 2 diabetes, and the trend is rising.«

Original Publication
How Sugar Promotes Obesity and Its Consequences

Sugar is said to play a major role in the development of obesity, type 2 diabetes and associated diseases. Scientists of the Department of Clinical Nutrition have found new evidence that the gut hormone glucose-induced insulinotropic peptide (GIP) plays a decisive role in this process. GIP is known for a number of adverse effects. For example, the gastrointestinal hormone promotes the development of fatty liver, insulin resistance and inflammatory reactions.

The research team led by Andreas F. H. Pfeiffer has already previously carried out studies on humans to investigate the role of gut hormones in glucose metabolism. In these studies, the researchers compared isomaltulose to ordinary household sugar. Like household sugar, isomaltulose consists of glucose and fructose, but it is split much more slowly. Following administration of household sugar, GIP levels of study participants increased drastically after only a few minutes. Isomaltulose, on the other hand, resulted only in a mild increase in GIP, the peak of which was only reached after an hour.

The disparate metabolic effects are due to the chemically different bonds between glucose and fructose. Whereas the digestive enzymes quickly split the household sugar into two monosaccharides, this process takes longer with isomaltulose. Thus, a large proportion of isomaltulose passes intact through the upper sections of the small intestine without significantly stimulating GIP release from K-cells.

In subsequent analyses, the team investigated mice that, due to genetic changes, did not have a receptor for GIP. Although these animals were fed household sugar, they maintained their weight and did not develop insulin resistance or fatty liver. The results provide further evidence that the hormone response, that is, the increased release of GIP, mediates the adverse effects of household sugar. The researchers assume that GIP is similarly responsible for the harmful metabolic effects of sugar-rich foods with a high glycemic index.

Original Publication


Glycemic Index

The glycemic index (GI) of a food indicates how strongly the carbohydrates it contains increase blood glucose levels. Complex carbohydrates, such as wholemeal bread, are broken down gradually, causing blood glucose levels to rise at a slow rate. In contrast, simple carbohydrates, for example from white bread or sugary soft drinks and sweets are absorbed quickly into the blood and cause the blood glucose level to rise rapidly. The blood glucose peaks can cause a sudden sharp drop in blood glucose levels sometime after eating. The result: hunger and an increased risk of overweight due to increased food intake.
Fatty Acids in the Blood Provide Information about Dietary Fiber Intake and Diabetes Risk

Fiber is said to have a number of health benefits. Hence, the fibers from whole grains, vegetables and fruits can for example reduce the risk of type 2 diabetes. So far, the mechanisms behind these positive effects are unknown. However, animal experiments indicate that liver cells have the ability to form the diabetic-protective odd-chain fatty acids (OCFAs) pentadecanoic acid (C15) and heptadecanoic acid (C17) from soluble fiber.

The scientists of the Department of Physiology of Energy Metabolism investigated whether the findings from the animal model are also applicable to humans: For one week respectively, healthy women and men were given either 30 grams of the insoluble fiber cellulose, 30 grams of the soluble fiber inulin or 6 grams of propionate, the salt of the short-chain fatty acid propionic acid. Propionic acid is produced when gut bacteria degrade soluble fiber such as inulin. Before and after each dose, the team of scientists headed by Karolin Weitkunat and Susanne Klaus determined the fatty acid levels in the blood. It was found that the consumption of cellulose did not affect the blood levels of C15 and C17 fatty acids. Inulin and propionate, however, led to a significant increase. Also, in cell culture experiments, the addition of propionate stimulated the production of both fatty acids in liver cells.

The results suggest previously unknown metabolic pathways through which fiber is utilized by the body. Further studies must show why the resulting long-chain fatty acids protect against type 2 diabetes. Since only a few people reach the recommended daily intake of 30 grams of fiber, C15 and C17 fatty acids could also be used as biomarkers to determine the dietary intake of soluble fiber – independently of frequently faulty self-reports by study participants.

Original Publication

Insoluble Fibers
Insoluble fibers are scaffolds and supporting substances of plants. They include lignin, hemicellulose and cellulose. The insoluble fibers are only partially degraded by the gut bacteria. They bind water in the colon. The binding causes the chyme to swell and soften. This promotes the movement of the bowel and causes the ingested food to be eliminated more quickly.

Soluble Fibers
The soluble fibers include pectin, resistant starches and inulin. The latter occurs naturally in plants such as Jerusalem artichokes and artichokes. The soluble fiber is broken down by the gut bacteria into short-chain fatty acids such as propionic acid. These serve the bacteria as a food source. In addition, the fatty acids, together with the resulting gases, make the stool bulkier and softer. Soluble fiber thus also ensures a stronger bowel movement and a shortened transit time.

Formation mechanism of OCFAs

fibers \[\rightarrow\] fermentation

colon

acetate

propionate

butyrate

propionyl-CoA

OCFAs

positive health effects

liver

\[\uparrow\]

\[\downarrow\]
How the Gut Bacterium Clostridium ramosum Promotes Obesity

It is known that certain gut bacteria affect body weight. So far, however, it is hardly understood how this effect comes about. A research team of the Department of Gastrointestinal Microbiology has discovered an important clue to the interaction between diet, metabolism of the host and a particular bacterium: The bacterium Clostridium ramosum causes specific cells in the intestinal epithelium of mice to reproduce more and release larger quantities of the neurotransmitter serotonin. Serotonin promotes fat absorption from the intestines, which makes the fat deposits grow faster.

Clostridium ramosum is a 10-micrometer bacterium, about 100 times smaller than a grain of sand. The spore-forming bacterial species is increasingly found in the gut of overweight people. It is unclear whether the weight gain is due to the bacterium. In animal experiments, the data situation is clearer. The team led by microbiologist Michael Blaut already observed in previous studies with mice that Clostridium ramosum promotes obesity by increasing the number of fatty acid transporters in the gut.

The group of researchers then continued to pursue this research further. In addition to mice, they also used intestinal organoids. The research team observed that Clostridium ramosum induces the intestines of the animals to generate more enterochromaffin cells. These specialized cells produce the neurotransmitter serotonin. Thus the bacterium can raise the concentration of serotonin in the intestine and increase the number of fatty acid transporters.

In particular, a diet high in fat could be problematic because the bacterium multiplies optimally under a high-fat diet. A possible consequence is increased body weight, which in the long term can lead to health problems. Increased cell counts of Clostridium ramosum were found in overweight people, but it is still unclear to what extent this bacterium in fact contributes to overweight and how this process can be slowed down by a particular diet.

Original Publication


Intestinal Organoids

Intestinal organoids are derived from stem cells and have properties similar to normal intestinal tissue. They are therefore also referred to as “mini-intestines”.

Enterochromaffin cells

produce serotonin, a tissue hormone and neurotransmitter. Serotonin is involved in digestive processes and can therefore influence food intake. Thus, it promotes for example the fat absorption from the intestine.
New Analysis Method: Dietary Patterns in Comparison

Nutrition plays an important role in the prevention and treatment of type 2 diabetes.

But which diet offers the greatest benefits? This was the question scientists of the Department of Epidemiology sought to answer with a new analysis method. The so-called network meta-analysis makes it possible to evaluate and compare many different forms of nutrition at the same time. Using this new analysis method, researchers led by Heiner Boeing analyzed 56 studies with a total of almost 5,000 participants. They concluded that the Mediterranean diet is best suited to improve the blood glucose levels of people with type 2 diabetes.

The researchers examined a total of nine diets. For this purpose, they looked at previously published individual studies – which usually compared only two diets – and further processed their results statistically. The chosen approach of the network meta-analysis made it possible to calculate both direct and indirect effects. Thus, even diets that were not tested in comparison to each other in the individual studies could be included in the evaluation of the effect.

