Editorial

Learning and brain plasticity in mental disorders

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This special issue assembles studies that show the importance of learning and brain plasticity processes for the understanding of mental disorders. Most approaches to mental illness have examined the molecular or psychosocial factors underlying these disorders but have not focused on specific mechanisms such as learning or memory processes or brain plasticity or have they examined these processes across disorders. Rather than taking a nosological approach, which leads to the problem of overlapping psychopathological characteristics and examining the neurobehavioral and molecular mechanisms of individual disorders, we suggest to determine similarities and differences of the underlying mechanisms of learning and neural plasticity across a variety of disorders. For example, rather than identifying genes related to anxiety disorder or addiction – very broad concepts – our approach focuses on genes related to Pavlovian fear conditioning and its extinction, glutamatergic signaling, plasticity of the amygdala or the orbitofrontal cortex, to name just some examples of dysfunctional learning or plasticity mechanisms that could be examined. This approach is the basis of Collaborative Research Center 636 (www.sfb636.de) where we have mainly examined anxiety, depression, bipolar disorder, addiction and personality disorders.

The role of learning and memory mechanisms in mental disorder has been broadly discussed in the relevant literature of the past years, for example, with respect to anxiety disorders, addiction, depression or across disorders (e.g., Hsieh and Eisch, 2010; Lubin, 2011; Parsons and Ressler, 2013). In addition, a mechanistic approach to the analysis of genetic mechanisms has been advocated with a special emphasis on functional and structural circuit features of the human brain, as well as on gene-environment interactions (e.g., Meyer-Lindenberg and Weinberger, 2006). This combination of research approaches is at the forefront of recent approaches to mental disorder and meets the requirements of the NIMH Strategic Plan (National Institute of Mental Health, 2008). A specialty of this strategic plan is the development of new classifications of mental disorders based on behavioral and neurobiological mechanisms (e.g., Cutlbert and Insel, 2010; Cutlbert and Insel, 2013). The implementation of this goal has been termed the Research Domain Criteria Project and the NIMH now funds studies along these lines (http://www.nimh.nih.gov/research-funding/rdoc.shtml). This new approach to mental...
disorder is in line with the mechanistic approach as outlined here – in fact, it could be argued that mechanisms must be the basis of a valid dimensional account of behavioral brain disorders. This issue of Restorative Neurology and Neuroscience summarizes examples of a learning- and memory-based approach to mental disorder and its treatment from Collaborative Research Center 636 as well as other laboratories, with a focus on reports of the current research performed there. Section 1 covers mechanisms across several disorders and starts with a description of this approach by Morris, Rumsey and Cuthbert ("Rethinking mental disorders: the role of learning and brain plasticity"). Kuhn, Popovic and Pezawas ("Neuroplasticity and memory formation in major depressive disorder: an imaging genetics perspective on serotonin and BDNF") describe the important role of learning processes in their interaction with genetic risk variants on brain plasticity and symptom formation. In their contribution on bipolar disorder, Wessa, Kanske and Linke ("Bipolar disorder: a neural network perspective on a disorder of emotion and motivation") suggest that altered structural and functional connectivity, mainly between limbic and prefrontal brain areas, underlies emotional and motivational dysregulation in this disorder and might represent relevant vulnerability and disease markers. In an exemplary article ("Pathological anxiety and functional dysregulations can be addressed with innovative psychological and pharmacological interventions. Ditzen et al. ("Incentive motivational salience and the human brain") discuss how motivational changes and specifically the activity of the brain reward system and salience processing are related to psychopathology with a focus on psychosis and how these motivational dysregulations can be addressed with innovative psychological and pharmacological interventions. Ditzen and Heinrichs ("Psychobiology of social support: the social dimension of stress buffering") discuss how...
social support modulates the effects of stress on brain plasticity and demonstrate the relevance of these factors for the understanding of stress-related disorders as well as mental disorders that are related to social dysfunction. Paulzen and Gründer (“Effects of psychotropic drugs on brain plasticity in humans”) suggest that many psychotropic drugs act upon synaptic plasticity and that new drugs that target plasticity should be developed. In an extension of these approaches, Hofmann, Fang and Gutner (“Cognitive enhancers for the treatment of anxiety disorders”) describe how pharmacological agents that can enhance specific mechanisms of psychotherapy such as exposure have been developed that may lead to new advances in the treatment of anxiety disorders but also other mental disorders. In a similar direction, Poustka et al. (“Neurobiologically based interventions for autism spectrum disorders—rational and new directions”) suggest that a mechanism-oriented approach to autism spectrum disorder requires new interventions that alter the brain regions and interaction in the brain that underlie core mechanisms of the disorder and suggest neurofeedback as a viable strategy. Finally, Degen and Schroder (“Training-induced cerebral changes in the elderly”) discuss maladaptive brain plasticity associated with normal and pathological aging and suggest innovative treatment approaches.

We hope that this special issue will provide an insight into mechanistic analyses of psychopathology that incorporate both behavioral and brain changes. The ultimate goal of this research effort is the exact description of the behavioral, neural and molecular deviations of learning and memory processes involved in the etiology of these disorders as well as the development of new assessment tools and mechanism-based behavioral and pharmacological treatment approaches.

References


