

ADHD and Executive Functions

A quick reference guide to understanding the latest thinking about ADHD

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Speaker Background

- RN, BSN, PhD Student, Faculty
- Neurodevelopmental Pediatrics – CDRC at OHSU
- ADHD Family Nurse Case Manager – PACT (Parents and Children Together): OHSU Intervention Study
- Co-Editor, *Pediatric Home Care for Nurses: a family-centered approach*, 3rd Edition
- Researcher / Author / Speaker
- Community Educator / School-Based In-services, Parent Educational Outreach, etc.
- *Father of 3 sons with ADHD*

What is ADHD?

- Current definition (DSM, 1994)
 - Predominantly Inattentive
 - Predominantly Hyperactive / Impulsive
 - Combined
- Is a brain disorder
- Is not from “bad parenting, too much TV, or sugar”
- Often comes with many other challenges

Other Problems + ADHD

- Oppositional defiant disorder (40%)
- Language disorder (30-35%)
- Anxiety (20-25%)
- Learning disability (15-25%)
- Mood disorders (15-20%)
- Conduct disorder (20%)
- Substance use disorder (15%)
- Tics (15%)

Other causes of attention and hyperactivity *problems*

- Sleep disorders
- Depression
- Bipolar disorder
- Learning disability
- Sensory deficits
- Previous brain injury or trauma
- Giftedness
- Language disorder
- Pervasive developmental disorder (autism)
- Abuse
- Mental retardation
- Migraines
- Lead poisoning
- Thyroid dysfunction
- Genetic disorders
- Seizures
- Anxiety
- Oppositional or conduct disorders
- Post traumatic stress disorder
- Substance abuse
- Adjustment disorders

Where in the brain can you 'find' ADHD?

- Each area of the brain does it's own special job.
- In ADHD, specific parts of the brain have been affected in a way that changes how brain cells communicate.
- Most of these disruptions are related to genes. Sometimes these cells are disrupted for other reasons such as injury or toxins such as lead.
- The area of the brain that is affected in ADHD is called the Frontal Lobe.

How do genetics cause ADHD?

- Genes are the material “blueprints” that tell our bodies how to grow and develop as well as maintain itself
- Nearly a dozen genes have been implicated in ADHD
- 4 specific genes are most likely the primary causes of ADHD
- Each of these 4 genes are “Brain Blueprints” – specific for brain functions

Blueprints for “Electrical Workers”

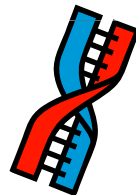
- The “brain blueprints” have to do with certain chemicals...electrical chemicals called “neurotransmitters”.
- Neurotransmitters allow the many brain cells (100 billion neurons!) to communicate with each other.
- In ADHD, two of these chemicals seem to not be able to work properly...there is a problem with the electrical system

Dopamine and Genes

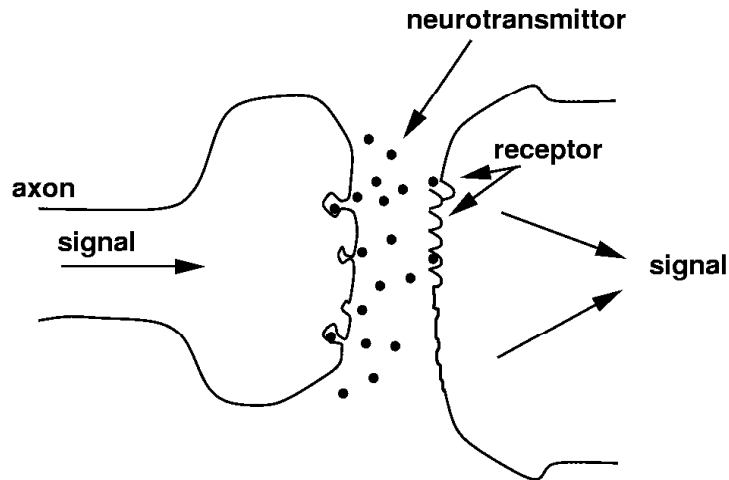
- One gene appears to have an “error” in telling the body how fast to recycle a brain chemical called dopamine...it recycles it so fast, that it doesn’t have time to transmit the electrical signal to other brain cells [re-uptake]
- Two other genes appear to have an error in telling the body how to grow cells that can use the brain’s dopamine correctly...”not enough outlets to allow the wiring to plug in...”

Dopamine and “Friends”

- The final gene of major interest appears to have an error in telling the body how to change one chemical (norepinephrine) into dopamine and back again resulting in not enough electrical “signal” being transmitted.