The nine diets studied included the Mediterranean diet as well as the Paleo, the high-protein and the low-carb diet. Using the new method, the team of scientists ranked the nine nutritional forms according to their blood glucose lowering effect. In the ranking, the Mediterranean diet came in first, both in terms of the fasting and long-term blood glucose levels.

In order to prevent serious secondary diseases such as a heart attack or stroke, a well-controlled blood glucose level is important. Researchers suspect that, in addition to the components of the Mediterranean diet, also wholemeal products are beneficial to health. People with elevated blood glucose levels or already existing type 2 diabetes should therefore positively influence their glucose metabolism by following a mainly plant-based, fiber-rich diet.

Mediterranean Diet

The so-called Mediterranean diet consists of plenty of vegetables, fruits, nuts, seeds, fish, legumes, cereals and olive oil – but includes only small amounts of meat, dairy products and alcohol. Numerous studies show that the traditional cuisine of southern Europe protects against cardiovascular diseases, type 2 diabetes and cancer.
According to the Federal Statistical Office, about one in five people in Germany is older than 65. The number of elderly people has increased by more than 36 percent in the last 20 years. Aging is often associated with processes and serious illnesses limiting the quality of life: from muscle mass loss, frailty, loss of mobility and independence, to overweight, type 2 diabetes, heart disease and cancer. Especially in a society whose members are getting older and older, a long and healthy life becomes increasingly important. “Living healthier, aging better” – following this motto the development of innovative nutritional strategies could decisively contribute to an improved health status of the 50 plus generation and delay adverse effects of aging. In order to create the basis for this, scientists within Research Focus II are investigating the causes of diet-related impairments and diseases of older people. The emphasis is on examinations of the musculature and bone structure.

Main Objectives of Research Focus II

1. Investigation of changes in energy metabolism during aging and understanding the physiology of nutrient utilization in older people

2. Influence of cellular aging processes on the effect of food ingredients

3. Investigation of the relationship between body composition, functionality and physical fitness in old age
Diabetes Drug May Improve Healing of Bone Fractures

A high-fat diet impairs bone healing at an advanced age. Drugs that inhibit the enzyme dipeptidyl peptidase 4 (DPP4) may protect against bone fractures. In addition to its influence on the glucose metabolism, DPP4 apparently plays an important role in bone composition, as scientists of the Department of Adipocyte Development and Nutrition have shown.

It is well known that aging processes promote overweight. The international team led by stem cell researchers Thomas H. Ambrosi and Tim J. Schulz showed for the first time in a mouse model that advanced age, especially in combination with a high-fat diet, leads to an accumulation of adipocytes in the bone marrow. The fat cells increase the risk of bone fractures and disrupt blood formation in the bone marrow. This may explain why bone fractures heal worse in old age, especially when patients are overweight due to a high-fat diet.

In addition, the team of scientists succeeded in identifying a first molecular link that mediates the negative effects of adipocytes on bone healing. It is DPP4. The enzyme is well known from diabetes therapy. A number of medicines are used to block the effects of DPP4, thereby lowering blood sugar levels. The new findings suggest that another treatment indication – bone healing – could be added to this group of drugs. It is particularly advantageous that DPP4 inhibitors are already established in diabetes therapy. The drug is already used routinely in the clinic. Should the results of the mouse model be confirmed in patient examinations, the gliptins could in the future not only help diabetics in general, but also promote bone healing in older overweight patients and older people with diabetes.

Original Publication
Aging Processes are associated with the loss of many physiological functions, tissue changes and the accumulation of harmful substances. These manifest themselves in a reduced ability to regenerate, which can lead to various diseases and ultimately death. The pancreatic islets of Langerhans are also affected by these processes.

The aim of the Department of Molecular Toxicology is to investigate how the functions and structures of the endocrine beta cells of the islets of Langerhans change in healthy mice due to age. They observed that the cells produced enough insulin even in old age and thus prevented high blood glucose levels. In addition, the scientists found that the Langerhans islets grew with a constant number of cells depending on age. The amount of proliferation and differentiation markers, Ki-67 and PDX-1, decreased with age while the concentrations of the tumor suppressor protein p16 increased. These parameters indicate a loss of cell division capability. The body appears to compensate the reduced growth rate of the number of cells with an increase in islet size.

The research team led by Tilman Grune also found that there was an accumulation of advanced glycation end products (AGEs). Interestingly, AGEs accumulated exclusively in the blood vessels of the islets of old mice, which had elevated levels of inflammatory markers such as inducible nitric oxide synthase (iNOS) and 3-nitrotyrosine (3-NT).

The results show that the aging process is accompanied by pro-inflammatory reactions in the vascular system of the islets of Langerhans. Further studies will now investigate isolated islets to elucidate the mechanisms behind these age-related changes.

Islets of Langerhans

The islets of Langerhans are essential for the regulation of blood glucose levels, because they release the metabolic hormones insulin and glucagon. Due to aging processes, however, the hormone-forming cells of the islets change in the course of life. Among other things, endocrine cells lose their ability to secrete hormones, which can cause blood glucose levels to get out of control. So far, insufficient research has been done into why the islets change under normal blood glucose conditions in healthy people.

Advanced Glycation Endproducts

Advanced glycation endproducts, abbreviated AGEs, are formed when carbohydrates react with endogenous proteins without the involvement of enzymes. The agglomeration of AGEs can damage vascular endothelial cells associated with vascular stiffness. Thus, AGEs can also be the cause of vascular damage.

Changes in the islets of Langerhans in old age

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<th>Young Langerhans Islet</th>
<th>Old Langerhans Islet</th>
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<td>Blood Vessels</td>
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<td>PDX-1</td>
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<td>&quot;Aging Process&quot;</td>
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Blessing or Curse: In Pursuit of the “Longevity Factor” FGF21

Older adults and especially patients with cachexia anorexia syndrome – characterized by persistent weight loss due to loss of appetite and inadequate food intake – have very high levels of fibroblast growth factor 21 (FGF21) in the blood. This is shown by studies of the Department of Nutrition and Gerontology.

FGF21 is a well-known regulator of lipid and glucose metabolism and is even referred to as a longevity factor due to its diverse functions. During periods of hunger, FGF21 levels rise to maintain metabolic homeostasis. Its ability to improve insulin sensitivity has already led to the investigation of FGF21 analogs as a therapy for insulin resistance. However, the use of long-term analogs not only resulted in a decrease in body weight, but also in a higher loss of bone mineral density. In addition, animal studies show that higher levels of FGF21 can reduce muscle mass (muscle atrophy). This is particularly disadvantageous in advanced age.

Older adults have basally higher concentrations of circulating FGF21 than younger people, although the reason for this is still unknown. Kristina Norman’s team of scientists investigated FGF21 levels in older hospitalized patients and in a young and an older healthy control group. Compared to the young healthy control group, the FGF21 level was significantly higher in the older healthy test subjects. However, the highest values were found in patients in hospital, especially those with cachexia anorexia syndrome. Further investigations must show whether the high FGF21 values in old age and especially in cases of disease and inadequate food intake act as a compensation mechanism or even contribute to the catabolic effects of the cachexia anorexia syndrome and aging.

Original Publication


Cachexia Anorexia Syndrome

Cachexia anorexia syndrome is a condition characterized by persistent loss of appetite, inflammation and unwanted weight loss. Patients are more susceptible to (accompanying) illnesses and have a lower life expectancy. The syndrome occurs at an advanced age or together with diseases such as cancer.
How Different Brain Regions Process Glucose

People with diabetes, in whom the blood glucose-lowering hormone insulin is not available in sufficient quantities or is not effective enough, can sometimes exhibit high blood glucose levels. Possible consequences include brain disorders ranging from mental confusion to convulsive seizures. At the same time, people with diabetes have an increased risk of depression and Alzheimer’s disease since insulin and an intact glucose metabolism are essential for brain function maintenance.

