

# How does ADHD Affect the Brain?



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Attention-deficit hyperactivity disorder (ADHD) is a condition characterized by an inability to control one's attention span so as to effectively complete one activity or cognitive process before proceeding to another. This leads to impulsive decision-making and actions, and typically a hyperkinetic mode of life.



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ADHD is a disorder which primarily originates in and affects the brain in different ways. The brain controls and regulates all physiological activities, assigning tasks to various areas within itself. Thus it can execute the following functions; namely, receiving sensory information, initiation, performance and coordination of voluntary and involuntary movements, regulate moods and

emotions, and behavioral control, among others. Information processing and sharing across vast neural networks is thus an essential part of normal brain functioning. This is achieved by neurotransmitters which transmit nervous stimuli across synapses to other neurons.

ADHD is associated with abnormally low levels of the neurotransmitters transmitting between the prefrontal cortical area and the basal ganglia i.e., dopamine and noradrenaline. Dopamine is closely associated with reward centers in the brain, and also interacts with other potent neurotransmitters to regulate mood. Low dopamine levels thus drive the individual to seek the reward feeling by other means.

Serotonin transporter gene polymorphisms are also known to be associated with different modes of response to treatment. In addition, glutamate levels may be lower in adults with ADHD, which could be responsible for the neurotransmitter abnormalities. This causes dysfunctional neural networking in the above parts of the brain.

The prefrontal cortex controls emotional responses, behavior and what is called judgment, which decides on the appropriateness of different actions, and of course, attention to the present task which enables individuals without ADHD to execute routine tasks without deliberate and focused attention to each step of the task. It is the part which plans, initiates and perfects actions as well as executing corrections, averting roadblocks by alternative actions, and enabling concentration on the task at hand. The basal ganglia regulate impulsive behavior so as to prevent unwarranted automatic responses to stimuli.

Dysfunction of the prefrontal cortex results in a lack of alertness, shortened attention span, and decreased efficiency of working or short-term memory, difficulty in initiating and sustaining activities, and being unable to distinguish and avoid unnecessary or distracting activities. This is why ADHD individuals have diminished focus. Again, there is a significant difficulty in organizing the brain for performance of any activity which requires planning of more than one step, because of behavior which is strongly guided by impulsivity and the experienced difficulty in being still or in one place.

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## Imaging Clues

Structural abnormalities have been found in the brains of ADHD patients, such as:

- Low density of gray matter
- Abnormalities in the structure of the white matter
- Lower than normal total brain volume
- Reduced size of some parts of the brain
- Slower-than-normal cortical maturation up to adult life
- Reduced cortical thickness in adults especially of the cortical network responsible for focused attention

## Functional Neuroimaging Findings

Underactive frontal and parietal networks which regulate execution of actions and attention, leading to poor attention and hyperactivity have been seen. Additionally, there are overactive visual and dorsal attention networks as well as the default mode network.

## References

- <http://www.adhdandyou.co.uk/what-is-adhd/how-adhd-affects-the-brain/>
- <http://adhd-institute.com/burden-of-adhd/aetiology/neurobiology/>

- <http://www.umm.edu/news-and-events/news-releases/1999/different-parts-of-brain-are-activated-in-people-with-adhd>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626918/>

## Further Reading

- [All Attention Deficit Hyperactivity Disorder \(ADHD\) Content](#)
- [What is Attention Deficit Hyperactivity Disorder?](#)
- [ADHD Causes and Risk factors](#)
- [ADHD Symptoms](#)
- [How do Doctors Test for ADHD?](#)

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