

What changes in ADHD from Preschool to Adulthood?

What Changes in ADHD from Preschool to Adulthood and Why?

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Shifts in Conceptualizing ADHD

- ◆ 1968 Hyperkinetic Disorder of childhood
- ◆ 1980 Attention Deficit Disorder
 - With or without hyperactivity
 - Residual type recognized
- ◆ 1987 ADHD (only combined symptoms)
- ◆ 1994 AD/HD–3 types
- ◆ 2000 AD/HD (impaired executive function)

“Focus” and Executive Function Impairments of ADHD

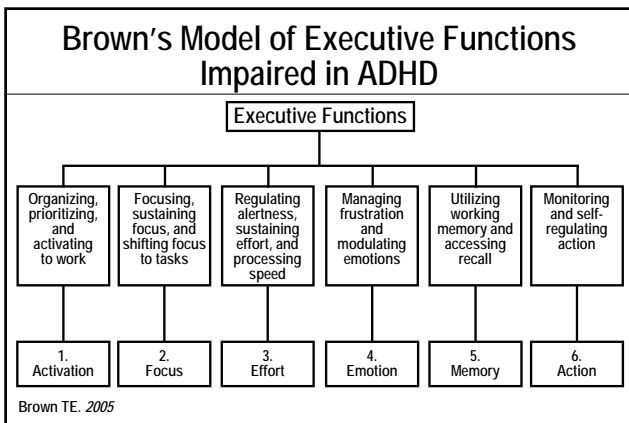
- ◆ In DSM-IV “inattention” symptoms of ADHD
 - Do not mean
 - Unable to focus as in holding the camera still to take a photo of an unmoving object
 - Do mean
 - Unable to focus as in focusing on the task of driving a car

Brown TE. In press.

What changes in ADHD from Preschool to Adulthood?

Executive Functions
<ul style="list-style-type: none">◆ Wide range of central control processes of the brain◆ Connect, prioritize, and integrate cognitive functions—moment by moment◆ Like conductor of a symphony orchestra

Brown's Model of Executive Functions Impaired in ADHD
Symptom Characteristics
<ul style="list-style-type: none">◆ Dimensional, not “all-or-nothing”<ul style="list-style-type: none">• Everyone sometimes has some impairments in these functions; in ADHD, it is a chronic, severe impairment◆ Situational variability: “If I’m interested”<ul style="list-style-type: none">• Most persons with ADHD have a few activities where ADHD impairments are absent <p style="text-align: center; border: 1px solid black; padding: 2px;">ADHD looks like a willpower problem, but it isn't!</p>



What Requires Executive Functions?

- ◆ Tasks that involve managing oneself
- ◆ To prioritize, start, sustain, shift, stop, and integrate cognitive functions
- ◆ Using memory without moment-by-moment guidance from others

Brown TE. 2005

Executive Functions: Development and Demands

- ◆ EF capacity develops through childhood, into adolescence, and beyond; it is not fully present in early childhood
- ◆ Environmental demands for EF increase with age, from preschool through adulthood
- ◆ EF impairments often are not noticeable by age 7!

Brown TE. Emerging understandings of attention deficit disorders and comorbidities. In: Brown TE, ed. *Attention-Deficit Disorders and Comorbidities in Children, Adolescents, and Adults*; 2000:3-55.

Development of Brain Structures that Support Executive Functions

- ◆ Structures and functions that support EF are not fully developed at birth
- ◆ Neural networks underlying effortful control begin development at 2-4 years old, but don't fully develop until one's 20s
- ◆ Development of EF capacities continues into early adulthood

Rothbart MK, Posner MI. Mechanism and variation in the development of attentional networks. In: Nelson CA, Luciana M, eds. *Handbook of Developmental Cognitive Neuroscience*; 2001.

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When Are ADHD Impairments Noticeable?

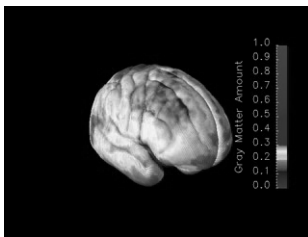
- ◆ Some are obvious very early and are noticeable in preschool years
- ◆ Some are not noticeable until middle elementary or junior high
- ◆ Some are not apparent until child leaves home to go to college or later

Continuing Brain Development in Late Childhood and Adolescence

- ◆ Between 6-15 years, extreme growth (to 80%) occurs at the collosal isthmus that supports associative relay, while considerable synaptic pruning occurs
- ◆ Brain myelination increases 100% during the teenage years
- ◆ Dopamine (DA), norepinephrine (NE), and serotonin (5-HT) transmitter systems in the brain continue to develop into one's 20s

Thompson PM, et al. *Nature*. 2000;404(6774):190-193.
Benes FM, et al. *Arch Gen Psychiatry*. 1994;51(6):477-484.