To show in the animal model how glucose is metabolized in the different brain regions, scientists of the Young Investigator Group Central Regulation of Metabolism used a combination of imaging mass spectrometry, gene and protein expression pattern analyses and enzyme activity measurements.

The team led by André Kleinridders found that the thalamus, a brain structure for rapid stimulus conduction, mainly delivers glucose into the pentose phosphate pathway. One of the main products is NADPH, which is needed for cholesterol synthesis and protects against oxidative stress. NADPH is especially valuable for cells with lipid-rich myelin sheaths that transmit stimuli very quickly. In contrast the amygdala, important for our emotional behavior, metabolizes simple sugars mainly for glycolysis to generate the energy carrier and neurotransmitter adenosine triphosphate (ATP). In addition, the Young Investigator Group was able to confirm that the brain is largely protected against hypoglycemia and that prolonged fasting does not have a major impact on the energy balance of the brain.

The glucose metabolism in the brain changes with age depending on the respective brain region. Using mass spectrometry, it may be possible to elucidate regional signaling pathways that are susceptible to neurodegenerative diseases such as Alzheimer’s disease. In further studies, the researchers want to use this imaging method to better understand the effects of aging on brain metabolism and to show new connections between obesity, diabetes and dementia.

Original Publication

Preventing Colorectal Cancer in Old Age with Lots of Exercise

Colorectal cancer is the term used to describe cancers of the colon and rectum. These are among the three most common cancers in women and men in Germany. The risk of colon cancer increases steadily with advancing age. More than half of the affected people develop colorectal cancer after the age of 70, and only about 10 percent develop the disease before the age of 55.

Genes as well as nutrition and lifestyle influence the risk of colorectal cancer. This includes lack of exercise. Numerous studies indicate that regular physical activity reduces the risk of disease. However, the underlying mechanisms are still largely unknown. In order to obtain insights into the causal relationships, researchers of the Senior Scientist Group Nutrition, Immunity and Metabolism evaluated data from the large long-term observational study European Prospective Investigation into Cancer and Nutrition (EPIC). The research team led by Krasimira Aleksandrova compared the values of 713 first cases of colorectal cancer with those of 713 healthy women and men. At the time of the first data collection, the test subjects were between 25 and 70 years old.

The data analysis showed that for physically active people with a weekly energy expenditure of more than 90 kilocalories per kilogram body weight per hour, the risk of colorectal cancer is reduced by about 25 percent compared to less active people. In addition, the results showed that factors related to metabolic and immune health, such as waist circumference, vitamin D levels and the blood value of the soluble leptin receptor can be used as biological markers to measure the risk relationship between physical activity and colorectal cancer.

The findings could significantly contribute to improve strategies for the prevention of colorectal cancer in order to avoid its frequent occurrence. Thus, a lot of personal suffering, especially among older people, could be prevented.

Original Publication

Leptin
Leptin is a hormone released by fat cells that curbs appetite. It plays an important role in energy metabolism. The hormone mediates its effect by binding to receptors located on the cell membranes of the target tissue. It also binds to soluble leptin receptors circulating in blood plasma. Possibly these soluble receptors regulate the bioavailability of leptin. Low concentrations of soluble receptors in the blood are associated with obesity and an increased risk of colorectal cancer.

Analysis of images of the human brain recorded by magnetic resonance imaging (MRI).
Cryo vessels with crushed tissue samples during precooling in liquid nitrogen.
RESEARCH FOCUS III: BIOLOGICAL BASIS OF FOOD CHOICE AND NUTRITIONAL BEHAVIOR

Although it has long been known what constitutes a healthy diet, only few people adhere to it. Why do we eat what we eat? And why is it rarely possible to follow dietary recommendations?

This is precisely the starting point of Research Focus III, which aims to bring about long-term and sustainable acceptance of dietary recommendations. In recent years, the focus has been on the molecular and cellular mechanisms of taste perception. Nowadays the scientists are mainly investigating which biological principles underlie nutritional behavior. In addition, they provide a molecular basis for the observation that people usually do not permanently succeed in following health-promoting dietary recommendations. Research Focus III thus provides a basis for studying dietary behavior as a cause of faulty nutrition.

Main Objectives of Research Focus III

1. Elucidation of the hormonal and cognitive control of eating behavior
2. Study of the influence of food on cognitive abilities
3. Development and implementation of epidemiological methods to identify dietary patterns influencing the risk of disease
As early as 1955, American researchers reported that the bitter aftertaste of the sweeteners saccharin and cyclamate decreased and their sweetening power increased when they were combined. Why this is so was unknown for a long time. After more than 60 years, however, scientists from the Department of Molecular Genetics finally succeeded in uncovering the taste secret of the mixture.

Using a self-developed cellular test system, the researchers led by Wolfgang Meyerhof showed that saccharin and cyclamate paradoxically are sweetener, bitter substance and bitter blocker at the same time. Both sweeteners activate the sweet receptor, which is why they taste mainly sweet. In addition, they also bind to bitter receptors, creating a bitter aftertaste. Cyclamate blocks the bitter receptors that are stimulated by saccharin. Conversely, saccharin inhibits the cyclamate-activated bitter receptor. As a result, the mixture tastes much less bitter than the individual substances and is therefore probably also perceived as sweeter. The research team did not observe any increased activity of the sweet receptor when the two substances were combined.

These investigations show that bitter substances – which also include some sweeteners – can also be bitter blockers at the same time. Food manufacturers could use this knowledge to further optimize the taste of diet jams or drinks. In the field of pharmacy, the findings may lead to drugs that will no longer taste bitter. That would be particularly interesting for chronically ill patients or children. However, prerequisite for the targeted use of bitter blockers is a precise knowledge of which receptor types the bitter substances activate or inhibit. The scientists are confident that this can be found with the specially developed test systems.
The sense of taste is important for survival. A bitter taste signals potentially toxic substances to our tongue. A sweet taste, on the other hand, announces simple carbohydrates, i.e. quickly available energy. Thus, the sense of taste helps to distinguish between useful and toxic substances. For this protective function, however, the brain first has to detect taste stimuli and recognize the respective taste.

The Speed of Recognition in the Brain Depends on the Taste

The Young Investigator Group Psychophysiology of Food Perception led by Kathrin Ohla investigated whether the “detection” and “recognition” of a taste takes place sequentially or simultaneously. Therefore, the team of scientists investigated at what point this information about taste is processed in the brain. Participants in the study received sour, salty, sweet and bitter solutions. Then, in two separate test runs they were prompted to push a button as soon as they: 1. tasted something and 2. could also recognize the taste. During these tests the reaction times were determined and the brain waves were recorded by electroencephalography (EEG). The reaction speed of the test persons was regarded as a measure for conscious perception. By analyzing the brain wave measurements, the research team assessed what actually happens in the brain.

The scientists found clear connections between the reaction times and the electrical activity of the brain. They were thus able to discover a neuronal signature that determines and predicts later behavior. Furthermore, they could observe that the tastes were processed differently in the brain: The detection and differentiation of salty/sour occurs at different times. The test subjects already knew that they would taste something before they could name the taste. In contrast the distinction and differentiation between sweet and bitter occurred at the same time: hence, the study participants immediately detected and distinguished the tastes. The team suspects that these differences are due to the assessment of the taste types. Both salty and sour are considered neutral, whereas sweet is perceived as delicious and bitter as repellent. In the course of evolution, this makes perfect sense. A bitter (thus potentially toxic) and a sweet (thus energizing and nutritious) taste is immediately recognized.

