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References

References

- Abdullaev Y, Posner MI, Nunnally R, Dishion TJ (2010) Functional MRI evidence for inefficient attentional control in adolescent chronic cannabis abuse. *Behavioural Brain Research* 215:45-57.
- Abrams DI, Vizoso HP, Shade SB, Jay C, Kelly ME, Benowitz NL (2007) Vaporization as a smokeless cannabis delivery system: a pilot study. *Clinical Pharmacology and Therapeutics* 82:572-578.
- Akbari Chermahini S, Hickendorff M, Hommel B (2012) Development and validity of a Dutch version of the Remote Associates Task: an item-response theory approach. *Thinking Skills and Creativity* 7:177-186.
- Akbari Chermahini S, Hommel B (2010) The (b)link between creativity and dopamine: spontaneous eye blink rates predict and dissociate divergent and convergent thinking. *Cognition* 115:458-465
- Barbato G, Ficca G, Muscettola G, Fichelle M, Beatrice M, Rinaldi F (2000) Diurnal variation in spontaneous eye-blink rate. *Psychiatry Research* 93:145-151.
- Bar-Haim Y, Lamy D, Pergamin L, Bakermans-Kranenburg MJ, van IJzendoorn MH (2007) Threat-related attentional bias in anxious and nonanxious individuals: a meta-analytic study. *Psychological Bulletin* 133:1-24.
- Baumeister RF, Bratslavsky E, Muraven M, Tice DM (1998) Ego depletion: is the active self a limited resource?. *Journal of Personality and Social Psychology* 74:1252-1265.
- Bergamaschi MM, Queiroz RHC, Chagas MHN, de Oliveira DCG, De Martinis BS, Kapczinski F, Quevedo J, Roesler R, Schröder N, Nardi AE, Martin-Santos R, Hallak JEC, Zuardi AW, Crippa JAS (2011) Cannabidiol reduces the anxiety induced by simulated public speaking in treatment-naive social phobia patients. *Neuropsychopharmacology* 36:1219-1226.
- Bhattacharyya S, Morrison PD, Fusar-Poli P, Martin-Santos R, Borgwardt S, Winton-Brown T, Nosarti C, O'Carroll C, Seal ML, Allen P, Mehta MA, Stone JM, Tunstall N, Giampietro V, Kapur S, Murray RM, Zuardi AW, Crippa JA, Atakan Z, McGuire P K (2010) Opposite effects of delta-9-tetrahydrocannabinol and cannabidiol on human brain function and psychopathology. *Neuropsychopharmacology* 35:764-774.
- Bhattacharyya S, Crippa JA, Allen P, Martin-Santos R, Borgwardt S, Fusar-Poli P, Rubia K, Kambeitz J, O'Carroll C, Seal M, Giampietro V, Brammer M, Zuardi AW, Atakan Z, McGuire PK (2012) Induction of psychosis by delta-9-tetrahydrocannabinol reflects modulation of prefrontal and striatal function during attentional salience processing. *Archives of General Psychiatry* 69:27-36.

- Bhattacharyya S, Fusar-Poli P, Borgwardt S, Martin-Santos R, Nosarti C, O'Carroll C, Allen P, Seal ML, Fletcher PC, Crippa JA, Giampietro V, Mechelli A, Atakan Z, McGuire PL (2009) Modulation of mediotemporal and ventrostriatal function in humans by delta-9-tetrahydrocannabinol: a neural basis for the effects of Cannabis sativa on learning and psychosis. *Archives of General Psychiatry* 66:442-451.
- Bisogno T, Hanuš L, De Petrocellis L, Tchilibon S, Ponde DE, Brandi I, Moriello AS, Davis JB, Mechoulam R, Di Marzo V (2001) Molecular targets for cannabidiol and its synthetic analogues: effect on vanilloid VR1 receptors and on the cellular uptake and enzymatic hydrolysis of anandamide. *British Journal of Pharmacology* 134:845-852.
- Block RI, Farinpour R, Braverman K (1992) Acute effects of marijuana on cognition: relationships to chronic effects and smoking techniques. *Pharmacology Biochemistry and Behavior* 43:907-917.
- Bloomfield MAP, Morgan CJA, Egerton A, Kapur S, Curran HV, Howes OD (2014) Dopaminergic function in cannabis users and its relationship to cannabis-induced psychotic symptoms. *Biological Psychiatry* 75:470-478.
- Bloomfield MAP, Morgan CJA, Kapur S, Curran HV, Howes OD (2014) The link between dopamine function and apathy in cannabis users: an [18F]-DOPA PET imaging study. *Psychopharmacology* 231:2251-2259.
- Bogacz R (2007) Optimal decision-making theories: linking neurobiology with behaviour. *Trends in Cognitive Sciences* 11:118-125.
- Bolla KI, Cadet J, London ED (1998) The neuropsychiatry of chronic cocaine abuse. *The Journal of Neuropsychiatry & Clinical Neurosciences* 10:280-289.
- Bonnet U, Specka M, Stratmann U, Ochwaldt R, Scherbaum N (2014) Abstinence phenomena of chronic cannabis-addicts prospectively monitored during controlled inpatient detoxification: cannabis withdrawal syndrome and its correlation with delta-9-tetrahydrocannabinol and -metabolites in serum. *Drug and Alcohol Dependence* 143:189-197.
- Borgwardt S, Allen P, Bhattacharyya S, Fusar-Poli P, Crippa JA, Seal ML, Fraccaro V, Atakan Z, Martin-Santos R, O'Carroll C, Rubia K, McGuire PK (2008) Neural basis of delta-9-tetrahydrocannabinol and cannabidiol: effects during response inhibition. *Biological Psychiatry* 64:966-973.
- Bosson MG, Mehta MA, van Berckel BNM, Howes OD, Kahn RS, Stokes PRA (2015) Further human evidence for striatal dopamine release induced by administration of delta-9-tetrahydrocannabinol (THC): selectivity to limbic striatum. *Psychopharmacology* 232:2723-2729.