Prepubescent Growth Spurt in Cortex (thickens just before puberty, then thins)



[View of right orbital lateral cortex; blue is thinner]

Aggregate of 52 MRI scans of normal kids scanned X4 @ 2 yr intervals

Cortex thickness peaks at:
11 yo in females
12.5 in males

Then prunes for
More efficient circuits

Pruning is gradual, over years
mostly caudal to rostral

J. Giedd (2003) NIMH

Cortex Maturation in ADHD vs NC

- ◆ MRI studies of 40K cortex sites in 223 youths with ADHD vs matched controls
- ◆ Brain maturation was delayed ~3yrs in specific regions in ADHD youths vs NC
- ◆ Frontal areas of cortex slower in ADHD
- ◆ Medial PFC developed lagged 5 yrs

(Shaw, et al, PNAS, Nov, 2007)

Challenges May Reveal Weaknesses

Cardiac weaknesses may not be noticeable in EKG taken while lying quiet on a table, but may be very noticeable while playing basketball, shoveling snow

EF weaknesses may not be noticeable until one's self-management is challenged by increased demands of adult life

How Can Executive Functions Become Impaired?

- ◆ Developmentally, eg, ADHD
- ◆ Trauma, eg, traumatic brain injury
- ◆ Disease, eg, Alzheimer's disease
- ◆ In trauma and disease, the patient usually has had adequate EF, then loses it
- ◆ In ADHD, EF has not developed adequately

What changes in ADHD from Preschool to Adulthood?

Tasks of Childhood Requiring Executive Functions

- ◆ Behaving carefully
- ◆ Cooperating with adults and peers
- ◆ Reading to comprehend
- ◆ Writing to communicate

Brown TE. In press.

ADHD in Preschoolers

- ◆ preschool presentation usually very hyper, impulsive, oppositional, sleep problems
- ◆ Onset of preschool sx usually 3-4 yo, but some as early as 2 yo
- ◆ 5-6% of preschoolers meet full DSM-IV criteria
- ◆ Some are developmental lag; in 45%, preschool sx remain stable into later childhood

Reading Problems Associated With ADHD

- ◆ 387 children monitored Kind -5th grade
- ◆ given IQ, reading tests, teacher evals of attention, behavior sx, parent involvement
- ◆ IQ & parent involvement important
- ◆ after controlling for IQ & Kind Rdg scores
- ◆ inattentive 1st graders 3X more likely to have significantly low reading scores in 5th

(Rabiner, Coie, et al, 2000)

What changes in ADHD from Preschool to Adulthood?

**Math Problems
Associated With ADHD**

- ◆ 30 students aged 7 to 11 years
 - ◆ 50% ADHD vs non ADHD
 - ◆ None had math LD-all matched math skills
 - ◆ ADHD students:
 - attempted fewer problems
 - X3 less efficient than non-ADHD
 - made X6 errors in subtraction (120-9)
- (Benedetto-Nasho & Tannock, 1999)

Same brain is used for:

- ◆ **School**
learning, work, behavior
- ◆ **Social relationships**
listening, conversing, interacting
- ◆ **Family life**
homework, daily routines, activities
- ◆ **Solitary thought & activities**
self-esteem, planning, hoping

**In social and family relationships, ADHD often
impairs**

- ◆ managing daily routines & homework
- ◆ communicating clearly
- ◆ adequately modulating emotions
- ◆ accurately recognizing feelings of others
- ◆ acting appropriately with others

What changes in ADHD from Preschool to Adulthood?

**As child gets older,
ADHD often increases**

- ◆ risk of school failure and dropout
- ◆ risk of motor-vehicle accidents
- ◆ risk of substance abuse
- ◆ and significantly lowers self-esteem

**Tasks of Adolescence
Requiring Executive Functions**

- ◆ Managing time and homework
- ◆ Developing relationships
- ◆ Driving a car
- ◆ Leaving home, modifying connections

Brown TE. In press.

**Tasks of Adulthood
Requiring Executive Functions**

- ◆ Holding a job and working productively
- ◆ Managing household and finances
- ◆ Managing work while nurturing relationships
- ◆ Parenting and sustaining partnerships

Brown TE. In press.

What changes in ADHD from Preschool to Adulthood?