Original Publication

What distances do mice cover when they voluntarily run on the wheel? This can be recorded electronically in the MRL around the clock and, in conjunction with other investigations, allow conclusions on the role nutrition or genes play in this.
With a flow cytometer, individual cells flow separated by a liquid stream one by one past a laser beam. Through the previous marking with fluorescent dyes, numerous parameters can be measured simultaneously, thus providing e.g. information on oxidative stress or changes in the cell cycle.
Capturing the structure and function of the heart with an ultrasound device to determine the cardiac health of a study participant.
Biology laboratory technicians are an important part of research teams in the laboratory. DIfE trainees learn to use a broad spectrum of methods.
Change of media for the cultivation of cells at a sterile workbench in the cell culture laboratory.
Robot for rapid pipetting of blood and urine samples from the GNC Health Study. The biosamples are then frozen at -196 °C for up to 30 years for later analysis.
DIfE investigates the relationship between nutrition and health. A central goal of the close cooperation between the departments and research groups is to transfer findings from basic research in the laboratory to humans as quickly as possible. For this reason, the expertise of experimental, epidemiological and human study-based research is anchored in each of the three focus areas.

Role of Fatty Acids in the Prevention of Type 2 Diabetes

The research focus of the 31-year-old nutritionist Karolin Weitkunat is fiber. Out of the indigestible fibers of plant-based food, gut bacteria produce useful molecules such as propionic acid, a short-chain fatty acid that promotes the formation of so-called odd-chain fatty acids (OCFAs).
Translational Research at DIfE  51

Original Publication


Epidemiological observations: protective effect of OCFAs

A number of studies have shown that OCFAs may protect against multiple sclerosis, Alzheimer’s disease and cardiovascular disease. In addition, research by the Department of Molecular Epidemiology indicates that these fatty acids may reduce the risk of type 2 diabetes. To elucidate the health benefits of OCFAs, Weitkunat and her team explore the underlying mechanisms.

Mouse model: investigation of biological mechanisms

In cooperation with the Department of Gastrointestinal Microbiology the research team was able to show that the soluble fiber inulin increases the propionic acid levels in the intestines of mice. The increase in propionic acid is associated with a number of positive effects: improved insulin sensitivity, more favorable fatty acid composition and reduced fat deposits in the liver. At the same time, the use of propionyl-CoA (Pr-CoA) led to an increase in OCFAs in plasma phospholipids. Pr-CoA is formed when propionic acid binds to coenzyme A. It acts as a substrate for the synthesis of OCFAs. Thus, there are many indications that an increased intake of soluble fiber and subsequent formation of propionic acid or Pr-CoA leads to an increase of OCFAs in the blood and thus reduces type 2 diabetes risk.

Transferability to humans

In order to transfer the results to humans, Karolin Weitkunat, in cooperation with the Department of Clinical Nutrition, conducted an intervention study with 16 healthy adults. For subsequent seven-day periods, the ten women and six men were in turn administered 30 grams of the insoluble fiber cellulose, 30 grams of the soluble fiber inulin or 6 grams of propionate, the salt of propionic acid. Before and after each administration, the research team determined the fatty acid levels in the blood. As the study showed, the consumption of cellulose had no influence on the levels of OCFAs in the blood. In contrast, degradation of inulin by gut bacteria resulted in increased production of OCFAs, presumably through increased availability of propionic acid. In addition, dietary propionate increased the amount of OCFAs in liver phospholipids by more than 10 percent. Because the OCFAs were also detectable in the blood, doctors and dieticians could use them as a biomarker that reflects dietary intake of fiber.

Useful molecules from soluble fiber

Various nutrition societies have been recommending a high-fiber diet for many years. The work of Weitkunat now illustrates why this is so important and how soluble fiber can help prevent metabolic diseases such as type 2 diabetes.

The nutritionist is currently conducting a project funded by the German Research Foundation (DFG) to determine whether other nutrients such as milk proteins or fats can also contribute to elevated levels of Pr-CoA in the liver and blood, thus causing an increase in protective OCFAs. For further information on this research, see page 32.
The future-oriented promotion of young talent is an important element of the strategic tasks of DIfE. In addition to in-house vocational training as well as bachelor’s and master’s theses, the institute offers comprehensive doctoral and postdoctoral training.
**PhD Program**

Intensive research forms the basis of doctoral training at DIfE. Accompanying measures such as seminars for doctoral candidates, colloquia and presentations at scientific conferences promote the scientific expertise of the doctoral students. A doctoral committee consisting of two professors and an experienced postdoc reviews the scientific progress of the doctoral project at regular intervals and advises on how to proceed. DIfE doctoral students are financially secured for the regular doctoral period of three years, whereby extensions are possible in justified cases.

<table>
<thead>
<tr>
<th>Financial security</th>
<th>PhD committee</th>
<th>Individual support</th>
<th>Internal project funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD seminars · Colloquia · Curriculum</td>
<td>Participation in scientific conferences</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Research activity**

**Postdoc Program**

The scientific work of the postdocs at DIfE is characterized by extensive research activities. The first three years serve as orientation. This gives the postdocs the opportunity to take the appropriate path within the scientific landscape.

The subsequent three-year phase enables the postdocs to qualify according to the previously defined career goals. In terms of an academic career this means raising one’s own third-party funds and publishing the results of these projects as last author. The aim is to develop a research topic of one's own and to qualify for an appointment to a professorship. The support measures described in DIfE’s postdoctoral guidelines are deliberately kept flexible so that individually tailored measures can be implemented in line with personal career goals.

<table>
<thead>
<tr>
<th>Individual support</th>
<th>Colloquia · Curriculum</th>
<th>Internal project funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation phase</td>
<td>Qualification phase</td>
<td></td>
</tr>
</tbody>
</table>

**Research activity**
Research Campus Potsdam-Rehbruecke – Shaping the Future

The two DIfE sites as well as the professorships of the Institute of Nutritional Science (IEW) at the University of Potsdam on the grounds of DIfE comprise the Research Campus for Nutrition and Health Potsdam-Rehbruecke. The campus enables DIfE and IEW to share animal research facilities, the Human Study Center, as well as analytical units, seminar and conference rooms. Furthermore, the close proximity promotes the education of young scientists. DIfE and IEW professors collaborate closely and are jointly responsible for the study programs in nutritional science and toxicology.

Due to its great potential, the campus is to be further developed in the following years. In the course of this, the DIfE will erect a new research building (Gerty Cori Building). Additionally, the University of Potsdam will also support the development of the campus with the construction of a new laboratory building.

In order to create optimal conditions for existing and future cooperation, it is important that the content and structural priorities of DIfE and IEW complement each other well. Both institutions are already members of the Cluster of Excellence for Nutrition Research NutriAct and in the DFG research group TraceAge (more information on this topic on page 73). In addition, the “JointLab Phytochemistry and Biofunctionality of Plant Secondary Metabolites” (PhaSe), jointly operated by DIfE, IEW and the Leibniz Institute of Vegetable and Ornamental Crops, was opened at the beginning of 2019. The Research and Competence Centre uses an interdisciplinary approach to investigate the influence of plant-based foods and in particular secondary plant metabolites on human health and on the development of nutrition-related diseases.
The New Gerty Cori Building

With the new research building, DfE is creating central premises for the Human Study Center and the Biomaterial Bank. Moreover, modern laboratories will be erected and additional office and seminar rooms created. Following completion of the planning, the construction work started in May 2019 and is expected to be completed in 2021. Half of the financing for the new building, totaling 20 million euros (gross), will come from the federal government, the other half from the state government of Brandenburg.

The new building is named after the biochemist Gerty Cori (1896–1957). In 1947, she was the first woman to receive the Nobel Prize for Medicine for her insights into the glucose metabolism, the function of the enzymes involved, and the formation and degradation of glycogen.
Ina Danquah

Climate Change and Nutrition – Extreme Contrasts in Sub-Saharan Africa

You will receive the Robert Bosch Junior Professorship 2019. How did this come about?

