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## A new era is around the corner - and the neurosciences will be key

Some of the most thrilling scientific questions are certainly the following: How does the human brain work? How do neurones communicate and affect each other? What happens when we are thinking? Nowadays, many scientists and experts believe that the age of genes will now be followed by the era of the neurosciences.



Neural interaction (Photo: BCCN)

Our understanding of brain and nerve functions has changed considerably over the last years due to a plethora of new findings. For example, the assumption that brain cells are unable to regenerate no longer holds true.

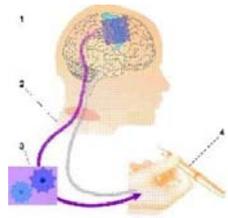
It is known that at least in the hippocampus, which is a part of the cerebrum that is responsible for certain learning processes, new, functional neurones are constantly developing from neural stem cells. However, it is not just knowledge about the development of functional brains and maturation that is increasing, researchers are also gaining greater insights into the degenerative processes in the brain that lead to diseases like Parkinson's and Alzheimer's.

It goes without saying that new knowledge also leads to new therapeutic strategies. For example, Syngis Pharma AG, a biotech company based in Heidelberg, is developing drugs for the treatment of central nervous system diseases for which hardly any or no treatments have been available up until now. An article written by the BioRegion Rhein-Neckar Triangle, presents the company.

Research not only focuses on the development of new drugs, but also strives to develop new surgical methods that seemed unthinkable a very short while ago. One type of Parkinson's therapy is known as deep brain stimulation or brain pacemaker operation, in which electrodes are implanted into the patient's brain, firing pulses that are controlled by a pacemaker implanted under the skin, either near the collarbone or in the abdomen. The pacemaker is tuned with a device that resembles a radio control. Three articles written by the Freiburg BioRegion describe such an intervention, talk about the suitability of certain types of people for such operations as well as discuss the technologies and knowledge required to carry out such operations. They also tell the story of a patient who has undergone deep brain stimulation and how he feels after having had two electrodes implanted in his brain.

## New methods pose ethicists serious questions

Methods such as deep brain stimulation in which doctors and scientists actively interfere with the brain processes, entail a number of serious ethical questions. The same is true for another new method known as brain-machine interface, which can potentially help severely paralysed people control the movement of prostheses.



- 1) Elektroden messen die Gehirnaktivität
- 2) System zur Datenübertragung der Signale an
- 3) Ein abgestimmtes System aus Verstärker, Computer und leistungsfähiger Software zur Dekodierung eines Signals.
- 4) Effektor, bspw. ein Computercursor, eine Arm- oder Handprothese oder die eigene Muskulatur, angesteuert durch direkte Muskelstimulation.

New methods pose ethicists serious questions

Signals are recorded on the brain surface and transferred to a computer where mathematical calculations use the measured brain activity to help interpret the patient's intention to move. When the brain signals are translated, the computer activates a prosthesis or robotic arm. An interview conducted by the Freiburg BioRegion deals with the ethical problems associated with modern brain research and surgery. The neurosciences are developing rapidly and sometimes they seem to resemble science fiction. At this year's AAAS conference held in February, a paralysed patient with leg muscle implants was introduced to the audience. The patient is able to control her implants with a radio control, the leg muscles are stimulated and contract and the patient is able to stand up. "This works but looks kind of clumsy," said a German journalist who attended the AAAS conference in San Francisco. In any case, the woman is able to stand up and can reach things and places that would have been out of reach had she had to use a wheelchair.

## Neurobiology has huge potential

The potential of neurobiology is generally regarded as very promising. That is why the Federal Ministry of Education and Research (BMBF) has established the National Network of Computational Neurosciences, including the four Bernstein centres in Freiburg, Göttingen.

## Announcements

**Two new BMELV funding priorities | 16.07.2007**  
The BMELV is hoping to boost the application of renewable materials in chemistry with the announcement of two new programmes.... [More information](#)

**Intercultural competences and project management in EU research projects | 16.07.2007**  
Four-day residential course "Intercultural Research Management" in June and July 2007 in Karlsruhe.... [More information](#)

**New programme planned for the advancement of women | 16.07.2007**  
The number of female professors at German universities has significantly increased.... [More information](#)

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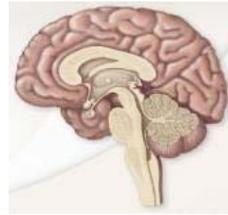
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Brain pacemaker for bilateral deep brain stimulation (Photo: Medtronik)

Berlin and Munich. The Network is funded with a total of €34 million. In addition, the Ministry also funds numerous individual projects in this field.

