

The NCCR Neuro 2001 - 2013

On 31 May 2013, the NCCR Neuro officially ended, but its legacy will live on in the newly created professorships in neuroscience and in most of its infrastructure, which will remain for neuroscience research at the co-leading University of Zurich and ETH Zurich.

Only limited help is available to patients suffering from diseases of the central nervous system. The central goal of this NCCR was to understand better the mechanisms and causes of neurological diseases and to alleviate the suffering of patients by designing and testing novel therapies for the future. After 12 years, an abundance of key novel insights were obtained in basic science which gave rise to new therapeutic approaches. Successful translations into clinical trials were achieved in the cases of Alzheimer's disease, spinal cord injury, and robot-assisted neurorehabilitation.

The research structure of the NCCR was determined by its overall topic, Neural Plasticity and Repair. From its inception, eight projects, usually consisting of basic and clinical neuroscientists and frequently an engineering or industrial partner, focused mainly on neural plasticity (stem cells, neuroprotection, plasticity and regeneration) and new strategies for the repair of central nervous system damage (Alzheimer's disease, stroke, epilepsy, multiple sclerosis and spinal cord injury). Projects in neuro-oncology and neurorehabilitation engineering were added during the course of the NCCR.

Scientific breakthroughs and clinical trials

Important advances were made in the understanding of brain functions and disease pathology. They included the identification of signaling pathways in neural stem cell fate determination, the formation of new circuits following spinal cord and brain injury as a basis of functional restoration after lesions, the discovery of the presence of antibodies with neuroprotective potential in healthy volunteers, the identification of new inflammatory mediators and cascades in multiple sclerosis and prion protein diseases, and important new insights into the function and plasticity of the animal and human sensory-motor cortexes.

The discovery of the occurrence of antibodies that recognize and initiate clearing of amyloid plaques and tangles in healthy human subjects led to the production of new, therapeutic, recombinant fully human antibodies. A clinical trial in Alzheimer's disease patients was initiated in 2011. The research on the development of antibodies for neurodegenerative diseases will be continued.

A major breakthrough in neuronal regeneration was the discovery of neurite growth inhibitors, in particular the protein Nogo, discovered prior to the NCCR. Its functional blockade by an anti-Nogo antibody was found to strongly enhance functional recovery after spinal cord injury, as demonstrated impressively in rodents and non-human primates within this NCCR. A phase I clinical trial performed in collaboration with Novartis and a European clinical network for para- and tetraplegic patients was completed successfully, showing no side effects. The further clinical development of the anti-Nogo antibody will continue.

New robot-assisted training devices were developed by combining novel technologies of sensory-motor rehabilitation with close input from basic physiological sciences and with consideration of clinical requirements. Some of these devices are currently being introduced into the market by spin-off companies, in particular for locomotion and arm movement training (including virtual reality-based settings) for spinal cord injury and stroke patients. The successful inclusion of engineering solutions into neurorehabilitation research is one of the major achievements of this NCCR.

New NCCR Neuro professorships

To strengthen neuroscience research at its home institutions, the NCCR has established nine new professorships: A new chair for animal imaging at UZH/ETH and eight assistant professorships (clinical multiple sclerosis (MS) research, experimental MS research, rehabilitation engineering (two positions), stem cell biology, experimental neurorehabilitation, clinical neurorehabilitation and systems biology of Alzheimer's disease) . Four of these assistant professorships have now received permanent professorships at the home institutions and two at other universities. All assistant professorships were funded by the NCCR Neuro with additional help from industrial partners, foundations and private donors. In addition, two independent junior research groups in proteomics research and super-resolution microscopy were set up. At present, research into the area of neurodegeneration is being reinforced by the creation of two new professorships for Parkinson's disease.

New technology platforms

The establishment of centers of expertise for transgenic technology, analysis of complex behaviors in rodents, cell surface proteome analysis and animal imaging as service platforms for all projects was extremely fruitful in expediting experimental progress and knowledge transfer within the NCCR. The Center for Animal Imaging was opened in 2005 as the first high-field magnetic resonance imaging (MRI) facility for animals in Switzerland. It develops MRI and optical technologies for the visualization of neuronal activity in the brain, ranging from high structural resolution to the registration of circuit dynamics over a time range of weeks in vivo. This service platform will continue permanently after the termination of the NCCR and is one of the greatest structural achievements of this NCCR.

Other developments by the home institutions

The University of Zurich launched two Clinical Research Priority Programs in 2012 in multiple sclerosis research and in neurorehabilitation which include the research groups of these NCCR Neuro projects. ETH Zurich inaugurated the new Department of Health Sciences and Technology in 2012 as a home for most neuroscience groups at ETH. Neuroscience Center Zurich has designed a new translational project in dementia research at the Life Science Campus Schlieren. This project is supported by Hochschulmedizin Zürich and will be started in 2014.