The Robert Bosch Stiftung annually invites applications for the junior professorship “Research into the Sustainable Use of Natural Resources”. In principle, the professorship is as open as its title and does not necessarily have anything to do with nutrition. Importantly the projects should come from applied research. Moreover it should intend to find new approaches to clarify and tackle pressing socio-ecological problems that are of particular relevance to developing or transition countries. This year, for the first time in a long time, research related to the health sciences was selected for the professorship. This makes me very happy. How it all came about? I applied and then went through the two-stage process.

You worked for many years as a research assistant in the Department of Molecular Epidemiology at DIfE under the direction of Professor Matthias Schulze. Did this time shape you and if so, how?

Definitely. Altogether, I worked here almost nine years. This time has influenced me especially with regard to methodology. I learned a lot from Matthias and of course from my other colleagues about the tools of the trade in nutritional epidemiology. But I also learned a lot about “structured work”. It is not self-evident that projects are so well documented and archived that they are transparent and comprehensible even after a few years. Matthias has always attached great importance to this, and I am very grateful to him for that. This approach has had a lasting impact on the way I work.

Climate change, sustainable nutrition and sub-Saharan Africa are not among the main research areas of DIfE. How did you manage to successfully establish and develop these topics here?

It is true: this is not really a research focus at DfE. But DfE is a member of the Leibniz Research Alliance “Sustainable Food Production and Healthy Nutrition”. That way, I came for the first time into contact with the topic at a professional level. Besides, sustainable nutrition is a very personal concern for me. As a mother of three children, I want them to have a livable future on our planet. Also, during a long period of illness, I thought a lot about general questions of meaning and specifically about what is important to me in life. What would I like to achieve? What can I perhaps create and preserve for posterity?

I devoted a lot of my time to the topics of ecological clothing, fair trade, food waste, etc. In addition to this personal interest, there was a growing demand for sustainability research in Germany.
How did you come to choose sub-Saharan Africa? Is there a personal connection? Or was it (as is so often the case) coincidence that the professor had acquired a corresponding project?

That was actually my own initiative. During my Abitur, I already knew that I wanted to go to Africa. Immediately after graduating from high school, I completed a youth exchange project in Uganda. The following year I was in Ghana where I did an internship at the regional Ministry of Food and Agriculture. During my studies at the University of Potsdam, I spent most of my holidays in Ghana and my penultimate semester there at the University of Ghana in Accra. Not all professors here liked that. However, this might be somehow understandable, since DIfE is excellently equipped in laboratory terms. Moreover, it was and still is the only place in Germany where one can study very effectively through the combination of the Institute of Nutritional Science at the University of Potsdam and DIfE. Later, however, a few courses of the semester abroad were after all recognized. In Africa I had subjects that don’t exist here, such as product development – super interesting. In human terms, such an experience abroad is always of great value. Yes, of course, the libraries were antiquated and the laboratories dusty, the lecturers always came late, but in the end the stay was very important for me: I started to combine my personal interest for this subcontinent with my work. That was like a red thread running through my professional life.

What makes sub-Saharan Africa particularly interesting for you as a nutritionist and epidemiologist?

This subcontinent is a region full of contrasts. When you arrive in the Ghanaian capital Accra and drive from the airport through the city, you could think this is Cape Town: glass façades, three-lane highways and large shopping centers. But if you drive along the coast and turn only once, there are still villages that have no electricity, that are built with mud huts and where children wear tattered clothing. These contrasts are extreme. This makes it exciting and perhaps even charming. On the other hand, it is of course challenging.

How do you manage to balance a family with three children and a career? What advice would you give other mothers who are aiming for a career in science?

The most important component is family support. Without this it simply doesn’t work. Of course, the institutional environment is also important, but usually there is nothing you can do about it. Ultimately, you are measured by how much and how well you publish, how you raise third-party funds, that you are present at conferences. This can only work with family support. Be it by parents or siblings and first and foremost, of course, by the partner. Without my husband, I would not have been able to do all this. Or without my mother, who takes the children when the day care center is closed or when a long business trip is on schedule.
Being only 37 years old, you already hold a professorship. How did you manage that? What is your secret?

Friendly stubbornness? I don’t know. Probably also my determination. It was always clear to me that I would like to do nutritional research in sub-Saharan Africa. But I don’t think there is a secret recipe. Surely serenity is also part of it. Efficiency means using the time you have as well as possible and doing the right things. In order to do the right things, you sometimes have to take a step back and think about it: What am I doing here anyway? Do I have to do these things or can someone else do it? What is my goal and how do I get there?

Who is your role model and how does your role model influence you?

I have several role models. My first great role model is my PhD supervisor Professor Frank Mockenhaupt, director of the Institute for Tropical Medicine and International Health Berlin, now a valued colleague and cooperation partner. He has shaped me very much in critical and scientific thinking and taught me how to write papers. Accuracy was and still is very important to him: precise language, consistent numbers: “Each number must be calculated three times before it is published.”

Then I went through the Leibniz mentoring program. My mentor was Professor Ute Nöthlings from the University of Bonn. She became a professor at a very young age, has a DIfE background and is a woman. That’s why I approached her and it was absolutely the best thing to do. The chemistry was just right. It was good to find out what her career was like, where obstacles were put in her path, how she solved them. The encounter was a great enrichment for me.

And of cause Matthias. But his special contribution to my career I already mentioned briefly.

You are investigating the relationship between nutrition and climate change. What is necessary for us to finally wake up and actually change our consumer behavior?

That is a difficult question. I think you cannot say “we” because many people have already changed their consumer behavior. Increasingly, they are trying to be more aware of our resources within the limits they have. But there are also many – I count myself here – who know they actually should ... , but still do not do it. Certain decisions are made against better knowledge because they are difficult to implement. For example, we have an extremely high meat consumption. My boys play soccer, my husband runs half marathons. If suddenly there would be steak for dinner only twice a week, the protest would be great. There are a few things that you can change, but not everything can be changed immediately and in equal measure for everyone. You have to train yourself properly.

Some things only work under pressure. I think for example of smoking or soft drinks. Many people are trapped in their everyday lives and often out of necessity think of themselves first.
**Is there something about DIfE that you will miss when you go to Heidelberg?**

The short official channels. That people know each other. DIfE is a relatively small institute and after nine years you know who is responsible for what. It will be a challenge for me to understand the administrative apparatus in Heidelberg and to get to know the individual constellations between the actors.

**What are your plans for the future of your research topic?**

The beauty of it is that I am allowed to take over a working group in Heidelberg that is currently called “Climate Change and Health”. Nutrition is only a very small aspect. There are employees who are working on the sustainable management of hospitals in India, there are some that study heat stress and cardiovascular diseases. So, the group has a pretty wide range. An important task will be to group everything thematically. My overall goal is to advance the research area “Sustainable Nutrition” in Germany. This is a topic that is widely discussed in the media, but to date there are few German research groups in this field.

Ina Danquah during a test run of a nutrition interview as preparation for the intervention study in Ouagadougou, capital of Burkina Faso.
Since 2017 you have been working as a postdoc at the renowned Stanford University in California. How did this come about?

Even before my PhD thesis I knew that I wanted to do a research stay abroad as a postdoc in the USA. Since I wanted to continue to do research on stem cells of the musculoskeletal system, I searched for particular laboratories. These were groups whose work I had been following for years because they published on similar topics. My PhD supervisor Tim J. Schulz then made the initial contact for me with my top five candidate institutions. During a conference visit to the United States, I was able to introduce myself to the labs. When I was finally offered the position at Stanford University, I did not hesitate since this had been my first choice for a long time.

