Psych 5614 Neurosynth Analysis

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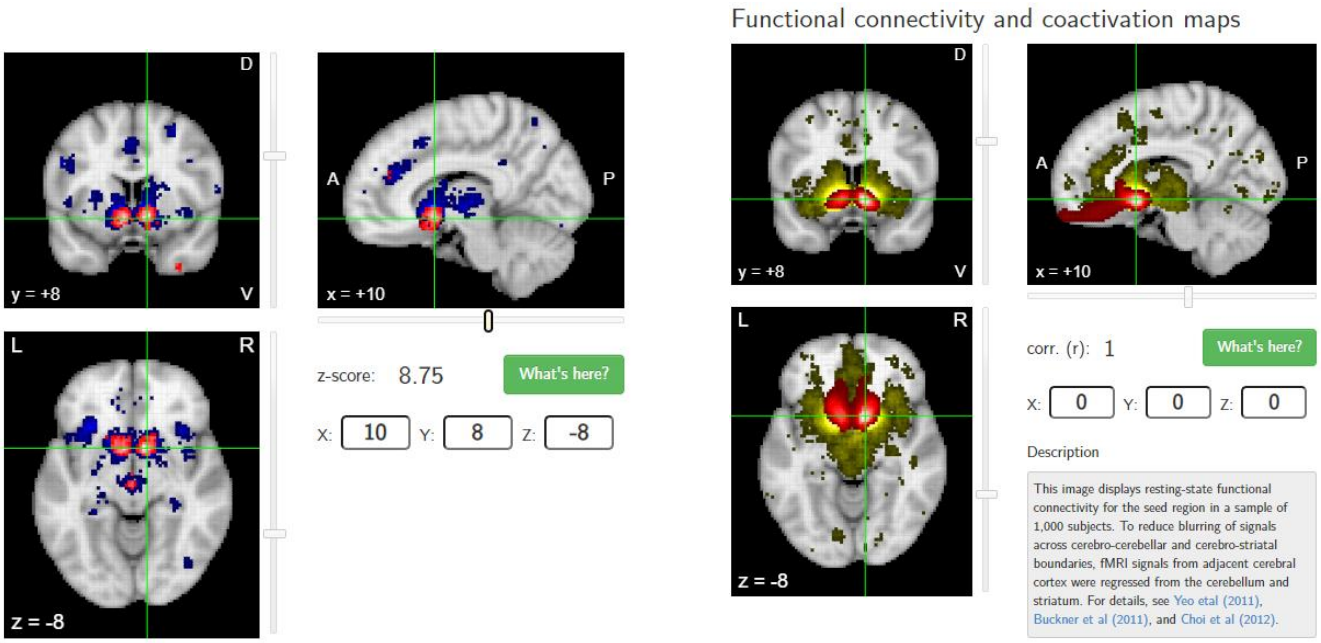
Addiction

