Own Research

Prof. Heinz Boeker, MD is Head of the research group „Therapy and Process Research“ at the Hospital for Affective Disorders and General Psychiatry Zurich East, University Hospital of Psychiatry, Zurich. These research activities focus on the investigation of the emotional-cognitive interaction in depression. For this, three different methodological approaches are taken:

1) Single-case studies (ideographic approach using the Repertory Grid Technique and Operationalized Psychodynamic Diagnostics) to analyse the subjective dimension of depression.
2) Combined neuropsychological and imaging studies focussing on neuropsychological symptoms and neuronal activity in the prefrontal cortex in patients with major depression.
3) Evaluation of the course of out-patient, day clinic and in-patient treatment of depression.

Single-case studies (ideographic approach):
Self-models and social perception in depressed patients were systematically investigated using the Repertory Grid Technique. Semi-quantitative analyses were developed to enable the comparison of the patients' different self-constructs and to make self-models available for further empirical research through nomographic application of ideographic findings (Boeker 1999, Boeker et al. 2000a-c).

Operationalized Psychodynamic Diagnostics (OPD) were used to explore the personality structure and affect regulation of female patients showing deliberate self-harm (Boeker et al. 2008).

In summary, it has been demonstrated that single-case oriented diagnostics (using the Repertory Grid Technique and OPD) enable empirical research into important personality dimensions on the basis of ideographic findings. This could also be useful for solving methodological questions arising in neurobiological depression studies (e.g. the problem concerning heterogenous samples).

Combined neuropsychological and imaging studies in depressed patients
Patients who had previously suffered from depressive stupor were investigated by means of neuropsychology and fMRI and subsequently compared with healthy controls and other psychiatric patients (without stupor). Whereas the healthy controls showed activation in the ventromedial prefrontal cortex, the patients who had had depressive stupor showed significantly less activation, particularly in the case of negative optical stimuli, i.e. aggression (Northoff, Boeker et al. 2004, Boeker and Northoff 2005, Northoff and Boeker 2006).

These neuropsychological investigations confirmed the finding of impaired decision-making ability in patients who had suffered depressive stupor: While healthy controls opted for long-term, more successful low-risk cards (in the Iowa Gambling Task/IGT), the patients who had previously had depressive stupor adhered to their original strategy (preferring high-risk cards), unable to change their minds despite negative consequences (Northoff et al. 2003, Boeker and Northoff 2005, Northoff and Boeker 2006). This points to a connection between emotional experience, behavioural decisions and the activity in the ventromedial prefrontal cortex: more activity in the ventromedial prefrontal cortex was related to positive decision-making behaviour (Boeker and Northoff 2005, Northoff and Boeker 2006).

In view of these results, further investigations have been carried out into emotional-cognitive interaction in depressed patients during depression and after improvement/remission of symptoms.

The results point to a disturbance in the reciprocal modulation of the ventromedial prefrontal cortex (VMPFC) and the dorsolateral prefrontal cortex (DLPFC) in depressed patients: greater activity in the VMPFC is correlated with negative, depressed emotions, and reduced activity in the DLPFC is correlated with negative judgement. These are most probably clinically relevant correlates of the cognitive disorders observed during depression. The connection between neuronal activity patterns and the severity of depression could be confirmed: the worse the depression is (both subjectively as seen in the BDI and objectively as seen in the HAMD), the greater the activity in the ventromedial prefrontal cortex and the amygdala. Our findings are in line with those of other neurophysiological and neuropsychological depression researchers (Mayberg et al. 2000). These findings have been published in leading international journals and can be considered important milestones in research into depression.

In a combined fMRI/MRS study in patients with major depression not taking medication, a connection was found between disturbed activation patterns in the pregenual anterior cingulate cortex (pgACC) and deficits in the glutamatergic metabolism in anhedonic depression.