References

- Bossong MG, van Berckel BNM, Boellaard R, Zuurman L, Schuit RC, Windhorst AD, van Gerven JMA, Ramsey NF, Lammertsma AA, Kahn RS (2009) Delta 9-tetrahydrocannabinol induces dopamine release in the human striatum. *Neuropsychopharmacology* 34:759-766.
- Botvinick MM, Braver TS, Barch DM, Carter CS, Cohen JD (2001) Conflict monitoring and cognitive control. *Psychological Review* 108:624-652.
- Bourassa M, Vaugois P (2001) Effects of marijuana use on divergent thinking. *Creativity Research Journal* 13:411-416.
- Bush G, Luu P, Posner MI (2000) Cognitive and emotional influences in anterior cingulate cortex. *Trends in Cognitive Sciences* 4:215-222.
- Bush G, Whalen PJ, Rosen BR, Jenike MA, McInerney SC, Rauch SL (1998) The counting Stroop: an interference task specialized for functional neuroimaging: validation study with functional MRI. *Human Brain Mapping* 6:270-282.
- Campos AC, Guimarães FS (2008) Involvement of 5HT1A receptors in the anxiolytic-like effects of cannabidiol injected into the dorsolateral periaqueductal gray of rats. *Psychopharmacology* 199:223-230.
- Carey SE, Nestor L, Jones J, Garavan H, Hester R (2015) Impaired learning from errors in cannabis users: dorsal anterior cingulate cortex and hippocampus hypoactivity. *Drug and Alcohol Dependence* 155:175-182.
- Carter CS, Mintun M, Cohen JD (1995) Interference and facilitation effects during selective attention: an H215O PET study of Stroop task performance. *NeuroImage* 2:264-272.
- Casey BJ, Trainor RJ, Orendi JL, Schubert AB, Nystrom LE, Giedd JN, Castellanos FX, Haxby JV, Noll DC, Cohen JD, Forman SD, Dahl RE, Rapoport JL (1997) A developmental functional MRI study of prefrontal activation during performance of a go-no-go task. *Journal of Cognitive Neuroscience* 9:835-847.
- Colzato LS, Hommel B (2008) Cannabis, cocaine, and visuomotor integration: evidence for a role of dopamine D1 receptors in binding perception and action. *Neuropsychologia* 46:1570-1575.
- Colzato LS, Ozturk A, Hommel B (2012) Meditate to create: the impact of focused-attention and open-monitoring training on convergent and divergent thinking. *Frontiers in Psychology* 3:116.
- Colzato LS, Szapora A, Pannekoek JN, Hommel B (2013) The impact of physical exercise on convergent and divergent thinking. *Frontiers in Human Neuroscience* 7:824.
- Colzato LS, van den Wildenberg WPM, Hommel B (2008) Reduced spontaneous