- ***Ventral Striatum***



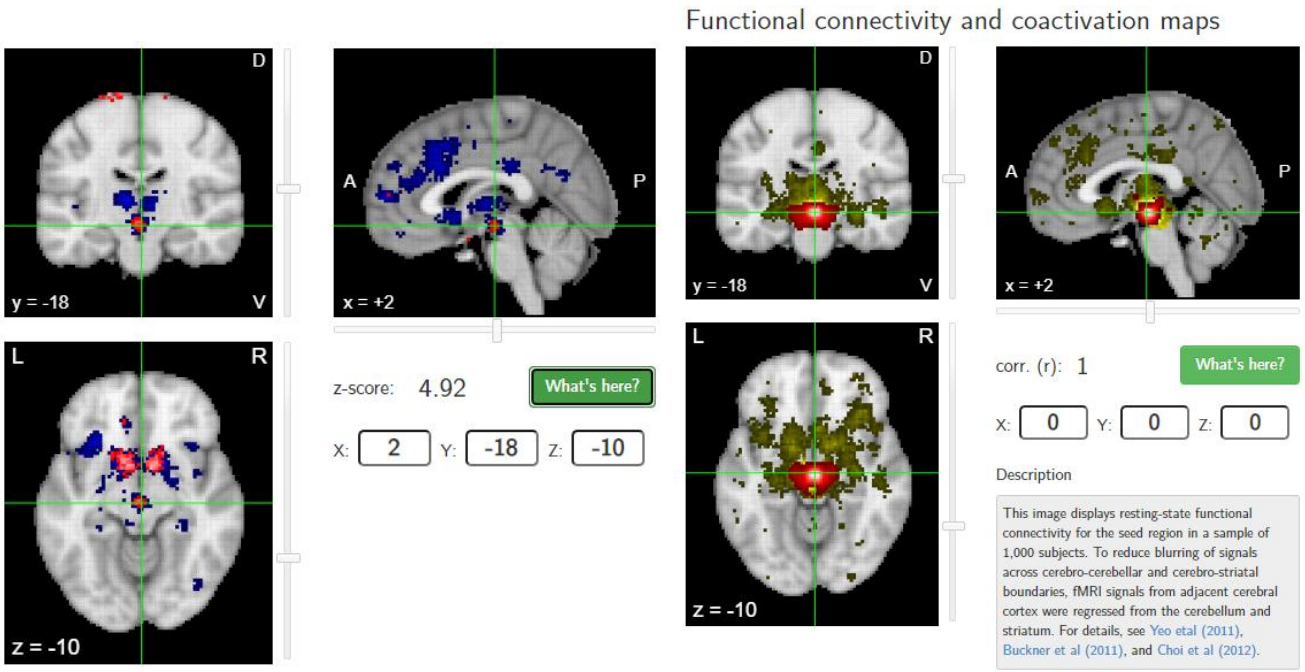
Various studies have shown that the ventral striatum is highly involved in addictive behaviors. One of the reasons that the ventral striatum is so heavily involved in addiction is because the ventral striatum receives glutamatergic inputs from the medial prefrontal cortex, the anterior cingulate cortex, and the orbitofrontal cortex. These frontal areas increase their glutamatergic input to the ventral striatum (nucleus accumbens), when the drug user is presented with a drug use mental cue; simultaneously there is a decrease in neural plasticity, partially explaining the formation of addictions.

Sources

Toda S. [The role of the striatum in addiction]. Brain Nerve. 2012 Aug;64(8):911-7. Japanese. PMID: 22868882.

Kalivas PW, Lalumiere RT, Knackstedt L, Shen H. Glutamate transmission in addiction. Neuropharmacology. 2009;56 Suppl 1(Suppl 1):169-73. doi: 10.1016/j.neuropharm.2008.07.011. Epub 2008 Jul 16. PMID: 18675832; PMCID: PMC3280337.