Impairments in Adult Life Activities U-Mass Study			
	ADHD n= 145	Clinical 97	Com Cntrs 75
Education	98	83%	3%
Home Responsibilities	90	78	3
Occupation	89	65	4
Dating or Marriage	82	73	6
Social Activities	77	50	1
Community Activities	47	34	0
Any Domain	100	99	11

(Barkley, Murphy & Fischer, 2008)

Adults with (464) or without (487) ADHD		
	with ADHD	without ADHD
C avg or less in school	52%	27%
Special education	37	10
Repeated a grade	30	8
Currently employed	52	72
Employed full-time	34	57
Addicted to tobacco	64	36
Divorced	28	15
# of jobs past 10 yrs	5.4	3.4

(Biederman, et al. J. Clinical Psychiatry, 2005)

ADHD: Persistence vs Change (3 different views)	
◆ Old View:	usually outgrown by mid-adolescence (only if one ignores inattention problems)
◆ Current View:	usually continues into adulthood (just keeps going, like the Energizer bunny)
◆ Proposed View:	more or less impairing in adolescence/adulthood (depends on challenges and resources)

What changes in ADHD from Preschool to Adulthood?

ADHD persistence may involve increasing impairment

impairment may become more and/or less problematic in adolescence and adulthood

Depends on unfolding of:

- ◆ Individual strengths/weaknesses
- ◆ challenges encountered
- ◆ supports available

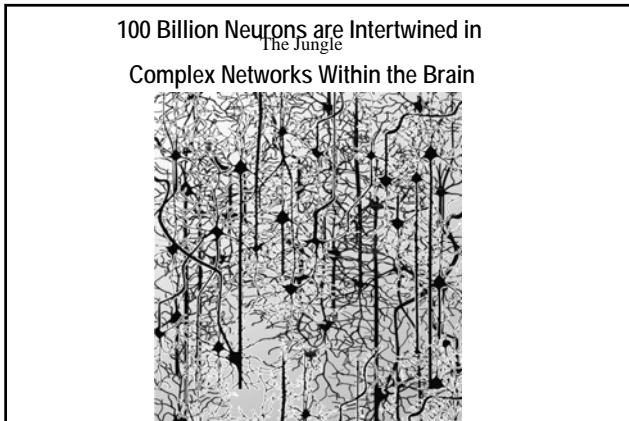
A Chemical Problem

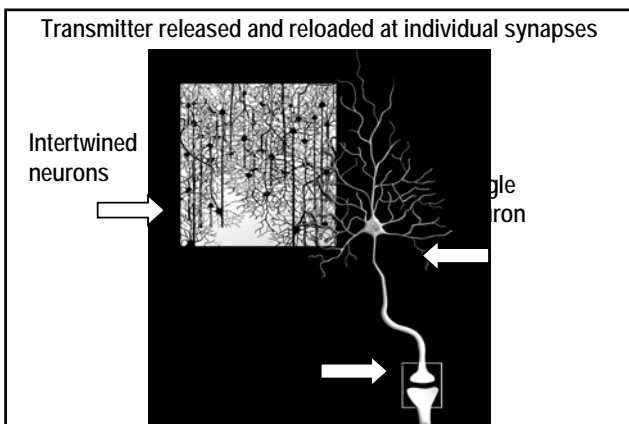
- ADHD is fundamentally a chemical problem
- Most effective treatment is to change the chemistry with medication
- Unless the problematic chemistry is changed, other interventions are not likely to be very effective

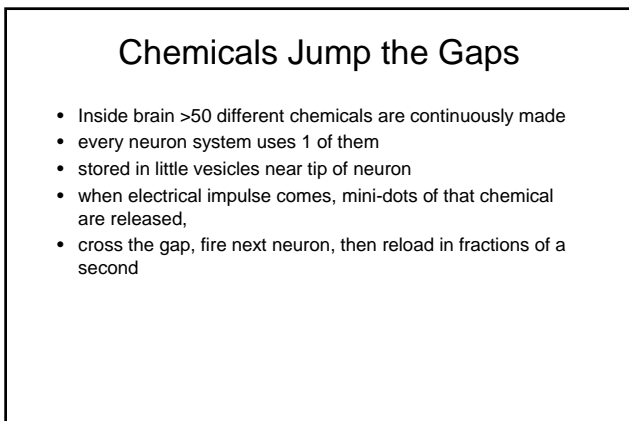
In the Human Brain

- 100 billion neurons
- each one linked to >1000 others
- in complex sub-systems
- that have to "talk to each other"
- using low voltage electrical impulses
- that have to jump across gaps
- so fast that 12 can cross in 1/1000 sec.