- eye blink rates in recreational cocaine users: evidence for dopaminergic hypoactivity. *PLoS ONE* 3:e3461.
- Colzato LS, Waszak F, Nieuwenhuis S, Posthuma D, Hommel B (2010) The flexible mind is associated with the catechol-O-methyltransferase (COMT) Val158Met polymorphism: evidence for a role of dopamine in the control of task-switching. *Neuropsychologia* 48:2764-2768.
- Cools R, D'Esposito M (2011) Inverted-U-shaped dopamine actions on human working memory and cognitive control. *Biological Psychiatry* 69:e113-e125.
- Cools R, Frank MJ, Gibbs SE, Miyakawa A, Jagust W, D'Esposito M (2009) Striatal dopamine predicts outcome-specific reversal learning and its sensitivity to dopaminergic drug administration. *Journal of Neuroscience* 29:1538-1543.
- Crane NA, Schuster RM, Gonzalez R (2013) Preliminary evidence for a sex-specific relationship between amount of cannabis use and neurocognitive performance in young adult cannabis users. *Journal of the International Neuropsychological Society* 19:1009-1015.
- Crippa JA, Derenusson GN, Ferrari TB, Wichert-Ana L, Duran FL, Martin-Santos R, Simoes MV, Bhattacharyya S, Fusar-Poli P, Atakan Z, Filho AS, Freitas-Ferrari MC, McGuire PK, Zuardi AW, Busatto GF, Hallak JEC (2011) Neural basis of anxiolytic effects of cannabidiol (CBD) in generalized social anxiety disorder: a preliminary report. *Journal of Psychopharmacology* 25:121-130.
- Crippa JA, Zuardi AW, Garrido GE, Wichert-Ana L, Guarnieri R, Ferrari L, Azevedo-Marques PM, Hallak JEC, McGuire PK, Busatto GF (2004) Effects of cannabidiol (CBD) on regional cerebral blood flow. *Neuropsychopharmacology* 29:417-426.
- Curran HV, Brignell C, Fletcher S, Middleton P, Henry J (2002) Cognitive and subjective dose-response effects of acute oral delta-9-tetrahydrocannabinol (THC) in infrequent cannabis users. *Psychopharmacology (Berl)* 164:61-70.
- Curran HV, Morgan CJA (2014) Desired and undesired effects of cannabis on the human mind and psychological well-being. In: *Handbook of Cannabis*, 1st ed. (Pertwee R, ed). Oxford: Oxford University Press.
- de Bruijn ERA, Hulstijn W, Verkes RJ, Ruigt GSF, Sabbe BGC (2004) Drug-induced stimulation and suppression of action monitoring in healthy volunteers. *Psychopharmacology* 177:151-160.
- de Bruijn ERA, Sabbe BGC, Hulstijn W, Ruigt GSF, Verkes RJ (2006) Effects of

References

- antipsychotic and antidepressant drugs on action monitoring in healthy volunteers. *Brain Research* 1105:122-129.
- De Dreu CKW, Baas M, Nijstad BA (2008) Hedonic tone and activation level in the mood-creativity link: toward a dual pathway to creativity model. *Journal of Personality and Social Psychology* 94:739-756.
- De Dreu CKW, Nijstad BA, Baas M, Wolsink I, Roskes M (2012) Working memory benefits creative insight, musical improvisation, and original ideation through maintained task-focused attention. *Personality and Social Psychology Bulletin* 38:656-669.
- Debener S, Ullsperger M, Siegel M, Fiehler K, von Cramon DY, Engel AK (2005) Trial-by-trial coupling of concurrent electroencephalogram and functional magnetic resonance imaging identifies the dynamics of performance monitoring. *Journal of Neuroscience* 25:11730-11737.
- Deuschel G, Goddemeier C (1998) Spontaneous and reflex activity of facial muscles in dystonia, Parkinson's disease, and in normal subjects. *Journal of Neurology, Neurosurgery & Psychiatry* 64:320-324.
- Devane WA, Dysarz FA, Johnson MR, Melvin LS, Howlett AC (1988) Determination and characterization of a cannabinoid receptor in rat brain. *Molecular Pharmacology* 34:605-613.
- Devane WA, Hanus L, Breuer A, Pertwee RG, Stevenson LA, Griffin G, Gibson D, Mandelbaum A, Etinger A, Mechoulam R (1992) Isolation and structure of a brain constituent that binds to the cannabinoid receptor. *Science* 258:1946-1949.
- Dreisbach G, Müller J, Goschke T, Strobel A, Schulze K, Lesch KP, Brocke B (2005) Dopamine and cognitive control: the influence of spontaneous eyeblink rate and dopamine gene polymorphisms on perseveration and distractibility. *Behavioral Neuroscience* 119:483-490.
- D'Souza DC, Fridberg DJ, Skosnik PD, Williams A, Roach B, Singh N, Carbutto M, Elander J, Schnakenberg A, Pittman B, Sewell RA, Ranganathan M, Mathalon D (2012) Dose-related modulation of event-related potentials to novel and target stimuli by intravenous delta-9-THC in humans. *Neuropsychopharmacology* 37:1632-1646.
- D'Souza DC, Perry E, MacDougall L, Ammerman Y, Cooper T, Wu YT, Braley G, Gueorguieva R, Krystal JH (2004) The psychotomimetic effects of intravenous delta-9-tetrahydrocannabinol in healthy individuals: implications for psychosis. *Neuropsychopharmacology* 29:1558-1572.
- D'Souza DC, Ranganathan M, Braley G, Gueorguieva R, Zimolo Z, Cooper T, Perry E, Krystal JH (2008) Blunted psychotomimetic and amnesic effects