- ***Ventral Tegmental Area (in midbrain)***

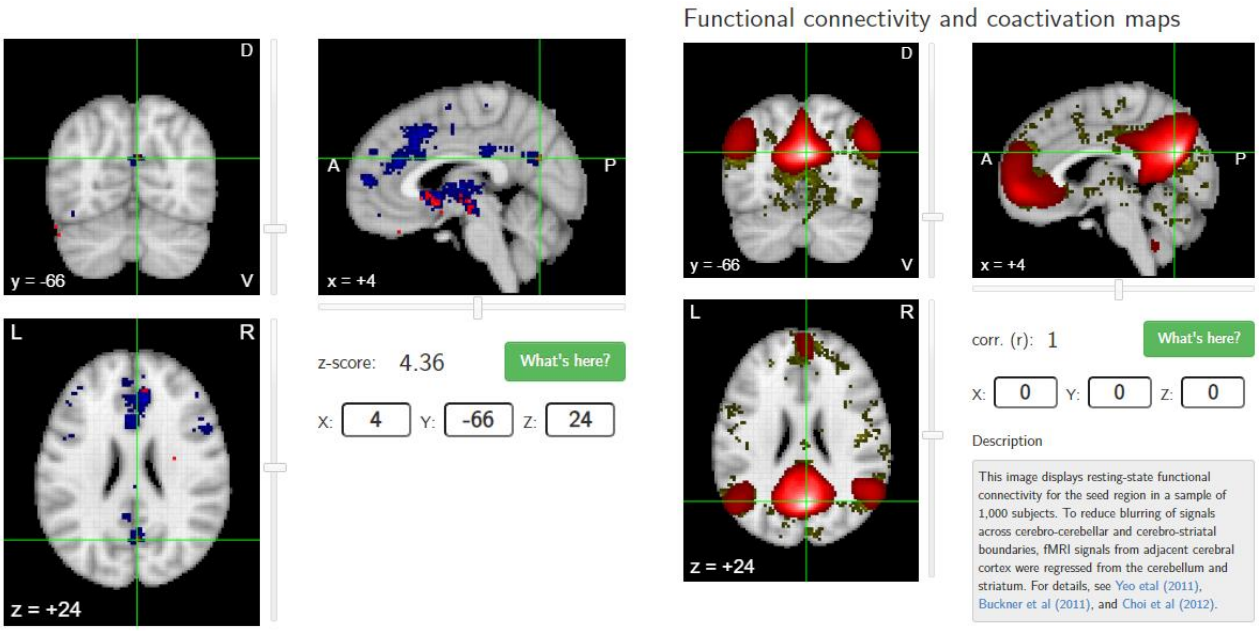


Many studies have shown that the ventral tegmental area is implicated in reward seeking and also drug seeking behavior. This is because the ventral tegmental area is the origin of dopaminergic cell bodies within the mesocorticolimbic dopamine system, as well as other dopamine pathways. The ventral tegmental area is largely implicated in the regulation of the distribution of dopamine within the brain, such as the frontal cortex and the caudal brainstem. With its role in distributing dopamine throughout the brain it is easy to imagine how the ventral tegmental area is highly implicated with addictive behaviors.

<u>Source</u>

Ventral tegmental area. (2021, March 31). Retrieved April 10, 2021, from https://en.wikipedia.org/wiki/Ventral_tegmental_area

- ***Posterior Cingulate Cortex***



In an experiment of 14 male chronic heroine users, compared to 14 healthy control subjects. Participants were put into an fMRI scanner and a cue-induced craving task was presented. Within the chronic heroine use group, there was higher functional connectivity in the posterior cingulate cortex and with longer duration of heroine having a positive correlation with increased posterior cingulate cortex activation. In another experiment, 30 cigarette smokers and 30 nonsmokers were put into an fMRI scanner and were presented with a smoking cue and mental simulation, more specifically smoking hand movements. In the smoker group, there was increased functional connectivity in the posterior cingulate cortex, in response to smoking hand mental simulations. Both studies exemplify the role of the posterior cingulate cortex in the context of addiction.

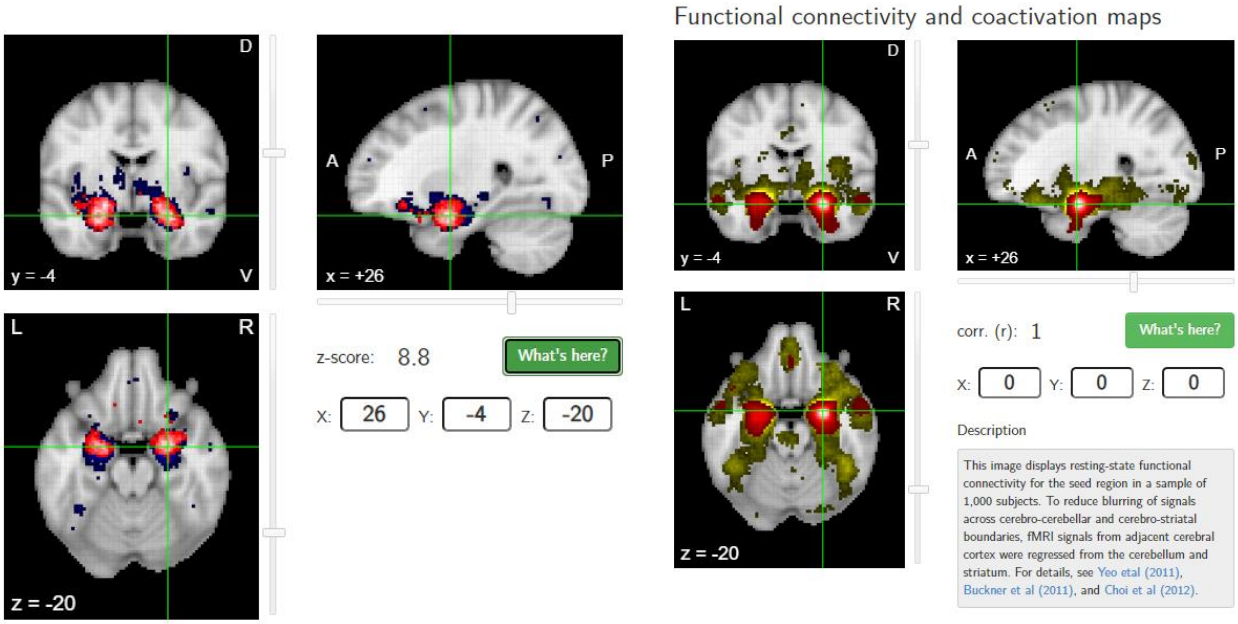
<u>Sources</u>

Li Q, Yang WC, Wang YR, Huang YF, Li W, Zhu J, Zhang Y, Zhao LY, Qin W, Yuan K, von Deneen KM, Wang W, Tian J. Abnormal function of the posterior cingulate cortex in heroin addicted users during resting-state and drug-cue stimulation task. Chin Med J (Engl). 2013 Feb;126(4):734-9. PMID: 23422198.

