Activation of serotonin 2A receptors underlies the psilocybin-induced effects on α oscillations, N170 visual-evoked potentials, and visual hallucinations

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 3720882
Author(s) Kometer, Michael; Schmidt, André; Jäncke, Lutz; Vollenweider, Franz X.
Author(s) at UniBasel Schmidt, André ;
Year 2013
Title Activation of serotonin 2A receptors underlies the psilocybin-induced effects on α oscillations, N170 visual-evoked potentials, and visual hallucinations
Journal The Journal of neuroscience : the official journal of the Society for Neuroscience
Volume 33
Number 25
Pages / **Article-Number** 10544-10551
Mesh terms Adult; Alpha Rhythm, drug effects; Analysis of Variance; Consciousness, drug effects; Data Interpretation, Statistical; Double-Blind Method; Electroencephalography, drug effects; Evoked Potentials, Visual, drug effects; Female; Hallucinogens, pharmacology; Humans; Ketanserin, pharmacology; Male; Photic Stimulation; Psilocybin, pharmacology; Psychometrics; Psychomotor Performance, drug effects; Reaction Time, physiology; Receptor, Serotonin, 5-HT2A, drug effects; Serotonin Antagonists, pharmacology; Serotonin Receptor Agonists, pharmacology; Surveys and Questionnaires; Young Adult
Visual illusions and hallucinations are hallmarks of serotonergic hallucinogen-induced altered states of consciousness. Although the serotonergic hallucinogen psilocybin activates multiple serotonin (5-HT) receptors, recent evidence suggests that activation of 5-HT2A receptors may lead to the formation of visual hallucinations by increasing cortical excitability and altering visual-evoked cortical responses. To address this hypothesis, we assessed the effects of psilocybin (215 μg/kg vs placebo) on both α oscillations that regulate cortical excitability and early visual-evoked P1 and N170 potentials in healthy human subjects. To further disentangle the specific contributions of 5-HT2A receptors, subjects were additionally pretreated with the preferential 5-HT2A receptor antagonist ketanserin (50 mg vs placebo). We found that psilocybin strongly decreased prestimulus parieto-occipital α power values, thus precluding a subsequent stimulus-induced α power decrease. Furthermore, psilocybin strongly decreased N170 potentials associated with the appearance of visual perceptual alterations, including visual hallucinations. All of these effects were blocked by pretreatment with the 5-HT2A antagonist ketanserin, indicating that activation of 5-HT2A receptors by psilocybin profoundly modulates the neurophysiological and phenomenological indices of visual processing. Specifically, activation of 5-HT2A receptors may induce a processing mode in which stimulus-driven cortical excitation is overwhelmed by spontaneous neuronal excitation through the modulation of α oscillations. Furthermore, the observed reduction of N170 visual-evoked potentials may be a key mechanism underlying 5-HT2A receptor-mediated visual hallucinations. This change in N170 potentials may be important not only for psilocybin-induced states but also for understanding acute hallucinatory states seen in psychiatric disorders, such as schizophrenia and Parkinson's disease.
Publisher SOC NEUROSCIENCE
ISSN/ISBN 1529-2401
edoc-URL https://edoc.unibas.ch/63103/
Full Text on edoc No;

Digital Object Identifier DOI 10.1523/JNEUROSCI.3007-12.2013
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/23785166
ISI-Number WOS:000320596400033
Document type (ISI) Article