

Summary of Current Brain Research Findings for Children and Adolescents

Unless otherwise noted, the studies described below were supported by NIMH.

- A number of studies have revealed brain abnormalities in children with ADHD.
 1. the hippocampus, tended to be enlarged in ADHD, particularly in children with fewer symptoms
 2. portions of the amygdala, the emotion processing hub of the brain, were smaller in children with ADHD. The researchers also observed poor connections between the amygdala and the pre-frontal cortex, which could contribute to impulse control problems and the ability to complete tasks associated with ADHD
 3. children with ADHD had significantly smaller brain volumes in all four lobes of the cerebrum, and the cerebellum than children without a diagnosis
 4. parts of the cortex, the brain's outer layer that controls attention and motor activity, is thinner in youth with ADHD.
- Scientists at UCLA and NIMH have used MRI technology to scan a group of teenagers repeatedly as they developed schizophrenia. The scientists found gray matter loss of more than 10% first in the parietal lobe (outer regions of the brain), then spreading to the rest of the brain over 5 years. Individuals with the worst tissue loss experienced the worst symptoms including hallucinations, delusions, bizarre and psychotic thoughts and depression.
- Studies indicate that children exposed to early life stressors are at increased risk for the development of depression, anxiety disorders or both. Studies suggest that early life stress creates long term overproduction of corticotrophin-releasing factor (CRF) systems as well as alterations in other neurotransmitter systems, resulting in increased stress responses.
- A Wayne State University study found significantly less of the neurochemical glutamate in the anterior cingulate cortex of children with OCD and children with major depression than in the brains of children without either disorder.
- A study at Cincinnati Children's Hospital Medical Center on a small group of children with a mood disorder found that those children showed neurochemical abnormalities within the frontal cortex and the cerebellar vermis similar to that found in adults with bipolar disorder.
- A study published in November 2007 found that the cerebral cortex of brains of children with ADHD develop more slowly than the brains of otherwise healthy

children, a lag time as much as three years. Typically, the thickness of the cortex, or gray matter, increases as the child develops, and then gets thinner throughout adolescence. The study found that healthy children reach peak cortical thickness around age 7 or 8, while kids with ADHD had a peak at around age 10. The delay in this developmental milestone was most apparent in the area of the brain that controls action and attention. The study also found that many of the children with ADHD eventually “caught up”, which helps explain why the symptoms disappear with some children as they age.

- A December 2007 study suggests that the brains of children with bipolar disorder (BD) are different from the brains of children with schizophrenia, and that there are also brain differences between boys and girls. Researchers found that the nucleus accumbens, a brain structure involved in motivation and pleasure was larger in the children with BD. They also found that the thalamus, the part of the brain through which sensory information passes to the cerebral cortex, was smaller in the children with schizophrenia. When the children with BD were compared to healthy children, the hippocampus, the part of the brain which plays a central role in memory, was smaller in the group with BD after puberty, particularly in girls. The findings suggest that sex hormones may influence how the brains of these vulnerable children develop and that the onset of puberty may be associated with the abnormal brain development seen in children with these disorders.
- A May 2008 journal article reported that a study of youth with generalized anxiety disorder (GAD) found an association between increased anxiety and an increased activation of the brain's fear center, the amygdala. Scientists believe that the amygdala is normally kept in check by the prefrontal cortex – the brain's executive hub. But brain scans using MRI technology show that the prefrontal cortex's control over the fear center (amygdala) is weakened in youth with GAD, and that the more anxious the youth, the less control the frontal cortex appeared to have.
- Co-occurring attention deficit hyperactivity disorder (ADHD) may be at the root of attention problems in children with Tourette syndrome (TS), according to NIMH-funded researchers. Their findings also support the theory that children with TS develop different patterns of brain activity in order to function at the same level as children without TS. The study was published in the November 2010 issue of the Journal of the American Academy of Child and Adolescent Psychiatry.
- Depressed teens with anhedonia, or the inability to experience pleasure, have lower levels of the neurotransmitter GABA in a key mood-regulating region of the brain, according to an NIMH-funded study published online October 3, 2011 in the Archives of General Psychiatry. The researchers note that focusing on specific symptoms and using different types of measures may offer new clues to the pathways and processes underlying depression and other mental disorders.