Kim JI, Lee JD, Hwang HJ, Ki SW, Park IH, Park TY. Altered subcallosal and posterior cingulate cortex-based functional connectivity during smoking cue and mental simulation processing in smokers. Prog Neuropsychopharmacol Biol Psychiatry. 2020 Mar 8;97:109772. doi: 10.1016/j.pnpbp.2019.109772. Epub 2019 Oct 22. PMID: 31647945.

Anxiety

- ***Amygdala***



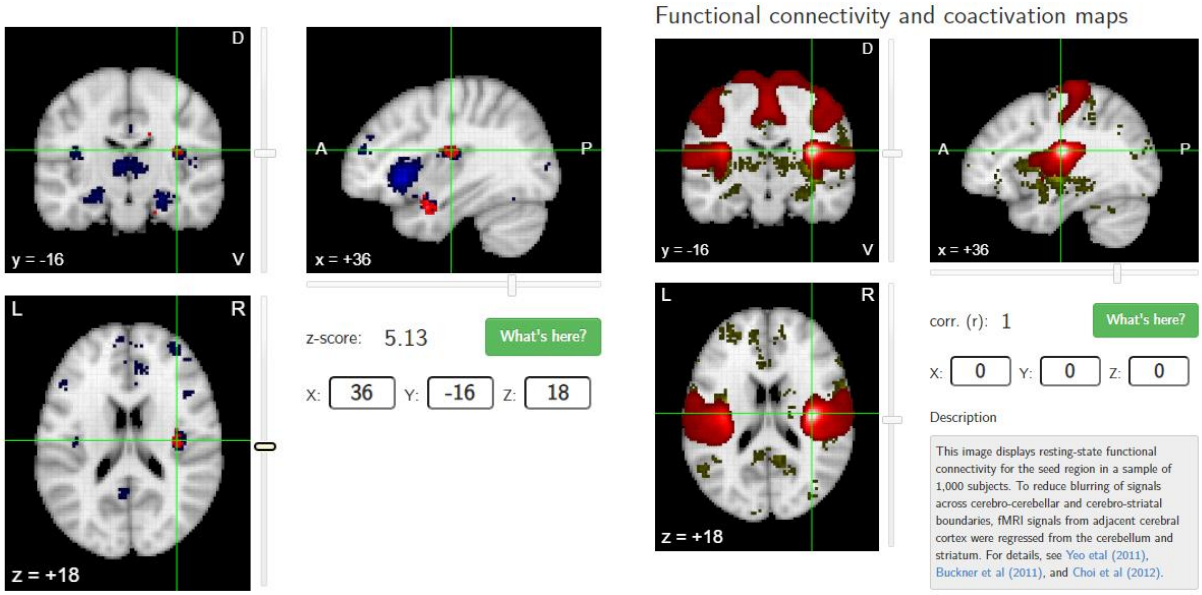
The amygdala is located within the limbic system of the brain and is involved in decision making, emotional responses and the fight or flight response; with these functions of the amygdala and limbic system in mind, its easy to imagine how the amygdala may be implicated in anxiety disorders. Researchers from Stanford were also able to study adolescent brains and were able to predict how anxious they are based on the size and functional connectivity of the amygdala. And they found that a larger amygdala correlated with more anxiety, further showing the amygdala's role in anxiety.

Sources

Hoy, T. (2019, May 05). The Amygdala: Function & psychology of fight or flight. Retrieved April 09, 2021, from https://www.betterhelp.com/advice/psychologists/the-amygdala-function-psychology-of-fight-or-flight/

StanfordMed. (2013, November 20). Size, connectivity of brain region linked to anxiety level in young children, Stanford study shows. Retrieved April 09, 2021, from https://www.eurekalert.org/pub_releases/2013-11/sumc-sco111413.php