- of delta-9-tetrahydrocannabinol in frequent users of cannabis. *Neuropsychopharmacology* 33:2505-2516.
- Dutilh G, van Ravenzwaaij D, Nieuwenhuis S, van der Maas HLJ, Forstmann BU, Wagenmakers EJ (2012) How to measure post-error slowing: a confound and a simple solution. *Journal of Mathematical Psychology* 56:208-216.
- Earleywine M (2002) *Understanding marijuana*. Oxford: Oxford University Press.
- ElSohly M, Gul W (2014) Constituents of *Cannabis sativa*. In: *Handbook of Cannabis*, 1st ed. (Pertwee R, ed). Oxford: Oxford University Press.
- Endrass T, Franke C, Kathmann N (2005) Error awareness in a saccade countermanding task. *Journal of Psychophysiology* 19:275-280.
- Eriksen BA, Eriksen CW (1974) Effects of noise letters upon the identification of a target letter in a nonsearch task. *Perception & Psychophysics* 16:143-149.
- Falkenstein M, Hohnsbein J, Hoormann J, Blanke L (1990) Effects of errors in choice reaction tasks on the ERP under focused and divided attention. In: *Psychophysiological Brain Research*, 1st ed. (Brunia C, Gaillard A, Kok A, ed), pp 192-195. Tilburg: Tilburg University Press.
- Falkenstein M, Hoormann J, Christ S, Hohnsbein J (2000) ERP components on reaction errors and their functional significance: a tutorial. *Biological Psychology* 51:87-107.
- Fattore L, Melis M, Fadda P, Pistis M, Fratta W (2010) The endocannabinoid system and nondrug rewarding behaviours. *Experimental Neurology* 224:23-36.
- Fernández-Ruiz J, Hernández M, Ramos JA (2010) Cannabinoid-dopamine interaction in the pathophysiology and treatment of CNS disorders. *CNS Neuroscience & Therapeutics* 16:e72-e91.
- Freed W (1980) Eye-blink rates and platelet monoamine oxidase activity in chronic schizophrenic patients. *Biological Psychiatry* 15:329-332.
- Fridberg DJ, Skosnik PD, Hetrick WP, O'Donnell BF (2013) Neural correlates of performance monitoring in chronic cannabis users and cannabis-naive controls. *Journal of Psychopharmacology* 27:515-525.
- Friendly M (2014) Power. Power analysis for ANOVA designs Available at: <http://www.math.yorku.ca/scs/online/power> [Accessed February 26, 2015].
- Fusar-Poli P, Allen P, Bhattacharyya S, Crippa JA, Mechelli A, Borgwardt S, Martin-Santos R, Seal ML, O'Carroll C, Atakan Z, Zuardi AW, McGuire PK (2010) Modulation of effective connectivity during emotional processing by $\Delta 9$ -tetrahydrocannabinol and cannabidiol. *The International Journal of Neuropsychopharmacology* 13:421-432.

References

- Fusar-Poli P, Crippa JA, Bhattacharyya S, Borgwardt S, Allen P, Martin-Santos R, Seal ML, Surguladze SA, O'Carroll C, Atakan Z, Zuardi AW, McGuire PK (2009) Distinct effects of delta-9-tetrahydrocannabinol and cannabidiol on neural activation during emotional processing. *Archives of General Psychiatry* 66:95-105.
- Gaoni Y, Mechoulam R (1964) Isolation, structure and partial synthesis of an active constituent of hashish. *Journal of the American Chemical Society* 86:1646-1647.
- Gehring WJ, Goss B, Coles MGH, Meyer DE, Donchin E (1993) A neural system for error detection and compensation. *Psychological Science* 4:385-390.
- Gerdeman GL, Partridge JG, Lupica CR, Lovinger DM (2003) It could be habit forming: drugs of abuse and striatal synaptic plasticity. *Trends in Neurosciences* 26:184-192.
- Gomes FV, Resstel LBM, Guimarães FS (2011) The anxiolytic-like effects of cannabidiol injected into the bed nucleus of the stria terminalis are mediated by 5-HT_{1A} receptors. *Psychopharmacology* 213:465-473.
- Gratton G, Coles MGH, Donchin E (1983) A new method for off-line removal of ocular artifact. *Electroencephalography and Clinical Neurophysiology* 55:468-484.
- Green B, Kavanagh D, Young R (2003) Being stoned: a review of self-reported cannabis effects. *Drug and Alcohol Review* 22:453-460.
- Grotenhermen F (2003) Pharmacokinetics and pharmacodynamics of cannabinoids. *Clinical Pharmacokinetics* 42:327-360.
- Guilford JP (1967) *The nature of human intelligence*. New York: McGraw-Hill.
- Hallak JEC, Machado-de-Sousa JP, Crippa JA, Sanches RF, Trzesniak C, Chaves C, Bernardo SA, Regalo SC, Zuardi AW (2010) Performance of schizophrenic patients in the Stroop Color Word Test and electrodermal responsiveness after acute administration of cannabidiol (CBD). *Revista Brasileira de Psiquiatria* 32:56-61.
- Harding IH, Solowij N, Harrison BJ, Takagi M, Lorenzetti V, Lubman DI, Seal ML, Pantelis C, Yücel M (2012) Functional connectivity in brain networks underlying cognitive control in chronic cannabis users. *Neuropsychopharmacology* 37:1923-1933.
- Hardwick S, King LA (2008) Home office cannabis potency study. Home Office Scientific Development Branch.
- Hart CL, Ilan AB, Gevins A, Gunderson EW, Role K, Colley JA, Foltin RW (2010) Neurophysiological and cognitive effects of smoked marijuana in frequent users. *Pharmacology Biochemistry and Behavior* 96:333-341.

