New Clue About Language Development

In an extensive screening program NGFN scientists have found genetic clues about language development in humans. They investigated a mouse model carrying part of the human TRF2 gene, which is thought to be a key gene for language development. In order to identify effects of the human TRF2 gene NGFN researchers from the German Mouse Clinic screened over 300 physiological parameters of the model mice such as voice, hearing, bone density as well as metabolic and neurological func-
tions. In accordance with the risk for serious facial and language development they analyzed the results of an international study led by the Leipzig Max Planck Institute for Evolutionary Anthropology.

A Novel Type of Cardiac Insufficiency and its Mechanism

The heart of the mouse and the human body - and its integrity is of major importance to health. NGFN scientists now demonstrated that mutations in the protein TRF2 are causative for a new type of heart failure. This protein is an important structural element of the heart muscle and its function is regulated in an essential way by the DNA molecule. These findings lead to the conclusion that a dysfunction of TRF2 or its absence directly lead to chronic cardiac insufficiency. The analysis of patients with heart failure confirmed these findings. 8 of 1,500 patients showed pathological changes of TRF2 and their disease. Hence, patients showing a TRF2 dysfunction might benefit from an optimized therapy aimed at recovery or to slow down the course of the disease.

Genome-wide association studies (GWAS) identify disease-associated genes and their variants that contribute to an increasing risk of developing a disease. This approach NGFN scientists identified nine new gene variants that predispose for changes in the heart rhythm and atrial fibrillation. It was already assumed that genetic differences make people more vulnerable to atrial fibrillation being one of the major risk factors for suffering a stroke. Now these differences could be located in the genome, which might help elucidating the molecular basis of atrial fibrillation and understanding its underlying mechanisms. This knowledge provides insights into atrial diseases and lead to new opportunities for prevention and therapy of atrial fibrillation.

International Projects

The implementation of new sequencing technologies shows a substantial change of the genome of single individuals in a very short time. Using high-throughput methods, this genome can be sequenced within the International 1000 Genomes Project in order to provide a database catalog of human genetic variations. By means of the Leibniz Institute for Molecular Genetics in Berlin-Germersheim a part of this international consortium, the German Federal Ministry of Education and Research (BMBF) is funding this contribution with about 8.8 million Euros.

NGFN Plus is a new project funded by the BMBF in cooperation with the German Ethics Council, together with the Max Planck Institute for Evolutionary Anthropology, the University of Leipzig, Germany and the Leibniz Institute for Molecular Genetics. The project aims at enhancing research on human genome related topics.

To date, the International Cancer Genome Consortium (ICGC) has sequenced 1,648 cancer genomes in ten tumor subtypes. By means of this project, NGFN aims at further expanding the scope of cancer research by providing new approaches to identify and prevent cancer. The BMBF projects are coordinated by the German Cancer Research Center (DKFZ) and coordinated with the Helmholtz Association. As of 2013, the German Cancer Research Center was merged into the German Cancer Consortium.

NGFN Plus and NGFN-Transfer

Locations of NGFN-Plus and NGFN-Transfer

NGFN-Plus and NGFN-Transfer in the Program of Medical Genome Research

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NGFNI-Plus and NGFNI-Transfer in the Program of Medical Genome Research

The successfull sequencing of the human genome was the first major achievement in human genome research. Since then, the genomic diversity between different people as well as the transfer of knowledge into medicine are considered crucial. In order to utilize the full potential of medical genome research, an interdisciplinary networking between the national research is essential for the purpose of the National Genome Research Network (NGFNI).

NGFNI was launched in 2006. In order to sustain the network's development in cancer research, the Geriatric Medicine Research Institute and Department of Clinical Research, in the field of genetic and epigenetic tumor genetics, is one of the research areas that are currently focusing on the investigation of experts from multiple disciplines, including physicians and molecular geneticists, in the NGFNI. Among the newly established Program of Medical Genome Research, NGFNI Plus is the third program, following the period of funding that started in 2012. The program consists of two main areas: molecular and functional genomics to elucidate the functions of disease-associated genes (NGFNI-Plus) and the other focusing on the rapid progress of the newest molecular diagnostics and therapy (NGFNI-Transfer), for the period spanning from 2012 to 2017. Within this period, Racem has been harped on by the SMRC, the SMRC decided the pace and method of advancement in the NEXT program and applying the strategy of comprehensive genomic science and research.

NGFNI-Plus – Seizing the Cues and the Conduits of Disease

Wide-spread diseases such as cancer, obesity, neurodegenerative diseases are complex phenotypes. The disease-oriented research of NGFNI-Plus is adding functional genomics and the understanding of the biological functions of specific diseases. By its clinical translation, NGFNI-Plus promises new strategies and treatment paradigms for the better quality of life in the next generation. Research in the field of genetic and epigenetic tumor genetics is contributing to the development and production for diagnostics and therapy, which will lead to the identification of new cancer drugs and the advancement of whole genome and search for disease-associated genome variants. Moreover, they analyze the relationships between the function of the identified genes and their products in a clinical and experimental method. This shift contributes to a better understanding of the molecular role of disease-related genes and the complex molecular interactions in the human body, which will be crucial for a specific prevention and for the development of effective therapeutics.

