Patrick Bach

Narrative Academic Profile

In my research, I seek to uncover the **neurobiological basis of clinically relevant disease mechanisms** and establish **neural biomarkers of substance use disorder (SUDs)**, as well as to **assess the potential of innovative treatments** by application of multimodal neuroimaging techniques and adaptive machine learning strategies. I am head of the research groups ***Neuroenhancement*** and ***Behavioral Addictions*** of the Department of Addictive Behavior and Addiction Medicine at the Central Institute of Mental Health in Mannheim. I have a background in psychology and medicine with particular expertise in the field of neuroscientific research and neuropsychological, neuroendocrine, neuroimaging, genetic, as well as pharmacological research methods.

A focus of my research is the identification and assessment of innovative new treatments for SUDs. Currently, only a limited number of approved drugs are available for the treatment of AUD, which yield unsatisfactory high relapse rates. Preclinical research and a randomized-controlled pilot-trial of our research group, applying innovative neuroimaging tools, have identified **oxytocin** as a particularly promising candidate for treating AUD, due to its beneficial effects on alcohol craving and neural response to alcohol cues and its **synergistic interactions with opioid-antagonists** (e.g. **naltrexone**) that are already approved for the treatment of AUD. Currently, I conduct a two-armed, randomized, double-blind, parallel group trial in AUD patients to test the putative synergistic effects of combined intranasal oxytocin spray + oral naltrexone against placebo spray + oral naltrexone on alcohol craving (primary outcome) and neurobiological markers of craving that show strong associations to individual relapse risk. Positive results of the exploratory trial will lay ground for following confirmatory trials and contribute to the establishment of new treatment options for AUD. Previous preclinical research has also indicated a **synergistic potential of Naltrexone and Cannabidiol** on alcohol use in animals, which might open up new therapeutic potentials. Following the **strong translational focus** of my work, we will also conduct a **proof-of-concept randomized controlled study in individuals with AUD**, in which we will explore the potential of **Cannabidiol** (800mg) to reducing alcohol craving and alcohol-cue induced sensitization.

Currently, pharmacological treatment for AUD suffers from modest effect sizes and a high inter-individual variability. Understanding the neural mechanisms underlying the highly variable treatment effects will be a key factor for improving individual treatment success. Previous studies of my research group showed that **neural alcohol cue-reactivity**, which can be measured using functional magnetic resonance imaging (**fMRI**), can provide a reliable marker that identifies patients, which benefit from treatment with the approved anti-relapse medication naltrexone. We designed a randomized, double-blind, parallel-group clinical neuroimaging trial to assess whether neural alcohol cue-reactivity significantly predicts treatment response to naltrexone (primary outcome) during a 90-day treatment period in patients with AUD. Patients will be randomized, based on the extent of their baseline alcohol cue-reactivity, to standard treatment or naltrexone treatment and neural alcohol cue-reactivity will be re-assessed after one and two weeks to determine predictive performance and reliability of the neural alcohol cue-reactivity as a **potential "biomarker"**.

Psychosocial stress has been identified as important risk factor for the occurrence of drug craving and relapse in patients. However, the exact neurobiological basis of these effects are poorly understood and currently available treatment options have very limited effects on stress-

induced craving and relapse. Identifying the neurobiological mechanisms underlying the association between stress, craving and relapse risk can contribute to the identification of risk profiles and treatment targets in patients. We aim to identify how stress induces craving and increases relapse risk by integrated assessment of stress-effects in participants with AUD on neuroendocrine, physiological and neural markers in a lab experiment using innovative **combined hybrid fMRI and positron emission tomography (PET) assessment**, which offers a unique platform for elucidating molecular and functional brain processes. We will investigate the effects of stress in a randomized cross-over design in patients with AUD and collect craving and drinking data during a 3-month follow-up period to investigate the predictive performances of the molecular, neuroendocrine, physiological and neural markers. This will allow us to identify stress-related disease mechanisms in AUD and treatment targets for future therapeutic interventions.

My work also expands to other substance use disorders, such as opioid use disorder, as well as behavioral addictions and obesity. Following a **transdiagnostic approach**, my work in these areas focusses on identifying common and distinct neurobiological mechanisms in these diseases, which underlie the shared symptomatology. Here we formed close cooperation with e.g. the department of surgery at the University Hospital Mannheim (Prof. Dr. Otto) and conducted multiple joint studies to identify the neurobiological basis of food craving and determine predictors for efficient surgical interventions and weight loss.