-
- Hart CL, van Gorp W, Haney M, Foltin RW, Fischman MW (2001) Effects of acute smoked marijuana on complex cognitive performance. *Neuropsychopharmacology* 25:757-765.
- Hazekamp A, Ruhaak R, Zuurman L, van Gerven JMA, Verpoorte R (2006) Evaluation of a vaporizing device (Volcano®) for the pulmonary administration of tetrahydrocannabinol. *Journal of Pharmaceutical Sciences* 95:1308-1317.
- Herrmann MJ, Römmler J, Ehlis AC, Heidrich A, Fallgatter AJ (2004) Source localization (LORETA) of the error-related-negativity (ERN/Ne) and positivity (Pe). *Cognitive Brain Research* 20:294-299.
- Hester R, Nestor L, Garavan H (2009) Impaired error awareness and anterior cingulate cortex hypoactivity in chronic cannabis users. *Neuropsychopharmacology* 34:2450-2458.
- Hindocha C, Freeman TP, Schafer G, Gardener C, Das RK, Morgan CJ, Curran HV (2015) Acute effects of delta-9-tetrahydrocannabinol, cannabidiol and their combination on facial emotion recognition: A randomised, double-blind, placebo-controlled study in cannabis users. *European Neuropsychopharmacology* 25:325-334.
- Hirvonen J, Goodwin RS, Li CT, Terry GE, Zoghbi SS, Morse C, Pike VW, Volkow ND, Huestis MA, Innis RB (2012) Reversible and regionally selective downregulation of brain cannabinoid CB1 receptors in chronic daily cannabis smokers. *Molecular Psychiatry* 17:642-649.
- Ho BC, Wassink TH, Ziebell S, Andreasen NC (2011) Cannabinoid receptor 1 gene polymorphisms and marijuana misuse interactions on white matter and cognitive deficits in schizophrenia. *Schizophrenia Research* 128:66-75.
- Hoffman AF, Oz M, Caulder T, Lupica CR (2003) Functional tolerance and blockade of long-term depression at synapses in the nucleus accumbens after chronic cannabinoid exposure. *Journal of Neuroscience* 23:4815-4820.
- Holroyd CB, Coles MGH (2002) The neural basis of human error processing: reinforcement learning, dopamine, and the error-related negativity. *Psychological Review* 109:679-709.
- Hommel B (2012) Convergent and divergent operations in cognitive search. In: *Cognitive search: evolution, algorithms, and the brain*, 1st ed. (Todd P, Hills T, Robbins T, ed), pp 221-235. Cambridge, MA: MIT Press.
- Hunault CC, Böcker KBE, Stellato RK, Kenemans JL, de Vries I, Meulenbelt J (2014) Acute subjective effects after smoking joints containing up to 69 mg delta-9-tetrahydrocannabinol in recreational users: a randomized, crossover clinical trial. *Psychopharmacology* 231:4723-4733.

References

- Inzlicht M, Schmeichel BJ (2012) What is ego depletion? Toward a mechanistic revision of the resource model of self-control. *Perspectives on Psychological Science* 7:450-463.
- Kalivas PW, Volkow ND (2005) The neural basis of addiction: a pathology of motivation and choice. *American Journal of Psychiatry* 162:1403-1413.
- Karson CN (1983) Spontaneous eye-blink rates and dopaminergic systems. *Brain* 106:643-653.
- Kawashima R, Satoh K, Itoh H, Ono S, Furumoto S, Gotoh R, Koyama M, Yoshioka S, Takahashi T, Takahashi K, Yanagisawa T, Fukuda H (1996) Functional anatomy of go/no-go discrimination and response selection: a PET study in man. *Brain Research* 728:79-89.
- Kelleher LM, Stough C, Sergejew AA, Rolfe T (2004) The effects of cannabis on information-processing speed. *Addictive Behaviors* 29:1213-1219.
- Kleven MS, Koek W (1996) Differential effects of direct and indirect dopamine agonists on eye blink rate in cynomolgus monkeys. *Journal of Pharmacology and Experimental Therapeutics* 279:1211-1219.
- Kowal MA, Colzato LS, Hommel B (2011) Decreased spontaneous eye blink rates in chronic cannabis users: evidence for striatal cannabinoid-dopamine interactions. *PLoS ONE* 6:e26662.
- Kowal MA, Hazekamp A, Colzato LS, van Steenbergen H, van der Wee NJA, Durieux J, Manai M, Hommel B (2015) Cannabis and creativity: highly potent cannabis impairs divergent thinking in regular cannabis users. *Psychopharmacology* 232:1123-1134.
- Kowal MA, Hazekamp A, Colzato LS, van Steenbergen H, Hommel B (2013) Modulation of cognitive and emotional processing by cannabidiol: the role of the anterior cingulate cortex. *Frontiers in Human Neuroscience* 7.
- Kowal M, van Steenbergen H, Colzato LS, Hazekamp A, van der Wee NJA, Manai M, Durieux J, Hommel B (2015) Dose-dependent effects of cannabis on the neural correlates of error monitoring in frequent cannabis users. *European Neuropsychopharmacology* 25:1943-1953.
- Kuepper R, Ceccarini J, Lataster J, van Os J, van Kroonenburgh M, van Gerven JMA, Marcelis M, Van Laere K, Henquet C (2013) Delta-9-tetrahydrocannabinol-induced dopamine release as a function of psychosis risk: 18F-fallypride positron emission tomography study. *PLoS ONE* 8:e70378.
- Kuepper R, Morrison PD, van Os J, Murray RM, Kenis G, Henquet C (2010) Does dopamine mediate the psychosis-inducing effects of cannabis? A review and integration of findings across disciplines. *Schizophrenia Research*