In the study "Functional neuroanatomy and regional metabolism before and after treatment with duloxetine: A combined fMRI and MRS study in major depression", emotional processing was investigated. Results of a pilot study in healthy subjects showed significant signal changes in the bilateral insula. Under „interoception" an activation of signal intensity was observed, while under „exteroception" a deactivation occurred. Moreover, significant signal changes in the bilateral DLPFC, PCC, VMPFC, SACC and DMPFC were found.
These results were compared with a sample of depressed patients (Ernst et al. 2012,2014). It could be shown that interoceptive awareness enhances neural activity during empathy and furthermore that interoceptive awareness and alexithymia are associated with neurotransmitter concentrations in insula and anterior cingulate.

In another neuroimaging study the modulation of fear and empathy by oxytocin was corroborated. It was found that the beneficial effect of oxytocin on avoidance-related facial emotion depends on early life stress experience (Feeser et al 2014).

Therapy and Process Research
Cognitive symptoms and psychopathology of depressed patients during in-patient treatment are systematically recorded. These findings obtained from a large sample of depressed in-patients are important for our on-going process research in depression and also for quality assurance.

Neuropsychological deficits were seen in a sample of in-patients with major depression even after remission (attention, memory, strategic aspects of working memory and executive functions, Boeker et al. 2012). These neuropsychological symptoms were observed simultaneously with disturbances in neural activity patterns in the prefrontal cortex; they may be interpreted as trait markers for depression and underline the dissociation of psychopathological and neuropsychological symptoms in the course of depression.

Further investigations centre on the course of depressive disorders and their treatment by medication and psychotherapy. Time parameters concerning improvement of symptoms are correlated with molecular-genetic parameters. Evidence was found for a molecular-genetic component in the course of improvement following treatment with antidepressants (Stassen et al. 2006). Additionally, as part of this research, the so-called "recovery-oriented genetic components" in the pharmacotherapy of depressed patients was investigated (Angst and Stassen 2001, Stassen et al. 2006, Stassen, Scharfetter, Boeker 2008).

The neural and metabolic correlates of emotional processing in major depression are currently being investigated in a multimodal imaging study using treatment with ketamine.

A further focus is on neural and metabolic markers in the course of ECT treatment in patients with chronic depression. Here, the aim is to generate new multimodal information on the neurobiological changes during treatment with ECT. To this end, the consecutive neurodynamic effects of ECT on metabolite concentrations (GABA/glutamate/glutamine), functional brain activity and blood flow to the brain are measured and correlated with effects resulting from antidepressant treatment. These investigations are carried out using various imaging procedures (ASL, fMRI, MRS).

We have recently also started studying the course of treatment of depression in different therapeutical settings (cognitive behavioural therapy, psychodynamic psychotherapy, drug therapy incl. supportive therapy).
The modulation of mental activity, the neural correlates of control of aversion and the change of mental structure due to Psychodynamic Psychotherapy is investigated using fMRI as well as Operationalized Psychodynamic Diagnostics by applying an individualized neuroimaging paradigm (Zurich Depression-Study).

In conclusion, the "Therapy and Process Research" group, headed by Prof. Heinz Boeker, MD, has developed various methodological approaches (ideographic approach, combined neuropsychological and imaging studies incl. fMRI and MRS, therapy and process research). This group of researchers is part of the Centre for the Treatment of Depression and Anxiety Disorders at the University Hospital of Psychiatry, Zurich. They work in close cooperation with the "Molecular Genetic Research Group" at the University Hospital of Psychiatry, Zurich (Head: Prof. Hans Stassen, PD, PhD), the Department for Biomedical Engineering at the ETH and University of Zurich (Former Head: Prof. Peter Boesiger, PD, PhD), The Royal Ottawa Healthcare Group, University of Ottawa/Canada , Institute of Mental Health Research (Head: Prof. Dr. Dr. phil. habil. Georg Northoff, MD, PhD), Psychiatric Hospital, Charité, Humboldt-University Berlin/Germany (Priv. Doz. Dr. rer. nat. Simone Grimm, PhD) and other national and international research centres.

In summary, our research group aims at developing specific diagnostic, therapeutic and prognostic markers of affective disorders.