From 2013 to 2017, you worked first as a doctoral student and then as a research assistant in the Department of Adipocyte Development and Nutrition. How did this time influence you?

I transferred from DIfE to Stanford University just over a year ago. But already I can say that my time at DIfE had a tremendous influence on me. What I learned there is the basis for everything I do today. Without DIfE I wouldn’t be in America. And without the topic of my doctoral thesis I wouldn’t be in bone stem cell research at Stanford University. Also, with regard to scientific work in general: how to publish, how to deal with colleagues, where you have to be sensitive. I didn’t know all that before my time at DIfE.

In your doctoral thesis you give insights into previously unknown mechanisms of bone health. Is there a personal connection? Or was it (as is so often the case) a coincidence that the professor had acquired a corresponding project?

The framework of the project was based on the ERC Starting Grant of my PhD supervisor Tim J. Schulz and was therefore roughly defined. At the beginning, I did not yet have experience in experimental project design. After about half a year, when I had become fully immersed in the research, I saw all the different possibilities of the project. From then on I continued to follow the given project plan, but also thought independently about what could be developed further.

You have found that inhibitors of the enzyme dipeptidyl peptidase 4 (DPP4) support bone healing. What needs to be done to ensure that these DPP4 inhibitors find their way into everyday clinical practice as a drug for the treatment of fractures?

My data is based on mouse models. The next step would be to first investigate if the effect is transferable to human bone stem cells. Clinical studies would then have to be done that target the inhibition of the enzyme DPP4 in order to improve bone healing. It would be possible to recruit people with fractures and try to support bone healing with DPP4 inhibitors, for example by local application. It would then be interesting to see whether the healing
supporting effect is improved in older or overweight people. DPP4 inhibitors are already being used in diabetes therapy. So, these are approved drugs. This simplifies matters enormously and could shorten the overall translational process by years.

**What can people do to keep their bones strong and healthy in the second half of their lives?**

That is actually generally known: through a good diet, exercise and of course enough sunshine. If you have healthy bones, you have a clear advantage. Healthy bones are enormously important for people’s overall health. I am also trying to get to the bottom of this larger context in my research work.

**How does it feel to do research at one of the world’s most prestigious universities in California?**

It’s really wonderful. The weather is always good and the mood of the people reflects this. The campus is tip-top. The conditions in the laboratories are great. Lack of money does not play a role in Silicon Valley. Here is the melting pot of innovations, and you have access to the latest equipment and technologies. Basic research is directly linked to application. Many discoveries lead to start-ups. Stanford Hospital is only 500 meters away from my lab, making translational research a lot easier. All in all, the work steps are short. Thus, what is discovered today, can reach the patient as quickly as possible.

**Are there disadvantages compared to a comparatively small institute like DIfE?**

The employees are under enormous pressure to succeed. However, group leaders and personal character can determine how one experiences this pressure. Everyone copes differently with pressure. Some people suffer and break. Others don’t mind that much. On the contrary, they may even need the pressure in order to get the necessary drive.

**Do you see a lot of competitive behavior?**

There’s a lot of talk about that. You often hear stories in which colleagues deliberately ruined each other’s experiments. Fortunately, I’ve never experienced that myself up to now.

Maybe I’m just lucky with my current research group. Everyone is very collaborative and everybody helps everyone. But competitive behavior in general is definitely a reality.

**What did you particularly like here at DIfE?**

The good technical conditions and the many opportunities offered by the generous start-up capital of my doctoral supervisor. I know many people who work in laboratories where money was scarce and who always had to ask themselves: Can I do the experiment at all?

I especially liked the atmosphere in my group. In particular, I benefited greatly from the lectures given by external national and international scientists and, of course, the doctoral seminars. I also enjoyed the surroundings and the remote setting. I found it very pleasant. You simply can concentrate much better without the bustle of the city.
Are you still in touch with your doctoral supervisor Tim J. Schulz?

Yes, we still have contact, also because we are still sharing unpublished data we generated together. Besides, Tim is a recognized stem cell researcher among my colleagues. My current bosses have also invited him for a guest lecture to California.

You have two small children. How do you manage the balancing act between family and scientific work? What advice would you give to other fathers who are seeking a career in science?

This can be tough, especially in science, where regular working hours are often impossible due to experiments. Good time management with a lot of advance planning is definitely helpful. It is also essential to leave things now and again lying around for the next day, even if you are deeply immersed in data analysis. But most important is probably the support of my wife Jamie – I would certainly not be able to do this balancing act alone.

Who is your role model and how does your role model influence you?

I definitely see my parents and grandparents as role models in general, who have always managed to create a well-balanced family life with an above-average successful career. If it is explicitly about the scientific side, I would like to mention my previous mentors, especially Tim J. Schulz and Chuck Chan as role models. They both have very different approaches as far as scientific work is concerned, and I have been able to make many of their positive qualities my own, which is crucial to my present aspirations in general and will be in the future.

What are your plans for the future when the fellowship expires?

My plan, of course, is to return to Germany. But it also depends on how the projects here at Stanford University develop. As it looks at the moment these will certainly not be completed within my two-year research fellowship. So, I will most likely spend another two to three years as a postdoctoral fellow before returning to Germany.
Vocational Training at DIfE

DIfE offers school graduates a sound and comprehensive education in a modern research environment. During the three- to three-and-a-half-year traineeship period, the apprentices get an instructor who mentors them individually and helps them to work in a self-reliant way. Depending on the job profile, the trainees go through various practical learning stations both in the scientific and administrative areas. Usually, five to eight trainees work at the institute. Internships abroad enable them to gain international experience. In 2018, DIfE received an award from the Potsdam Chamber of Industry and Commerce for its commitment to promote young talent.

What traineeship occupations are offered at DIfE?
- Biology laboratory technicians
- Animal keeper for the areas research and clinic
- IT systems electronics technician
- Office manager

For more information on traineeships at DIfE, see www.dife.de/jobs-karriere/ausbildungsberufe

Contact
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Department of Human Resources and Social Services
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e-mail: patricia.froemling@dife.de

Please send applications to
e-mail: jobs@dife.de

DIfE job portal at
www.dife.de/jobs-karriere/stellenangebote/
Institutional Funding and Third-Party Funding

**Institutional Funding**

Institutional funding by the State of Brandenburg and the Federal Government

2017: 15.7 m.
2018: 15.9 m.

**Third-party funding**, including EUR 0.9 million (2017) or EUR 1.1 million (2018) from international funding providers

2017: 8.3 m.
2018: 7.9 m.

Total Budget

**2017**
EUR 24 million

**2018**
EUR 23.8 million

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**Third-Party Funding**

2017
EUR 8.3 million

2018
EUR 7.9 million

- Federal Government
  - 2017: 1.0 m.
  - 2018: 1.1 m.

- Federal Government (DZD, DZHK, GNC)
  - 2017: 4.4 m.
  - 2018: 4.1 m.

- State (MWFK, DZD, DZHK, GNC)
  - 2017: 0.8 m.
  - 2018: 0.8 m.

- DFG
  - 2017: 0.9 m.
  - 2018: 0.8 m.

- EU
  - 2017: 0.7 m.
  - 2018: 0.4 m.

- Industry
  - 2017: 0.3 m.
  - 2018: 0.1 m.

- Foundations and Other
  - 2017: 0.2 m.
  - 2018: 0.1 m.

- EFRE
  - 2018: 0.5 m.