- 121:107-117.
- Lecrubier Y, Sheehan DV, Weiller E, Amorim P, Bonora I, Harnett Sheehan K, Janavs J, Dunbar G (1997) The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. *European Psychiatry* 12:224-231.
- Luo X, Zhang S, Hu S, Bednarski SR, Erdman E, Farr OM, Hong KI, Sinha R, Mazure CM, Li CSR (2013) Error processing and gender-shared and -specific neural predictors of relapse in cocaine dependence. *Brain* 136:1231-1244.
- Marco E, Garcia-Gutierrez MS, Bermudez-Silva FJ, Moreira FA, Guimarães FS, Manzanares J, Viveros MP (2011) Endocannabinoid system and psychiatry: in search of a neurobiological basis for detrimental and potential therapeutic effects. *Frontiers in Behavioral Neuroscience* 5:63.
- Marhe R, Luijten M, van de Wetering BJM, Smits M, Franken IHA (2013) Individual differences in anterior cingulate activation associated with attentional bias predict cocaine use after treatment. *Neuropsychopharmacology* 38:1085-1093.
- Matsuda LA, Lolait SJ, Brownstein MJ, Young AC, Bonner TI (1990) Structure of a cannabinoid receptor and functional expression of the cloned cDNA. *Nature* 346:561-564.
- McDonald J, Schleifer L, Richards JB, de Wit H (2003) Effects of THC on behavioral measures of impulsivity in humans. *Neuropsychopharmacology* 28:1356-1365.
- McPartland J, Russo E (2014) Non-phytocannabinoid constituents of cannabis and herbal synergy. In: *Handbook of Cannabis*, 1st ed. (Pertwee R, ed). Oxford: Oxford University Press.
- Mechoulam R, Parker LA, Gallily R (2002) Cannabidiol: an overview of some pharmacological aspects. *Journal of Clinical Pharmacology* 42:11-19.
- Mednick S (1962) The associative basis of the creative process. *Psychological Review* 69:220-232.
- Mink JW (1996) The basal ganglia: focused selection and inhibition of competing motor programs. *Progress in Neurobiology* 50:381-425.
- Mizrahi R, Suridjan I, Kenk M, George TP, Wilson A, Houle S, Rusjan P (2013) Dopamine response to psychosocial stress in chronic cannabis users: a PET study with [11C]-(+)-PHNO. *Neuropsychopharmacology* 38:673-682.
- Moore TH, Zammit S, Lingford-Hughes A, Barnes TR, Jones PB, Burke M, Lewis G (2007) Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *The Lancet* 370:319-328.

