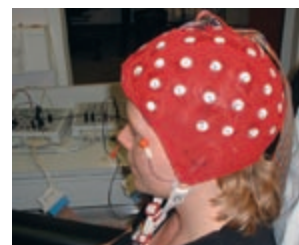


Plasticity in object processing

The principles of functional reorganization within the human brain are being investigated in Hamburg and Kiel using object recognition as an example. Functional recovery after brain damage and transient disorders is being investigated in several brain regions. Among other things, changes in the brain of blind people will be demonstrated, which enables fast and purposeful object recognition despite impaired perception.

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Pain perception measurement device

Pain perception

Pain is the most intensive experience of all perceivable experiences. Research groups in Mannheim, Mainz and Düsseldorf are studying the influence of emotion and cognition on pain perception in order to develop more effective pain treatments. Apart from healthy volunteers, patients with increased pain perception (chronic pain patients), reduced pain perception (borderline patients), altered pain perception (depressive patients) and persons with masochistic tendencies will be investigated.

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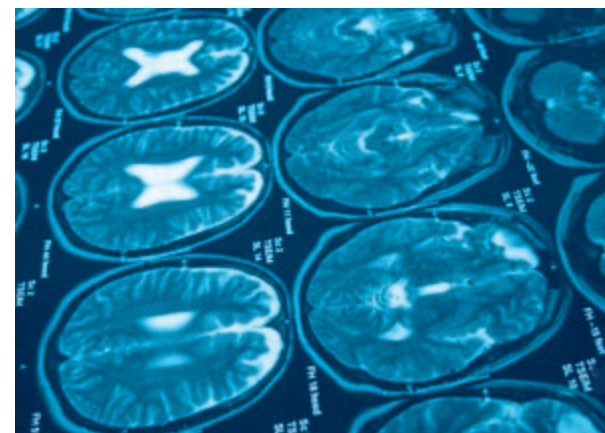
Complex movement

Apraxia

Apraxia is a Greek word which means inactivity. Patients with apraxia are unable to achieve complex movement sequences despite intact motor function and perception. Research on the neuronal basis of higher motor cognition and the basis of limb and speech apraxia is being undertaken in Lübeck, Munich, and Hamburg. The long-term aim is to develop new procedures for diagnosis and therapy.

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MRI images of the brain



Cognitive Research



RESEARCH



Cognitive performance and relevant disorders

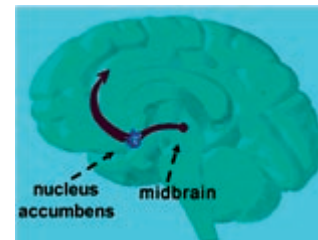
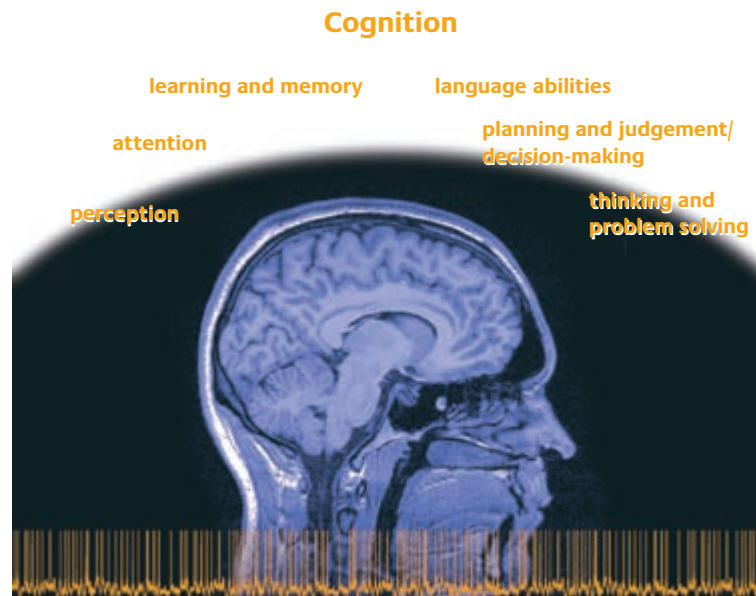
A man perceives his surroundings. He pays attention to his environment and begins to reflect on it. He learns and stores information in his mind. Memories are “translated” into speech. The next step is planned. All of these processes take place in the brain and can be summarized by the term “cognition”.

Cognition is derived from the Latin word *cognitio*, which means realization. Cognitive research is not only concerned with the neurobiological fundamentals of cognition but also provides insights into the progress of diseases involving the impairment of brain functions. It is necessary that various disciplines including psychology, psychiatry, neurology, neurophysiology and computational neurosciences cooperate. Major insights for a better understanding of higher brain functions and relevant disorders are, therefore, expected from cognitive research.

In 2005 the German Federal Ministry of Education and Research (BMBF) awarded a three-year grant totalling 6.2 million euros to seven research collaborations focusing on cognitive performance and relevant disorders in humans. The research collaborations are to bridge the gap between a research approach which aims to improve the basic understanding of higher cerebral functions and clinical research with human patients.

Within the research collaborations human cognition is being investigated both by studying behavior and by measuring brain activation using different methods. As an example, functional Magnetic Resonance Imaging is used to show brain activation during learning and memory tasks. The investigations on humans will be supplemented by experimental animal studies to investigate brain activity on the cellular level as well.

The funding initiative is a part of the lead vision “Understanding thought processes”. Several funding initiatives have been established to address the objective of helping to understand information processing, cognition, creativity, and learning. Social objectives are implementations in medicine, biological science, and learning and education. As from 2006 the BMBF will fund another research collaborations on cognitive performance and relevant disorders in humans.



Dopaminergic system

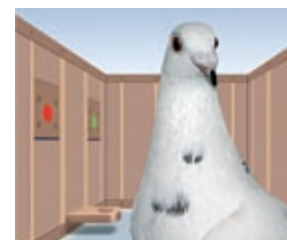
Dopaminergic enhancement of learning

Enhancement of learning and memory and recovery after brain damage is being investigated in Münster. A focus of interest is the neurotransmitter dopamine.

It is being investigated if dopaminergic modulation in the brain improves memory impairments and language recovery after stroke. Additionally, it is being tested if physical exercise enhances learning and memory in older people via an up-regulation of dopamine in the brain.

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Pigeon in a learning experiment

Feedback-based learning

This collaboration aims to determine the neurobiological basis of learning. It is known that dysfunction of specific human brain regions (basal ganglia and prefrontal cortex) results in learning impairment.

This so-called fronto-striatal system is being investigated in Bochum and Freiburg to contribute to the understanding of cognitive deficits in Parkinson’s disease and stroke patients.

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Deep brain stimulation

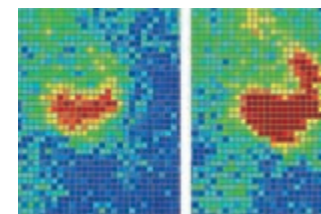
Reward system

Learning and memory are influenced by different kinds of rewards. In this collaboration the reward system of the brain is being investigated in Magdeburg, Leipzig, and Cologne. Among others the role of the nucleus accumbens,

which is an important part within the reward system, will be examined. The neuronal activation of patients treated with deep brain stimulation within the framework of their therapy can be recorded during a learning task.

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Synaptic activity

Synaptic plasticity

The neuronal basis of learning is a change at the connections between nerve cells. This is termed “synaptic plasticity”. The role of synaptic plasticity

in learning and memory and in cognitive deficits of epileptic patients is being explored in Bonn and Rostock. The collaboration aims to achieve a contribution in developing new therapies.

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