*shown in euros are expenditures of third-party funding as of December 31, 2018.*
### Third-Party Funded Projects 2017/2018

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Expenditures in T€</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DFG Grants</strong></td>
<td>743 / 10</td>
<td>772 / 20</td>
</tr>
<tr>
<td>Individual Projects of the German Research Foundation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emmy Noether</strong></td>
<td>280 / 1</td>
<td>5623 / 36</td>
</tr>
<tr>
<td>Program of the German Research Foundation for young and aspiring researchers, which enables the participants to qualify for a university professorship.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ERC Starting Grant</strong></td>
<td>420 / 1</td>
<td>999 / 14</td>
</tr>
<tr>
<td>Funding that enables outstanding young scientists to achieve scientific independence at an early stage. The funding volume can total up to two million euros.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>National Individual Projects</strong></td>
<td>772 / 20</td>
<td>7251 / 2</td>
</tr>
<tr>
<td>Among others, the German Diabetes Association, Max Kade Foundation and the European Foundation for the Study of Diabetes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>National Cooperation</strong></td>
<td>5623 / 36</td>
<td>35 / 3</td>
</tr>
<tr>
<td>Among others, the GNC Health Study, NutriAct Competence Cluster and the Focus Area DynAge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>International Cooperation</strong></td>
<td>999 / 14</td>
<td>35 / 3</td>
</tr>
<tr>
<td>Cooperation with industry, cooperation in the National Institute of Health and international research alliances funded by the European Commission; research alliances funded by the German Federal Ministry of Education and Research and the German Federal Office for Agriculture and Food.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leibniz Research Alliances</strong></td>
<td>7251 / 2</td>
<td>35 / 3</td>
</tr>
<tr>
<td>Healthy Ageing/Sustainable Food Production and Healthy Nutrition/Bioactive Compounds and Biotechnology.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>German Centers for Health Research</strong></td>
<td>280 / 1</td>
<td>420 / 1</td>
</tr>
<tr>
<td>DIFE is a partner of two of the six centers: the German Center for Diabetes Research (DZD) and the German Center for Cardiovascular Research (DZHK).</td>
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</tr>
</tbody>
</table>

87 ongoing third-party funded projects in 2017/2018
Personnel

Family-conscious personnel policy

DIfE is committed to a family-conscious personnel policy. Since 2011, it has been certified by the berufundfamilie Service GmbH as a family-friendly employer. In order to promote the compatibility of work and family life, the Institute offers its employees various options: flexible working hours, changing from full-time to part-time (and vice versa) as well as leave during periods of personal crisis. Since 2015, there has been a parent-child office that can be used when problems with childcare arise.

307 employees from 24 countries,
of these 39 doctoral students and 5 trainees

- Bangladesh
- Bolivia
- Brazil
- Bulgaria
- Costa Rica
- France
- Greece
- India
- Italy
- Cameroon
- Kazakhstan
- Croatia
- Netherlands
- Austria
- Portugal
- Russian Federation
- Sweden
- Serbia
- Slovenia
- Spain
- Tunisia
- Ukraine
- USA
- Cyprus

As of: December 31, 2018
Habitations, Dissertations and Academic Degrees 2017/2018

Habitations: 2
Dissertations: 26

Master’s degrees: 37
Bachelor’s degrees: 30

Colloquia 2017/2018: 32
Publications 2017/2018:
- Original papers: 321
- Review articles: 43
- Books: 4
- Other: 15
The DIfE – GERMAN DIABETES RISK SCORE was developed from research work conducted at DIfE. It offers the opportunity to assess the risk of type 2 diabetes with a high predictability. The test is non-invasive, free of charge, and can conveniently be done from home. In addition, it provides information on individual options for reducing the risk. The test has already gained enormous reach through its distribution in various media and is used by private individuals as well as by doctors’ practices, health insurance companies, pharmacies, companies and associations.

www.dife.de/diabetes-risiko-test
DIfE has been mentioned 4,344 times in daily newspapers, magazines and journals (print and online) in the past two years, e.g. in articles on:

- Sugar / Sweeteners 903
- Overweight / Weight Loss 519
- Diabetes 585
- Fats / Proteins / Carbohydrates 388
- Intermittent Fasting 268
Our scientists make their findings available to the broad public. In order to do so, they write stakeholder publications, participate in various committees and advise politicians, associations and professional societies on their research findings.
DIfE’s research services are also used in so-called stakeholder publications. These are publications that address disseminators in government and in the health system. In this way, the scientific findings of DIfE are also brought to the attention of society. DIfE researchers, for example, play an occasionally leading role in the preparation of the nutritional recommendations of the German Nutrition Society (DGE) and in the evidence-based guidelines of the German Diabetes Association (DDG). DIfE is also involved in the development of the DGE Nutrition Report and advises the DGE departments on all questions relating to nutrition and health. The Federation of European Nutrition Societies (FENS) is currently chaired by DIfE scientist Professor Heiner Boeing.

DIfE researchers are also active in various committees for the preparation of drafts for political decisions and, if necessary, advise on individual social and political issues. This advice consists of short-term statements on day-to-day policy, but also of an assessment of long-term developments. The advisory services are based on the research work of the institute. The expertise of the scientists is made available to associations and organizations, parliaments and ministries through expert hearings, consultations or expert opinions.

DIfE is also represented by its leading scientists in numerous advisory boards and advisory and expert committees:

- Review Board of the German Research Foundation (DFG)
- Senate Commission of the DFG on Food Safety
- Scientific Steering Committee and Working Group Evidence-based Guidelines of the German Nutrition Society (DGE)
- Committee “Nutrition” of the German Diabetes Society (DDG)
- Committee “Research in Nutritional Medicine” of the German Society for Nutritional Medicine (DGEM)
- European Guideline Group of the Diabetes & Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD)
- Expert Committee for “Contaminants in the Food Chain” and “Nutrition, Dietetic Products, Novel Foods and Allergies” of the German Federal Institute for Risk Assessment (BFR)
- Advisory Board of the Leibniz-Institute for Food Systems Biology at the Technical University of Munich
- Advisory Board of Kiel Life Science
- BASF Advisory Board Nutrition & Health
In order to strengthen health research in Germany DIfE participates in outstanding national collaborative projects. Integrated into various strategic actions of the Federal Government, it thus fulfills the important social mission of a Leibniz Institute to conduct science for the benefit and good of humanity. As a partner in major beacon projects, DIfE can shape the development of research over many years. The institute is also well networked internationally, for example with research institutions in the USA, Uruguay, France and Spain. It is interlinked in eleven European research alliances. In five of these alliances, it is involved with its Potsdam cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC). In addition, DIfE succeeded in obtaining funding from the European Research Council (ERC Grant) and acquired numerous projects funded by the German Research Foundation (DFG).

Outstanding National Collaborative Projects

**GNC: Germany’s largest health study**
Launched in 2014, the GNC Health Study is a nationwide, long-term population study involving a total of 200,000 randomly selected participants. They undergo extensive examinations and are followed up for a maximum of 30 years. The goal of the GNC is to identify the causes of the most important widespread diseases such as diabetes, cancer and dementia in order to develop new prevention and treatment strategies.

DIfE plays a leading role in the research modules that capture nutritional behavior and physical activity. In the pilot phase, it developed corresponding survey instruments and statistical analysis methods. In the main phase, it is responsible for these topics and leads the corresponding competence groups. Until the end of 2018, DIfE was able to recruit about 9,400 of the total of 10,000 participants for the initial examination at the Study Center Berlin-South/Brandenburg.

**German Centers for Health Research**
DIfE participates in two of the so far six German Centers for Health Research founded by the Federal Ministry of Education and Research (BMBF) and the state governments; the German Center for Diabetes Research and the German Center for Cardiovascular Research.

**German Center for Diabetes Research**
The German Center for Diabetes Research (DZD) is a national association that brings together experts in the field of diabetes research and interlinks basic research, epidemiology and clinical application. The DZD was founded in 2009. One of the speakers of the center is Professor Annette Schürmann.