Two of these projects are coordinated by Prof. Dr. Dr. Hans-Otto Karnath at the University Hospital in Tübingen. The joint project "Spatial orientation" is looking into strategies for the treatment of orientation disorders. The second project focuses on how an overall visual impression is generated. The STERN BioRegion has written about these outstanding concepts. However, it is not just the German BMBF who are well aware of the potential of neurobiology and brain research, but also the universities themselves. Those who can, try to combine and pool their strengths. For example, the Interdisciplinary Centre of Neurosciences (IHZ) was established in Heidelberg, in which leading university groups work together with scientists at extramural research institutions such as the DKFZ and EMBL. The BioRegion Rhein-Neckar Triangle presents the IHZ.



Brain hemisphere (Illustration: The McGraw-Hill Companies)

#### Ants help to develop walking robots

High expectations of neurobiological research mainly focus on the benefit to humans. However, research involving less complex nervous systems is indispensable. The neurobiologist Harald Wolf from Ulm is using grasshoppers and ants to find out how these invertebrates find their bearings. Something that sounds like pure basic research is, however, close to real application. Wolf was involved in DFG-funded projects, in which he contributed to the construction of walking robots. An article by the Ulm BioRegion presents the important work of the Ulm zoologist.

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Overview of allocated articles

**Excellent research on the brain's communication nodes** | 25.05.2007 Prof. Peter H. Seeburg from the Max Planck Institute for Medical Research in Heidelberg has been awarded the InBev-Baillet Latour Health Prize 2007. The scientist has made fundamental discoveries about the mechanisms that enable the neurones in the brain to communicate with each other. [More information](#)

**In silico learning** | 28.04.2007 Scientists at the Bernstein Centre for Computational Neuroscience, the University of Freiburg and RIKEN Brain Science Institute in Tokyo are investigating learning processes by simulating one cubic millimetre of the brain. [More information](#)

**Neuroscientific networks in Heidelberg** | 02.03.2007 The Interdisciplinary Centre for Neurosciences (IZN) was founded as the joint platform for neurobiological and neuromedical research in Heidelberg. The IZN is now set to be restructured in order to promote networking activities between university, extramural research institutions and the hospital. [More information](#)

**Coordinated fight against brain tumours** | 21.02.2007 Through the appointment of two outstanding scientists, neuropathologist Andreas von Deimling and neurologist Wolfgang Wick, Heidelberg has strengthened its profile as one of the most important European centres dealing with the research and treatment of brain tumours. [More information](#)

**A painful road to happiness** | 09.02.2007 Andreas Meissner, a Parkinson's patient, had to endure six whole months of pain and distress before the final fine-tuning of his brain pacemaker eventually took place. However, he then felt the story had a happy ending: "The exhausting operation last summer was worth it." [More information](#)

**Where does man stop and machine begin?** | 08.02.2007 Today, neurosurgeons and neurobiologists with modern surgical and investigation methods are intervening directly in the brain. Karin Bundschuh from BioRegio Freiburg spoke with Dr. Jens Clausen of Freiburg's Interdisciplinary Ethics Centre about the ethical questions and problems raised by modern brain research. [More information](#)

**Deceived by ones own perception** | 08.02.2007 Since not much is known about the processes in the brain, it is difficult to treat disorders in the neural processing of sensations. In Tübingen, two BMBF-funded projects are working on the development of new therapeutic approaches. [More information](#)

**In the beginning there were ants** | 07.02.2007 Harald Wolf, a neurobiologist from Ulm, is studying the motor control of invertebrates such as grasshoppers and ants. Just recently, the zoologist was able to show experimentally how desert ants navigate in a featureless environment. [More information](#)

**Improve the quality of life of severely paralysed people** | 27.01.2007 The idea is fascinating: scientists at the University of Freiburg hope to develop a computer-based motor neuroprosthesis that will help improve the quality of life and motor ability of severely paralysed people. The concept won the "Go-Bio" competition of the Federal Ministry of Education and Research. [More information](#)

**Deep brain stimulation can improve the quality of life** | 07.08.2006 The implantation of brain pacemakers is torture. Ten years ago, the first brain pacemaker operations were undertaken in Germany. Nowadays, deep brain stimulation, as this kind of surgery is also called, has become an established method. [More information](#)

**The transplantation of brain pacemakers** | 06.08.2006 The treatment of Parkinson's disease involves drugs to counteract dopamine deficiency in the brain. A brain pacemaker implantation is only advised in cases when the aforementioned drugs and combinations thereof do not lead to satisfactory treatment results, and in patients under 70. [More information](#)