References

- Morgan CJA, Freeman TP, Schafer GL, Curran HV (2010) Cannabidiol attenuates the appetitive effects of delta-9-tetrahydrocannabinol in humans smoking their chosen cannabis. *Neuropsychopharmacology* 35:1879-1885.
- Morgan CJA, Gardener C, Schafer G, Swan S, Demarchi C, Freeman TP, Warrington P, Rupasinghe I, Ramoutar A, Tan N, Wingham G, Lewis S, Curran HV (2012) Sub-chronic impact of cannabinoids in street cannabis on cognition, psychotic-like symptoms and psychological well-being. *Psychological Medicine* 42:391-400.
- Morgan CJA, Schafer G, Freeman TP, Curran HV (2010) Impact of cannabidiol on the acute memory and psychotomimetic effects of smoked cannabis: naturalistic study. *The British Journal of Psychiatry* 197:285-290.
- Murphy PR, Robertson IH, Allen D, Hester R, O'Connell RG (2012) An electrophysiological signal that precisely tracks the emergence of error awareness. *Frontiers in Human Neuroscience* 6:65.
- Nicholls C, Bruno R, Matthews A (2015) Chronic cannabis use and ERP correlates of visual selective attention during the performance of a flanker go/nogo task. *Biological Psychology* 110:115-125.
- Nieuwenhuis S, Ridderinkhof KR, Blom J, Band GPH, Kok A (2001) Error-related brain potentials are differentially related to awareness of response errors: evidence from an antisaccade task. *Psychophysiology* 38:752-760.
- Nijstad BA, De Dreu CKW, Rietzschel EF, Baas M (2010) The dual pathway to creativity model: creative ideation as a function of flexibility and persistence. *European Review of Social Psychology* 21:34-77.
- Pardo JV, Pardo PJ, Janer KW, Raichle ME (1990) The anterior cingulate cortex mediates processing selection in the Stroop attentional conflict paradigm. *Proceedings of the National Academy of Sciences* 87:256-259.
- Paus T (2001) Primate anterior cingulate cortex: where motor control, drive and cognition interface. *Nature Reviews Neuroscience* 2:417-424.
- Pertwee RG (2008) The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: delta-9-tetrahydrocannabinol, cannabidiol and delta-9-tetrahydrocannabivarin. *The British Journal of Pharmacology* 153:199-215.
- Quik M, Chen L, Parameswaran N, Xie X, Langston JW, McCallum SE (2006) Chronic oral nicotine normalizes dopaminergic function and synaptic plasticity in 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine-lesioned primates. *The Journal of Neuroscience* 26:4681-4689.
- Rabbitt PMA (1966) Errors and error correction in choice-response tasks. *Journal*

- of *Experimental Psychology* 71:264-272.
- Ramaekers JG, Kauert G, Theunissen EL, Toennes SW, Moeller MR (2008) Neurocognitive performance during acute THC intoxication in heavy and occasional cannabis users. *Journal of Psychopharmacology* 23:266-277.
- Ramaekers JG, Kauert G, van Ruitenbeek P, Theunissen EL, Schneider E, Moeller MR (2006) High-potency marijuana impairs executive function and inhibitory motor control. *Neuropsychopharmacology* 31:2296-2303.
- Raven JC, Court JH, Raven J (1988) *Manual for Raven's progressive matrices and vocabulary scales*. London: Lewis.
- Runco MA (2007) *Creativity: theories, themes, and issues*. San Diego, CA: Academic Press.
- Russell JA, Weiss A, Mendelsohn GA (1989) Affect grid: a single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology* 57:493-502.
- Russo EB (2011) Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects. *British Journal of Pharmacology* 163:1344-1364.
- Schafer GL, Feilding A, Morgan CJA, Agathangelou M, Freeman TP, Curran HV (2012) Investigating the interaction between schizotypy, divergent thinking and cannabis use. *Consciousness and Cognition* 21:292-298.
- Schier ARM, Ribeiro NPO, Silva ACO, Hallak JEC, Crippa JA, Nardi AE, Zuardi AW (2012) Cannabidiol, a Cannabis sativa constituent, as an anxiolytic drug. *Revista Brasileira de Psiquiatria* 34:104-117.
- Schoedel KA, Harrison SJ (2012) Subjective and physiological effects of oromucosal sprays containing cannabinoids (nabiximols): potentials and limitations for psychosis research. *Current Pharmaceutical Design* 18:5008-5014.
- Schubart CD, Sommer IE, van Gastel WA, Goetgebuer RL, Kahn RS, Boks MP (2011) Cannabis with high cannabidiol content is associated with fewer psychotic experiences. *Schizophrenia Research* 130:216-221.
- Schulz S, Arning L, Pinnow M, Wascher E, Epplen JT, Beste C (2012) When control fails: influence of the prefrontal but not striatal dopaminergic system on behavioural flexibility in a change detection task. *Neuropharmacology* 62:1028-1033.
- Scott DJ, Stohler CS, Egnatuk CM, Wang H, Koeppe RA, Zubieta JK (2007) Individual differences in reward responding explain placebo-induced expectations and effects. *Neuron* 55:325-336.
- Scott DJ, Stohler CS, Egnatuk CM, Wang H, Koeppe RA, Zubieta JK (2008)