NGFNI-Transfer – Application in the Preventive Domain

The rapid and efficient development of results from medical genome research is the objective of NGFNI-Transfer, encouraging cooperative acquisitions of academic research and the commercialization of the program in the field of genetic and epigenetic tumor genetics, research institutes and biotechnological enterprises. Thus, the NGFNI-Transfer will lead to the improvement of existing medical and the development of new drugs, which are opened to research and research topics of NGFNI-Transfer aiming for a personalized and targeted medicine, which optimizes the individual patients.

Prof. Dr. Detlev W. Bornemann (Chairman for the NGFNI-Plus)

"The success of an NGFNI-Plus project from the human genome research is a complex endeavor. Due to the decision of molecular geneticists of the NGFNI-Plus, the partners have a chance to collaborate to achieve the common goals. The project is a collaborative effort, which can result in significant progress to economic growth and the creation of high-quality jobs in Germany.”

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The structure of the NGFNI

The structure of the next generation of the NGFNI is shown at the image below. The layout of the NGFNI is designed to allow for the integration of various research fields, which is characterized by a network of interactions that focus on the integration of the different fields. The NGFNI is divided into five main sections: Pharmaceutical Biotechnology, Medical Informatics, Clinical Efficacy, Technology Transfer, and Clinical Research.

Pharmaceutical Biotechnology

This section aims to develop new drugs and therapies for the prevention and treatment of diseases. It includes research on drug discovery, development, and clinical trials.

Medical Informatics

This section focuses on the development and implementation of medical informatics tools and systems to improve patient care and healthcare delivery.

Clinical Efficacy

This section investigates the effectiveness and safety of new drugs and therapies through clinical trials and real-world evidence.

Technology Transfer

This section is responsible for the commercialization of research findings, including patenting, licensing, and technology transfer.

Clinical Research

This section conducts research on human subjects to evaluate the safety and efficacy of new drugs and therapies.

The Structure of the NGFNI

At most in cancer institutes, various factors play an important role and are the focus of the medical genome researchers. Numerous scientific groups are in the NGFNI working to identify modifications of genes, which are relevant to the development of various cancers. This knowledge allows for targeted therapeutic strategies and new therapies.

NGFNI/Medical Research Drugs

Among the drugs identified for treating various cancers, drug candidates were selected that target specific metabolic pathways. Examples of such drug candidates are currently being evaluated in clinical trials.

Breast Cancer Cell Lines Degenerated via miRNAs

Breast cancer cell lines are often deregulated during tumor growth. NGFNI-Plus is working on the development of miRNA-based therapeutic approaches. One example is the use of miR-200b and miR-200c, which are known to inhibit the proliferation of breast cancer cells.

Genome Medicine/Other research

The involvement of epigenetic modifications in cancer development is crucial. Various histone modifying enzymes and DNA methyl transferases are involved in the regulation of gene expression.

The development of targeted therapies for cancer has been significantly advanced by the development of small-molecule drugs and monoclonal antibodies. These therapies have revolutionized the treatment of cancer and have led to significant improvements in patient outcomes.

Genome Medicine/Lung cancer

The identification of specific mutations in the lung cancer genome has led to the development of targeted therapies, such as the EGFR inhibitor Gefitinib, and the ALK inhibitor Crizotinib. These drugs have shown promising results in clinical trials and have become standard treatments for patients with specific genotypes.

New Insights into the Pathogenesis of Parkinson’s Disease

The causal role of p-Tau in the pathogenesis of Parkinson’s disease has been highlighted in recent years. The discovery of the pattern of phosphorylation of tau protein in the brains of patients with Parkinson’s disease has opened new avenues for the development of potential therapeutic strategies. The identification of the tau phosphorylation site in the neurofibrillary tangles of Parkinson’s disease cases has led to the development of novel therapeutic approaches.

Miguel-Risk Factor Identified

Miguel is a pancreatic cancer risk factor. It is a pancreatic neoplasm that may play an important role in the risk of developing pancreatic cancer. The identification of Miguel as a risk factor for pancreatic cancer has important implications for the development of preventive strategies. Further research is needed to fully understand the role of Miguel in the development of pancreatic cancer and to identify potential targets for intervention.

NGFNI-Plus and NGFNI-Transfer

Breaking Apart Breast Tissue in Tumors

In a study recently published in Nature, a novel approach to target tumor cells in the breast was described. The approach uses a novel method to disrupt the tumor tissue in the breast, allowing for the isolation of tumor cells for further analysis. This method is expected to provide new insights into the mechanism of tumor growth and could potentially be used as a therapeutic strategy.