New Source of Excitatory Neurons Discovered in the Brain (Nature Neuroscience 12, 1524)
Mouse Models for the Presymptomatic Phase of Parkinson’s Disease (Genes Brain Behav.
2010 Apr;9 (3):305-1)
Researchers Find Faster Way to Modify Targeted Genes in the Mammalian Genome (PNAS doi:10.1073/pnas.1009424107)

(compact) Mental Health

One Gene Defect Alone Is Insufficient: Why the Number of Neurons Diminishes (PLoS Biol.2010 Apr 6;8(4))
Neurological and Psychiatric Diseases Are on the Rise

Life expectancy has increased substantially during the past century – not only through improvements in the field of medicine and general hygiene. At the same time, age-associated diseases are increasing, among them neurodegenerative disorders such as Alzheimer’s and Parkinson’s disease. The number of patients with psychiatric disorders such as depression is also on the rise. The World Health Organization predicts a further increase in the number of cases until 2030. This is a burden to society in many respects – socially, economically and with regard to health care economics.

Neurological and psychiatric disorders are only partially due to genetic predisposition. Especially in age-associated diseases, a combination of environmental and genetic risk factors is responsible for the outbreak of the diseases. This is a cumulative effect, which is why these diseases are often not diagnosed until the pathogenic processes in the brain have progressed to an advanced stage. Alzheimer’s disease, Parkinson’s disease, and also depression have come to be viewed as environmental diseases – they are influenced by toxins, air pollution, nutrition or stress during pathogenesis. However, the exact pathogenic mechanisms on a molecular level still remain quite elusive.

Precisely these mechanisms and their interrelationships are explored by researchers at the Helmholtz Zentrum München. The elucidation of complex interactions is crucial for the development of new therapies, diagnostic methods and successful prevention strategies. To facilitate this research, the center provides cutting-edge technology platforms as scientific infrastructure. Through intensive cooperation with clinical partners, we ensure that insights gained from research are transferred quickly into medical practice for the benefit of patients.

Last but not least, scientific education and training and the promotion of the young generation of scientists is a key focus of the center, exemplified by the new graduate school, the Helmholtz Graduate School of Environmental Health (HELENA), with which Helmholtz Zentrum München is setting new standards. The HELENA module Neuro and Stem Cell Biology plays a major role in the advancement of mental health research. Moreover, four junior research groups are active in this field.

Prof. Dr. Günther Wess
CEO and President

Prof. Dr. Wolfgang Wurst
Director of the Institute of Developmental Genetics

Prof. Dr. Magdalena Götz
Director of the Institute of Stem Cell Research
Alzheimer’s disease, Parkinson’s disease and various forms of depression are major common diseases (1) on which Helmholtz Zentrum München is focusing. Environmental Health (2) is the leitmotif of our research. We investigate the relationships of man, his living conditions and his genetic predisposition. Through translational research (3), the clinical cooperation group Molecular Neurogenetics works closely with hospitals in order to transfer insights gained from basic research as fast as possible to medical practice for the benefit of patients. This goal is based on excellent research (4), education and training (5) and technologies (6) and cooperations (7). Several institutes and research units contribute to achieving this goal.

**Contact Persons (Institutes) (4)**

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**Contact Persons (Technologies) (6)**

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Our Expertise in the Research of Neurological and Psychiatric Diseases

Institute of Developmental Genetics
- Director: Prof. Dr. Wolfgang Wurst
  (Chair of Developmental Genetics at TUM)
- One of the aims: development of animal models and biomarkers of CNS diseases
- Clinical cooperation group and three junior groups

Institute of Stem Cell Research
- Director: Prof. Dr. Magdalena Götz
  (Chair of Physiological Genomics at LMU)
- One of the aims: multi-organ stem cell research to elucidate the underlying mechanisms in stem cell specification and to selectively repair damaged cells

Institute of Human Genetics
- Director: Prof. Dr. Thomas Meitinger
  (Chair of Human Genetics at TUM)
- One of the aims: to identify genes and signaling pathways which lead to neurological and psychiatric diseases

Research Unit Zebrafish Neurogenetics
- Acting head: Prof. Dr. Wolfgang Wurst
- One of the aims: to investigate mechanisms and factors of neurogenesis and neuronal specification of the vertebrate brain

Institute of Bioinformatics and Systems Biology
- Director: Prof. Dr. Hans-Werner Mewes
  (Chair of Genome-Oriented Bioinformatics at TUM)
- One of the aims: to gain insights into the pathogenesis of neurological and psychiatric diseases by means of bioinformatic modeling

Institute of Biological and Medical Imaging
- Director: Prof. Dr. Vasilis Ntziachristos
  (Chair of Biological Imaging at TUM)
- One of the aims: to develop and make in vivo imaging technologies available

Institute of Experimental Genetics
- Director: Prof. Dr. Martin Hrabě de Angelis
  (Chair of Experimental Genetics at TUM)
- One of the aims: Analysis of mouse models in order to identify the systemic effects of genes associated with disease (GMC)

Institute of Radiation Biology
- Director: Prof. Dr. Michael John Atkinson
  (Chair of Radiation Biology at TUM)
- One of the aims: to investigate the effects of low-dose radiation on mental health

Institute of Epidemiology
- Director: Prof. Dr. Dr. H.-Erich Wichmann
  (Chair of Epidemiology at LMU)
- Responsible scientist: Prof. Dr. Karl-Heinz Ladwig
- One of the aims: to identify epidemiological risk factors of mental health

