The Physical Effects of Dyslexia and ADHD

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HDFS 225H Section 002

Abstract

The purpose of my research is to get a better understanding of the physical effects or the biology behind these two very common disorders. Then, my research briefly looks to see how the physical effects of ADHD and Dyslexia affects a child's development both cognitively and emotionally.

Why am I researching the physical effects of Dyslexia and ADHD?

1. The biology behind how these two disorders happen is very interesting and much research still needs to be done for both disorders as well.
2. These disorders are very common.
   a. I have friends with ADHD and I have friends with dyslexia.
   b. Many famous people have these disorders, too. For example, Tom Cruise has dyslexia and Elton John has ADHD.[1]

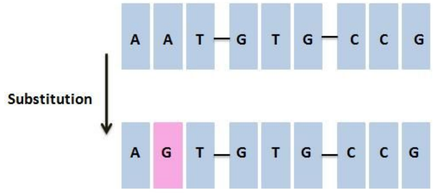

Figure 1: Substitution mutation that can happen with Dyslexia

Physical Effects of Dyslexia

- Dyslexia is defined as a "neurological developmental disorder characterized by impairments in decoding, word reading accuracy and fluency, and spelling" with difficulties in these areas lasting for at least six months.[2]

My research has shown that:

- Dyslexia is shown to be heritable with children having a 40%-66% chance of inheriting the disorder.[2]
- This genetic basis for the condition can be traced back to how our genetic code can affect the functioning of one's brain who has dyslexia.[3]
- Mutations in multiple genes, for example, in DCDC2 and ROBO1 are shown to be responsible for dyslexia.[3]
  - Either a substitution mutation happens (Figure 1), a short stretch of DNA is missing, or gene inhibition occurs (silencing of gene so it isn't expressed).[3]
- These mutations can damage neural circuits between hemispheres of the brain.[4]
- Affects axon guidance or transmission of messages, particularly, in the visual and language regions of the brain (Figure 3).[4]
- This lack of transmission is believed to contribute to the characteristics associated with dyslexia, but more research still needs to be done to understand the underlying mechanism.[4]

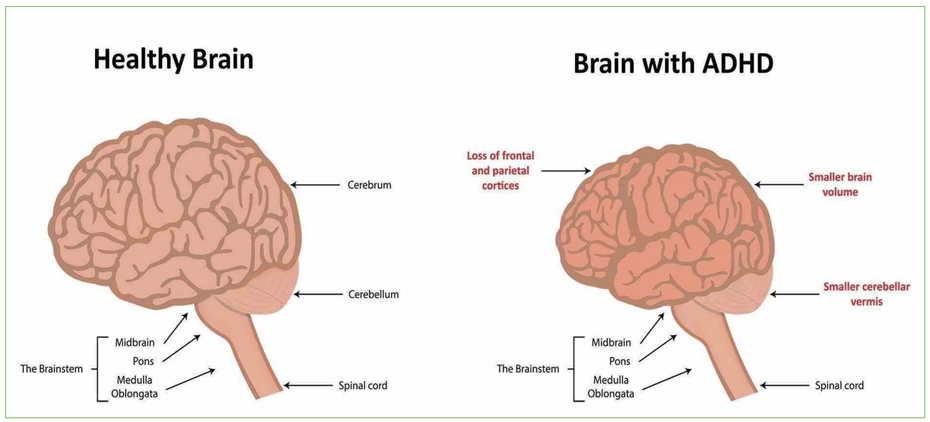

Figure 2: A brain of a person with ADHD compared to a brain of a person without ADHD

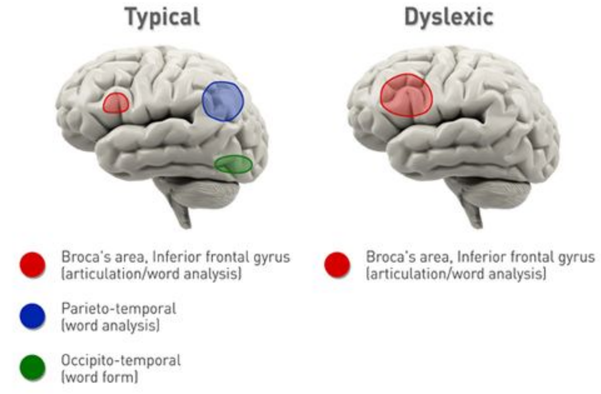

Figure 3: Brain areas activated by a person without dyslexia compared to brain areas activated by a person with dyslexia

Connection to HDFS

- Brains are constructed over time from "womb to tomb" due to the plasticity of the brain.[1]
- With both learning disorders, we can see how gene mutations or polygenic inheritance can bring about the disorder.[1]
- All three domains of development are interrelated.[1]
- Children with dyslexia tend to struggle in school due to being unable to process sensory information. If this is not handled properly, this can have a great effect on the child when they are an adult trying to get a job; they might not be able to get a good job, which then can affect their SES.[4]
- Many children who have dyslexia are frustrated at their inability to read properly and this can also affect a child's ability to communicate and their social interactions as well with others due to low self-esteem.[5]
- Children with ADHD can also struggle focusing in school and getting their work done.
- Children with ADHD are often bullied and "approximately 50% of children with ADHD experience significant peer relationship problems".[6]
- Children with ADHD tend to be unpopular due to them being aggressive, hyperactive, inattentive, or withdrawn.[1]

Physical Effects of ADHD

- Attention-deficit/hyperactivity disorder (ADHD) is characterized by a "…persistent inattention and distractibility, impulsivity, low tolerance for frustration, and inappropriate overactivity".[1]

My research has shown:

- ADHD is shown to be heritable with heritability reaching 80%.[7]
- That many genes are involved in ADHD. Combination of recessive and dominant genes like DRD4, SLC6A3, and more.[7]
- Neuroimaging studies have shown that children with ADHD tend to have:
  - Smaller brain volume due to a reduction in white matter volume[7] (Figure 2)
  - Smaller corpus callosum[7]
  - Developmental delay by about three years of grey matter in the frontal cortex[1]

Implications

- Starting Social-Emotional Learning School Programs (SEL) young.[2]
  - Programs help with regulating emotions, teamwork, cooperation, perspective taking, and more.[2]
  - Studies have proven the success of SEL programs, but there is still a strong need for this to be implemented globally and for funding.[2]
- Speech-language pathologists (SLPs) are a great resource at school for children with dyslexia.
  - Many people advocate for SLPs due to their incredible work with children that have dyslexia and similar disorders.
  - They can help develop a dyslexic child become more aware phonologically; they can support reading difficult texts; they can help with writing exercises; and much more tactics can be employed by a SLP.[4]
  - SLPs may have difficulty establishing a role in a school due to funding and regulations, but SLPs are in high demand nowadays.
- To help treat ADHD, behavioral therapy in combination with ADHD medication is shown to strongly help.[1]
- Parents and teachers breaking down activities into smaller segments helps children with ADHD focus better and work on a goal.[1]
- There is a huge debate on whether children with ADHD should be medicated as much as they are and if they are better off.
  - This is being asked due to sharp increase in ADHD medication being prescribed by physicians.[8]
  - In fact, in 2011, the U.S. used roughly 55,550,320 grams of Ritalin, accounting for 75% of the world's consumption.[8]
- More work needs to be done to resolve this debate and many are asking if the classification of ADHD should be modified or changed.

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