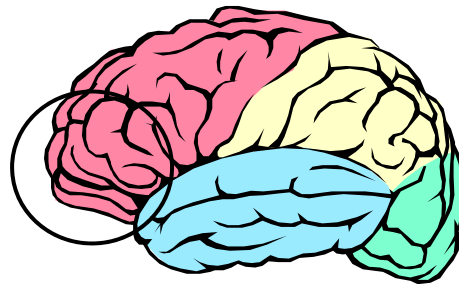


The Synapse – where 2 brain cells communicate

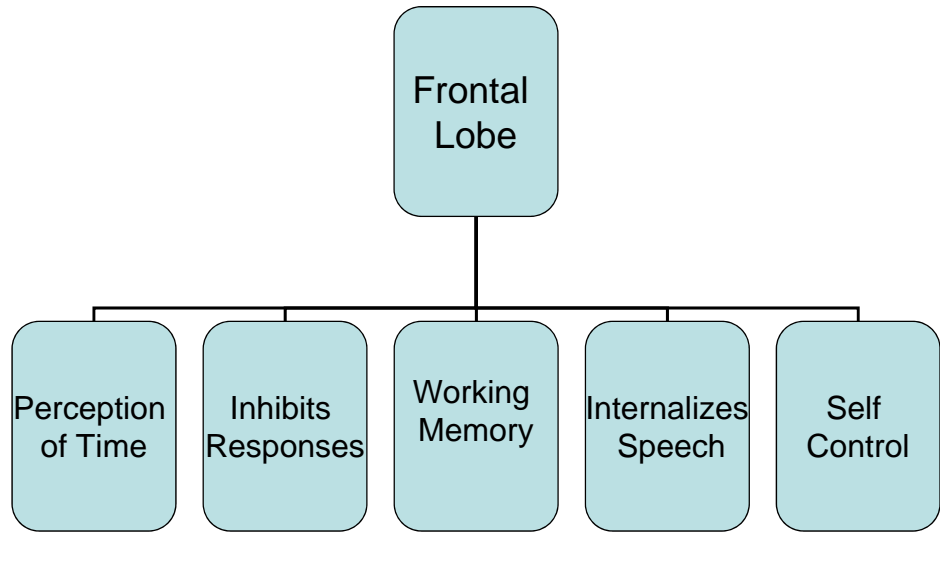


The Frontal Lobe

- There are several regions of the frontal lobe.
- You may also hear the term 'pre-frontal cortex' used to better describe the region affected in ADHD.
- This is the executive, managing, thinking part of our brain.
- Thus we call these qualities 'Executive Functions'.



The Frontal Lobe: “Executive Functions”



Perception of Time



- The frontal lobe is where we seem to ‘feel’ time passing.
- In childhood, this sense is undeveloped.
- Over time, we learn to ‘synchronize’ the passage of actual time with our feelings.
- As children grow they learn how time feels to them. They learn what 5 minutes and 5 hours ‘feel’ like.
- In ADHD, this function is disrupted.

Blindness to Time

- Russell Barkley refers to this phenomenon as 'blindness' to time in children and adults with ADHD
- An ADHD affected brain does not allow for the same development of skill in relation to feeling time
- 5 minutes can seem like 5 hours and vice versa depending upon the circumstances
- This ALONE could be considered a very disruptive challenge

Inhibiting Responses



- The frontal lobe is also responsible for helping us 'stop' in the moment and choose to respond to a stimulation.
- For example, when an animal hears a loud sound it immediately runs to escape. Survival instinct kicks in and it responds.
- In humans, our frontal lobe develops to let us 'screen out' all those signals from the outside. To give us time to think "What was that? Do I need to react or I am safe?"
- We can *stop*, if even for a brief second, before we react to a stimulus.

Inhibition Continued

- In ADHD, this quality is disrupted.
- As such, a person with ADHD finds that they cannot help but respond to any stimulus (sight, sound, thought, etc.) that comes into contact with them.
- They are very challenged when required to remain focused upon most tasks.
- There is not a way to 'filter' everything else out.
- They don't 'mean' to be distracted. In fact, they cannot help it.

Working Memory



- Working memory has also been called 'short term memory'.
- It is because of working memory that we can remember our past experiences and future goals.
- Working memory is like the "RAM" of a computer...the place where all the programs on the hard drive 'go' to be useful.
- In a brain with ADHD, the connection between the "RAM" (working memory) and the Hard Drive (long term memory) is very, very slow.
- ADHD is like having a 'dial-up connection' in a 'high speed' internet brain.

Working Memory

- The ADHD brain has the same 'hard drive' capacity as any other brain. Intelligence is not directly impaired by ADHD. These kids KNOW what to do and are as smart as their peers on average.
- They do however, have a very slow connection to that knowledge. So they cannot DO as fast as their peers can do.
- If we test these kids, their "IQ" follows the average curve of all children. But their working memory and processing speed are much slower.