References

- Placebo and nocebo effects are defined by opposite opioid and dopaminergic responses. *Archives of General Psychiatry* 65:220-231.
- Shackman AJ, Salomons TV, Slagter HA, Fox AS, Winter JJ, Davidson RJ (2011) The integration of negative affect, pain and cognitive control in the cingulate cortex. *Nature Reviews Neuroscience* 12:154-167.
- Shou-Zhong Y (1997) *The divine farmer's materia medica: a translation of the Shen Nong Ben Cao Jing*. Boulder, CO: Blue Poppy Press.
- Shukla D (1985) Blink rate as clinical indicator. *Neurology* 35:286.
- Spronk D, Dumont GJH, Verkes RJ, de Bruijn ERA (2011) Acute effects of delta-9-tetrahydrocannabinol on performance monitoring in healthy volunteers. *Frontiers in Behavioral Neuroscience* 5:59.
- Stadelmann AM, Juckel G, Arning L, Gallinat J, Eppelen JT, Roser P (2011) Association between a cannabinoid receptor gene (CNR1) polymorphism and cannabinoid-induced alterations of the auditory event-related P300 potential. *Neuroscience Letters* 496:60-64.
- Stemmer B, Segalowitz SJ, Witzke W, Schönle PW (2004) Error detection in patients with lesions to the medial prefrontal cortex: an ERP study. *Neuropsychologia* 42:118-130.
- Stokes PR, Egerton A, Watson B, Reid A, Lappin J, Howes OD, Nutt DJ, Lingford-Hughes AR (2012) History of cannabis use is not associated with alterations in striatal dopamine D2/D3 receptor availability. *Journal of Psychopharmacology* 26:144-149.
- Stokes PR, Mehta MA, Curran HV, Breen G, Grasby PM (2009) Can recreational doses of THC produce significant dopamine release in the human striatum?. *NeuroImage* 48:186-190.
- Tapert SF, Schweinsburg AD, Drummond SPA, Paulus MP, Brown SA, Yang TT, Frank LR (2007) Functional MRI of inhibitory processing in abstinent adolescent marijuana users. *Psychopharmacology* 194:173-183.
- Tart CT (1970) Marijuana intoxication: common experiences. *Nature* 226:701-704.
- Taylor JR, Elsworth JD, Lawrence MS, Sladek JR, Roth RH, Redmond DE (1999) Spontaneous blink rates correlate with dopamine levels in the caudate nucleus of MPTP-treated monkeys. *Experimental Neurology* 158:214-220.
- Theunissen EL, Kauert GF, Toennes SW, Moeller MR, Sambeth A, Blanchard MM, Ramaekers JG (2012) Neurophysiological functioning of occasional and heavy cannabis users during THC intoxication. *Psychopharmacology* 220:341-350.
- Tinklenberg JR, Darley CF, Roth WT, Pfefferbaum A, Kopell BS (1978) Marijuana effects on associations to novel stimuli. *The Journal of Nervous*

- and Mental Disease 166:362-364.
- Torrance EP (1966) Torrance tests of creative thinking-norms. Lexington, MA: Personal Press.
- Ullsperger M, Fischer AG, Nigbur R, Endrass T (2014) Neural mechanisms and temporal dynamics of performance monitoring. *Trends in Cognitive Sciences* 18:259-267.
- Urban NBL, Slifstein M, Thompson JL, Xu X, Girgis RR, Raheja S, Haney M, Abi-Dargham A (2012) Dopamine release in chronic cannabis users: a [¹¹C]raclopride positron emission tomography study. *Biological Psychiatry* 71:677-683.
- Volkow ND, Wang GJ, Telang F, Fowler JS, Alexoff D, Logan J, Jayne M, Wong C, Tomasi D (2014) Decreased dopamine brain reactivity in marijuana abusers is associated with negative emotionality and addiction severity. *Proceedings of the National Academy of Sciences* 111:E3149-E3156.
- Weckowicz TE, Fedora O, Mason J, Radstaak D, Bay KS, Yonge KA (1975) Effect of marijuana on divergent and convergent production cognitive tests. *Journal of Abnormal Psychology* 84:386-398.
- Yeung N, Botvinick MM, Cohen JD (2004) The neural basis of error detection: conflict monitoring and the error-related negativity. *Psychological Review* 111:931-959.
- Zanelati TV, Biojone C, Moreira FA, Guimarães FS, Joca SRL (2010) Antidepressant-like effects of cannabidiol in mice: possible involvement of 5-HT_{1A} receptors. *British Journal of Pharmacology* 159:122-128.
- Zenasni F, Lubart T (2011) Pleasantness of creative tasks and creative performance. *Thinking Skills and Creativity* 6:49-56.
- Zuardi AW, Cosme RA, Graeff FG, Guimarães FS (1993) Effects of ipsapirone and cannabidiol on human experimental anxiety. *Journal of Psychopharmacology* 7:82-88.
- Zuardi AW, Crippa JA, Hallak JEC, Pinto JP, Chagas MHN, Rodrigues GGR, Dursun SM, Tumas V (2009) Cannabidiol for the treatment of psychosis in Parkinson's disease. *Journal of Psychopharmacology* 23:979-983.
- Zuardi AW, Hallak JEC, Dursun SM, Morais SL, Sanches RF, Musty RE, Crippa JA (2006) Cannabidiol monotherapy for treatment-resistant schizophrenia. *Journal of Psychopharmacology* 20:683-686.
- Zuardi AW, Shirakawa I, Finkelfarb E, Karniol IG (1982) Action of cannabidiol on the anxiety and other effects produced by delta-9-THC in normal subjects. *Psychopharmacology* 76:245-250.
- Zuurman L, Roy C, Schoemaker RC, Hazekamp A, den Hartigh J, Bender JC,

References

Verpoorte R, Pinquier JL, Cohen AF, van Gerven JMA (2008) Effect of intrapulmonary tetrahydrocannabinol administration in humans. *Journal of Psychopharmacology* 22:707-716.