- ***Posterior Insular Cortex***

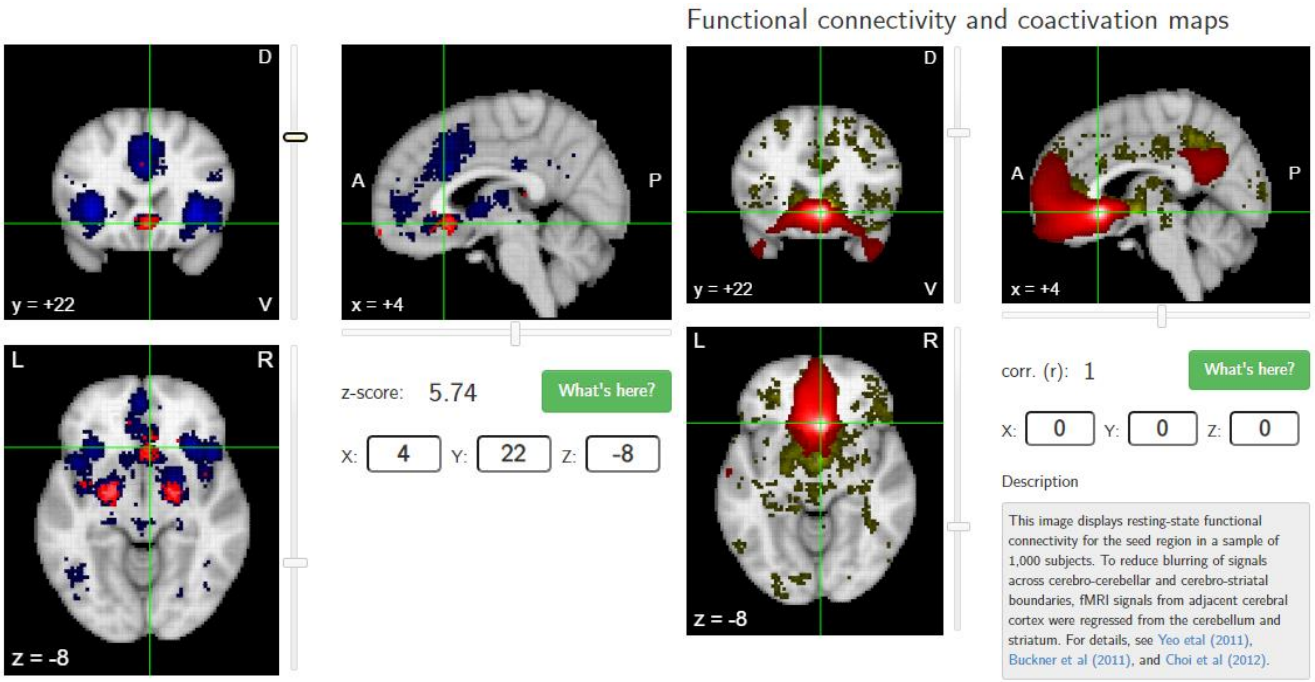


In mice models, through the use of optogenetics, researchers were able to identify a pathway from the insula to the amygdala which mediates anxiety. This is significant because the amygdala is highly implicated in emotional responses and anxiety disorders. These same researchers were also able to show in mice that the posterior insular cortex is involved in processing aversive sensory stimuli, bodily and emotional states, as well as even shifting one's behavior based on these states and stimuli. These findings support the notion that the posterior insular cortex is implicated in anxiety disorders because of how involved it is in processing aversive stimuli.

<u>Sources</u>

Gehrlach DA, Dolensek N, Klein AS, Roy Chowdhury R, Matthys A, Junghänel M, Gaitanos TN, Podgornik A, Black TD, Reddy Vaka N, Conzelmann KK, Gogolla N. Aversive state processing in the posterior insular cortex. Nat Neurosci. 2019 Sep;22(9):1424-1437. doi: 10.1038/s41593-019-0469-1. Epub 2019 Aug 27. PMID: 31455886.

- ***Ventromedial Prefrontal Cortex***



In humans, it has been shown that the ventromedial prefrontal cortex plays a big role in regulating amygdala activity, which is also highly involved in anxiety. It has also been shown that the ventromedial prefrontal cortex plays an active role in regulating the fear response, largely through its role in context learning and forming associations. Both of these studies support the idea that the ventromedial prefrontal cortex plays a role in regulating anxiety.

Sources

Motzkin, J. C., Philippi, C. L., Wolf, R. C., Baskaya, M. K., & Koenigs, M. (2015). Ventromedial prefrontal cortex is critical for the regulation of Amygdala activity in humans. Biological Psychiatry, 77(3), 276-284. doi:10.1016/j.biopsych.2014.02.014

Pennington ZT, Anderson AS, Fanselow MS. The ventromedial prefrontal cortex in a model of traumatic stress: fear inhibition or contextual processing? Learn Mem. 2017 Aug 16;24(9):400-406. doi: 10.1101/lm.046110.117. PMID: 28814465; PMCID: PMC5580532.