Institute of Virology
- Director: Prof. Dr. Ulrike Protzer
  (Chair of Virology at TUM)
- Responsible scientist: Prof. Dr. Ruth Brack-Werner
- One of the aims: to elucidate the effects of infections (e.g. HIV) on the brain

Institute of Ecological Chemistry
- Director: Dr. Sigurd Schulte-Hostede
- Responsible scientist: Prof. Dr. Bernhard Michalke
- One of the aims: to elucidate the pathogenesis of manganese-induced parkinsonism

Institute of Structural Biology
- Director: Prof. Dr. Michael Sattler
  (Chair of Biomolecular NMR Spectroscopy at TUM)
- One of the aims: structural analysis of proteins associated with Parkinson’s disease to better predict the outcome of using therapeutically active molecules

Institute of Lung Biology
- Director: Prof. Dr. Oliver Eickelberg
- Responsible Scientist: Prof. Dr. Wolfgang Kreyling
- One of the aims: to elucidate the influence of airborne nanoparticles on neurological diseases
Our Approaches in the Research of Neurological and Psychiatric Diseases

Projects

Clinical and Pre-Clinical

- Identification of genes which trigger disease and of epidemiological risk factors
- Identification of genes associated with disease (Parkinson’s, restless legs syndrome)
- Creation of animal models

Basis

- Environmental factors of Alzheimer’s, Parkinson’s and various types of depression
- Regulation of stem cell differentiation
- Mechanisms of neuron formation and migration
- Neurogenesis in adults
- Identification of the molecular mechanisms of the etiology of neurological and psychiatric diseases

- Maturation mechanisms of stem cells decoded
- New source discovered for the formation of nerve cells
- Migration mechanisms of new nerve cells decoded
- Function of the mitochondria for the pathogenesis of neurological diseases
- Dysfunction of the cytoskeleton and the oxidative stress response in the pathogenesis of neurological diseases
- Central effect of the stress hormone in the pathogenesis of depression

New Approaches to Therapy

- Stem cells and regeneration
- Cell replacement therapy

- Support cells can be converted into specific neurons
- CRH-R1 antagonists have an antidepressive effect

New Diagnostic and Imaging Methods

- Non-invasive diagnostic options (e.g. biomarkers)
- Structural analysis of proteins associated with Parkinson’s

- Combination of light and ultrasound for imaging
- New methods of molecular diagnosis of mitochondrial defects established

New Approaches to Prevention

- Identification and utilization of protective mechanisms of the brain in the case of brain damage

- Animal models suitable for the study of preventive therapies
- Neuroprotective effect of a food supplement identified

Our Partners in the Research of Neurological and Psychiatric Diseases

Helmholtz Alliance Mental Health in an Aging Society
Focus: Neurodegenerative diseases, which are considered to be the most common causes for the breakdown of mental health in old age (Alzheimer’s, Parkinson’s and their comorbid diseases such as depression). Aim: to investigate the causes and mechanisms of neurodegenerative diseases and to develop new therapy strategies, using a translational approach encompassing all diseases. The coordination is carried out by Helmholtz Zentrum München.

Helmholtz Virtual Institute of Neurodegeneration and Aging
Focus: Study of the triggers of neurodegenerative diseases such as Alzheimer’s and Parkinson’s and the influence of molecular aging processes on their pathogenesis. The cooperation partners are LMU and TUM. Prof. Dr. Wolfgang Wurst, Institute of Developmental Genetics, is head coordinator.

German Center for Neurodegenerative Diseases
Helmholtz Zentrum München is a key participant in the Munich location of the German Center for Neurodegenerative Diseases (DZNE).

European Conditional Mouse Mutagenesis Programme (EUCOMM/EUCOMMTTOOLS)
Aim: To mutate all genes in the embryonic stem cells of the mouse in order to investigate the function of genes and to elucidate their significance in pathogenesis. The European partners are coordinated by Helmholtz Zentrum München. EUCOMM/EUCOMMTTOOLS is partner of the International Knockout Mouse Consortium (IKMC).

From Disease Genes to Protein Pathways (DiGtoP)
The network From Disease Genes to Protein Pathways is dedicated to the analysis of the proteome, the entire set of proteins expressed in the genome and their function and interactions. The focus is on major common diseases. The coordination is carried out by Helmholtz Zentrum München.

BMBF Network New Neurons
Aim: To conduct research on the generation of nerve cells for regenerative medicine. The coordination is carried out by Prof. Dr. Magdalena Götz, Institute of Stem Cell Research.

Bavarian Research Association ForNeuroCell
Aim: To develop regenerative cell replacement therapy for acute and chronic diseases of the nervous system based on adult stem cells and to lead these results to a clinical application. Helmholtz Zentrum München is a partner of ForNeuroCell.
Compact: Helmholtz Zentrum München in numbers

Research at Helmholtz Zentrum München: 33 institutes and independent research units; 20 technology platforms; 2 translational research centers; 12 clinical cooperation groups; 8 junior research groups

1879 staff members: 607 scientists and post-docs; disciplines of the scientists: biology 41%, chemistry/biochemistry 14%, physics/biophysics 10% and medicine 7%; 430 doctoral students, of these 307 employed at Helmholtz Zentrum München; 824 technical staff and other employees; 46 trainees; 95 work-students, interns, temporary employees; 33% of positions are financed through third-party funds; 77% of employees in scientific area, 14% in the technical area, 9% in the administration (as of January 31, 2011)

Finances: Total budget 173 million euros: 120 million euros from the Federal Government and the Free State of Bavaria; financing ratio 90:10; over 50 million euros in third-party grants (as of January 31, 2011)