Scientists from DIfE contribute to the research program of the DZD with their experimental and applied research on three levels:
1. Identification and functional characterization of diabetes risk genes and epigenetic changes contributing to type 2 diabetes
2. Optimization and validation of the DIfE-GERMAN DIABETES RISK SCORE as a clinical type 2 diabetes screening tool
3. Participation in clinical trials

**German Center for Cardiovascular Research**

In interdisciplinary collaboration, research teams from 32 institutions at seven sites in the German Center for Cardiovascular Research (DZHK) are conducting research to advance the prevention, early diagnosis and treatment of cardiovascular diseases. New findings ought to be translated more quickly and efficiently into clinical practice. DIfE has been a member of the DZHK since 2014. It cooperates primarily with institutes at the Berlin DZHK site to elucidate mechanisms that affect the heart muscle, vessels and metabolism. Among other things, DIfE addresses diseases of the cardiovascular system as a complication of obesity and type 2 diabetes.

**NutriAct: Competence Cluster Nutrition Research**

Under the name “NutriAct - Nutritional Intervention for Healthy Aging: Food Patterns, Behavior and Products,” one of the four competence clusters of nutrition research funded by the BMBF was launched on June 1, 2015. The joint project with more than 50 partners from science and industry is of great importance for nutrition and health research as well as the economy in the Berlin-Potsdam region. The main goal is to improve the health status of people aged 50 to 70. For this purpose, the different partners aim to jointly develop an acceptable, easy-to-implement nutritional strategy. In addition, tasty products are being developed to facilitate an age-appropriate and healthy diet. DIfE plays a key role in the network and cooperates with scientific institutions in the region as well as with industrial partners. The speaker of the network is Professor Tilman Grune, scientific director of the DIfE.

**Health Research Brandenburg**

The state of Brandenburg has created a Faculty of Health Sciences in Brandenburg with 16 professorships.

**Goals:**

1. Long-term provision of medical care for the state of Brandenburg
2. Strengthening of university health research through research collaborations
3. Promotion of practical education and training in health and care

The supporting institutions Brandenburg Medical School Theodor Fontane, University of Potsdam and Brandenburg University of Technology Cottbus-Senftenberg cooperate with other universities and non-university research institutions such as DIfE. It is planned to design the professorship for epidemiology in a joint appointment together with DIfE.

In preparation for this faculty, joint projects were funded by the state. As a partner in the joint project “Cardiovascular Health in Non-Metropolitan Regions of Brandenburg,” DIfE contributes its expertise in nutrition and health research to the research and treatment of cardiovascular diseases in old age.

**DynAge**

The research network DynAge was founded in 2013 as the result of a cooperation between Freie Universität Berlin and Charité - Universitätsmedizin Berlin. Since 2015, the DIfE, the Max Planck Institute for Human Development and the Robert Koch Institute have been partners of DynAge.

The project focuses on interdisciplinary and translational research on the relationship between aging processes and age-specific diseases. The focus is on four disease groups: cardiovascular diseases, diseases of the musculoskeletal system, cancer and cognitive disorders/depression.

**Leibniz Research Alliances**

In order to conduct research on current topics of high scientific and societal relevance, Leibniz institutions work together within Leibniz research alliances. According to its core competence, DIfE participates in three Leibniz research alliances:

1. Leibniz Research Alliance “Healthy Ageing”
2. Leibniz Research Alliance “Sustainable Food Production and Healthy Nutrition”
3. Leibniz Research Alliance “Bioactive Compounds and Biotechnology” (until the end of 2018)
Excerpt

Cooperation partners / institutes with framework agreements

- University of Potsdam
- Charité – Universitätsmedizin Berlin
- JointLab PhaSe, Leibniz Institute of Vegetable and Ornamental Crops (IGZ)
- Humboldt-Universität, Freie Universität, Technische Universität Berlin

Other important cooperation partners / institutes (cooperation exists through various projects)

- Max Delbrück Center for Molecular Medicine (MDC)
- German Cancer Research Center (DKFZ)
- Helmholz Zentrum München, Technische Universität München
- German Diabetes Center

- Leibniz Institute for Prevention Research and Epidemiology (IfP)
- IGZ
- Leibniz Institute for Agricultural Engineering and Bioeconomy (JLU)
- Leibniz-Institute for Farm Animal Biology
- Ernst von Bergmann Clinic Potsdam
- University of Bonn
- University of Tübingen
- TU Dresden
PRIZES AND AWARDS

28 honors and awards in 2017 and 2018 – of which we present five outstanding achievements.

Paul Ehrlich and Ludwig Darmstaedter Prize for Young Researchers

Prof. Dr. Tim J. Schulz
For his biomedical research on the function of white and brown fat cells, Tim J. Schulz, head of the Department of Adipocyte Development and Nutrition, has received the 2018 Paul Ehrlich and Ludwig Darmstaedter Prize for Young Researchers, which is endowed with 60,000 euros. Schulz explores how the different types of fat cells develop and what physiological and pathological effects they have. His findings show new ways to better treat common diseases such as obesity, but also associated disorders like age-related fractures. For more information, see page 36.

Success Story Tim J. Schulz
After a five-year research stay at the Joslin Diabetes Center of Harvard Medical School in Boston (USA), Tim J. Schulz returned to DIfE in 2012 with an Emmy Noether grant from the German Research Foundation and a Starting Grant from the European Research Council. In 2016, he accepted the joint appointment of DIfE and the University of Potsdam for a W2 professorship and became head of the Department of Adipocyte Development and Nutrition. In 2017, he published an outstanding paper on age- and nutrition-dependent differentiation of bone stem cells. In 2018, the Paul Ehrlich Foundation honored him with one of the most highly endowed and internationally renowned prizes awarded in Germany in the field of medicine: the Paul Ehrlich and Ludwig Darmstaedter Award for Young Researchers. This was followed by an offer from Technische Universität München for the appointment to the W3 professorship Nutritional Programming. By appointing Schulz to a W3 professorship, DIfE successfully countered the offer from Munich.
Felix Burda Award

Dr. Krasimira Aleksandrova

Krasimira Aleksandrova, head of the Senior Scientist Group Nutrition, Immunity and Metabolism, received the Felix Burda Award 2018 in the category “Medicine and Science”, endowed with 5,000 euros, for her work on the influence of weight gain and physical activity on the development of colorectal cancer. Aleksandrova investigates the influence of nutrition on the metabolism and immune system. Her research focuses on the development and progression of age-related diseases. For further information, see page 40.

Promotion Award of the German Diabetes Association

Dr. Mandy Stadion

Mandy Stadion, a young scientist in the Department of Experimental Diabetology, has been awarded the promotion award of the German Diabetes Association. She received the 10,000 euros prize for her dissertation on the validation and characterization of Ifi202b and Zfp69. These are two novel disease genes associated with overweight-related insulin resistance.

Max Kade Fellowship of the DFG

Dr. José Pedro Castro

As a result of his outstanding scientific work in the Department of Molecular Toxicology, José Pedro Castro received a fellowship from the German Research Foundation and the Max Kade Foundation.

The scholarship allows him to spend a year conducting research in the United States. In the laboratory of Professor Vadim Gladyshev of the Brigham Women’s Hospital at Harvard Medical School, Boston, he is continuing his work to elucidate the molecular causes of aging and age-related diseases and to deepen his scientific expertise.

IHK Best Trainee Award

Enrico Fiege

The Chamber of Industry and Commerce (IHK) Potsdam honored Enrico Fiege for his successful graduation as a biology lab technician. The 24-year-old is one of the best graduates of the state of Brandenburg in 2018. His personal training highlight: an internship at Karolinska Institutet in Stockholm. After graduation, the biology lab technician now works in the Department of Experimental Diabetology.
Management and Governing Bodies

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