Working Memory and Actions

Knowing

7 x 5 = 35

Don't push people

Doing

100 math problems in 2 minutes

30 minutes of no pushing on the playground

Internalizing Speech

- All children are born with a 'quiet' mind. We are not born thinking words inside our heads.
- As we learn to speak, we learn 'outside' our mind. We say everything we think.
- *"Kids say the darnedest things"*.
- As we grow, we learn to 'think' the words inside our head instead of saying them aloud.
- Over time, we develop an 'inner voice' that we use to guide our behavior and reason through problems.



- With impaired frontal lobe function, kids with ADHD tend to be very far behind their peers in this development.
- This often means they seem 'hypervocal' or that they can't stop talking. It also seems that they say everything they think, even if they shouldn't say it at all.
- It also means that the 'inner voice' or 'conscience' is much slower to develop. This means that there is often a lack of talking to themselves in many situations, good and bad.

Internal Speech and Behavior

- Parents and teachers often find themselves saying “What were you thinking” only to hear the child respond “I don’t know!” Now we know they may not have had any ‘little voice’ to guide them ‘in the moment’.
- Combined with impulsivity and slow processing, they may truly not have known why they did a particular behavior.
- “It just happened”!
- “I didn’t mean to”!

Self Control

- Adding all of these functions together one has the ability to be in control of oneself at almost all times.
- Think about a book report as an example of executive functions at work.
- The assignment requires all of the executive functions to be used effectively to complete the task.

The Book Report



“This report is due in 1 week” – Teacher

(Perception of Time)

“Come spend the weekend at my house and we’ll have a sleep over!” – The friend



“Wait...I need to think about it for a moment...” – The child
(Inhibit Responses)



“My book report is due next Friday”
(Working Memory)



“If I go this weekend, I will not have enough time
for the book report...but I really want to go!” –

(Internalizing Speech)



“Sorry, I can’t this weekend. How about next weekend?”

(Self Control)

Treatments and Supports

Medication

- Medications have been shown to be the most helpful for helping ADHD symptoms
- Medication works to help brain cells communicate
- The earliest use of medication was in 1938
- There are many kinds of medications that may work
- Medication needs change over time
- Often come with short-term side effects
- Must be prescribed by a NP or MD

Behavior Therapy

- The next most studied and effective treatment is called Behavior Modification
- This can be provided by a Psychologist, Clinical Social Worker, Nurse, or in some cases a MD
- Therapy is really more like 'skills training' and should focus on both the child and on the parent
- Usually both parents and kids need help to change their behavior
- Often, the focus is on using incentives and reward systems for kids, and on planning and actions for parents

Education Supports

- ADHD is not directly considered a disability under federal law
- Child with ADHD can still qualify for educational help under the category:
 - “Other Health Impairment”...something that interferes with a major life function such as learning
- Children may qualify for special education assistance
- Section 504 (504 Plan)
- IEP (Individualized Education Plan)
- Talk to your child’s teacher to initiate the process

Health Behaviors

- Exercise and outdoor spaces are known to decrease hyperactivity and increase attention
- Sleep is OFTEN a problem for kids with ADHD – focus on solving sleep problems to be helpful
- Family health is important too – focus on spending time together and building good relationships
- Diet is important – foods do not cause ADHD, however a poor diet can make symptoms more difficult to manage

Counseling

- Counseling can be provided by a number of people, often at school
- Focus upon specific problems like anxiety
- Can also focus on general problems like building / maintaining friendships
- Can be a valuable source of help to the child and family

Complimentary Help (from research)

- Yoga
- Massage Therapy
- Musical Instruments
- Guided Imagery
- Working Memory Training
- Tai Kwan Do

Parent Self Care

- Oxygen Mask Theory
- Mom's stress is key to family function
- Fathers can help by strengthening mothers
- Daily breaks
- Parents are shepherds, not engineers

For More Information

- [Taking Charge of ADHD: The complete authoritative guide for parents.](#) Russell Barkley, 2005. – Parent friendly guide. The 2005 edition has info on executive functions...the earlier ones do not.
- [The ADHD Book of Lists: Sandra Rief](#) – VERY helpful, easy to use book broken down into checklists. Good for parents and teachers too.
- [ADHD and the Nature of Self Control](#) by Russell Barkley, 2005 – In depth book on ADHD and Executive Functions
- www.CHADD.org
- www.ldonline.org (that is L D Online, for clarity)

Question and Answer Time!

Ethical Disclaimer:

I cannot directly answer specific questions about your child, however if you may certainly ask questions about something in general.

For example, I cannot answer "Why does Emma's medication stop working at 3:00?" But I can answer "Do medications sometimes wear off? How is that best helped?"