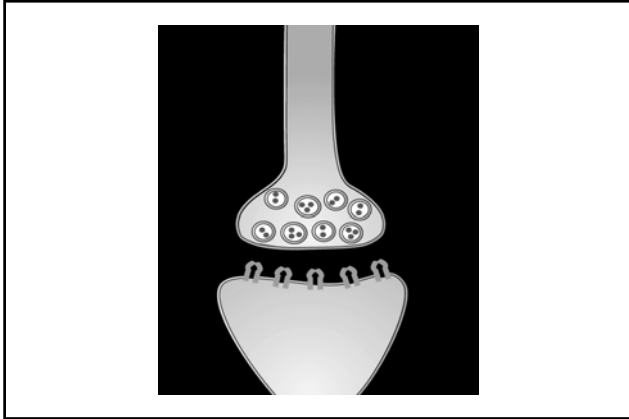
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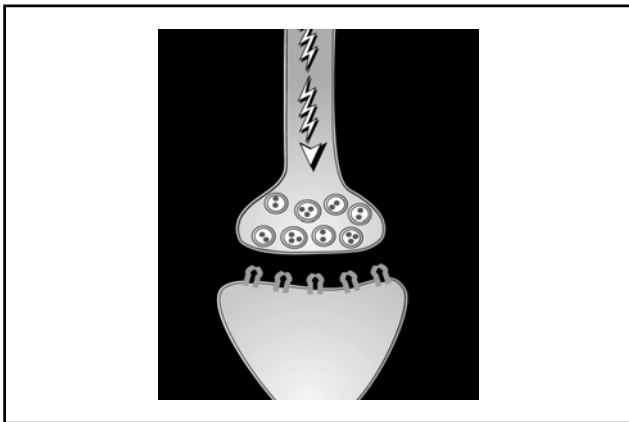


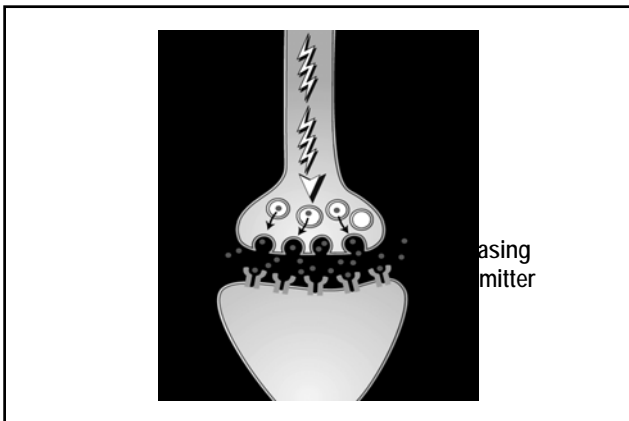




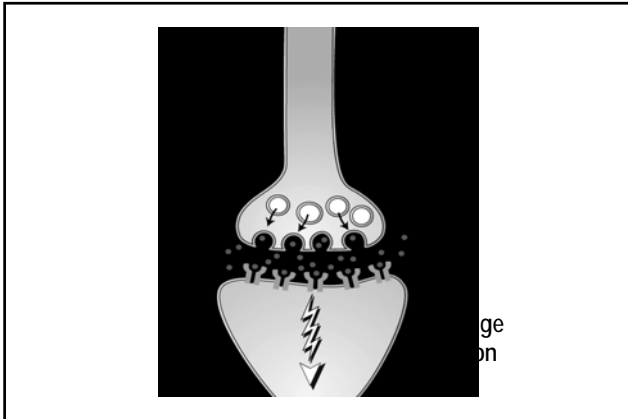
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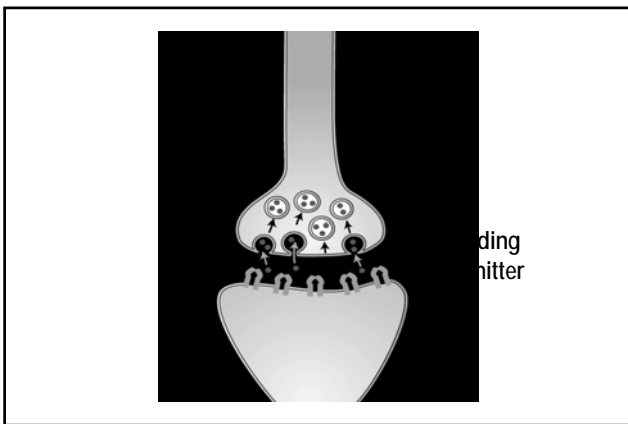


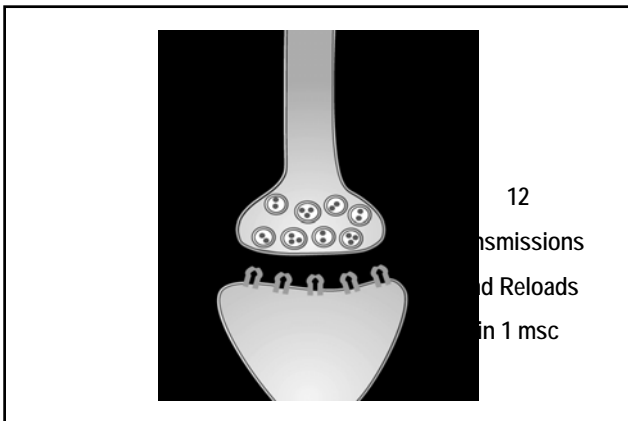




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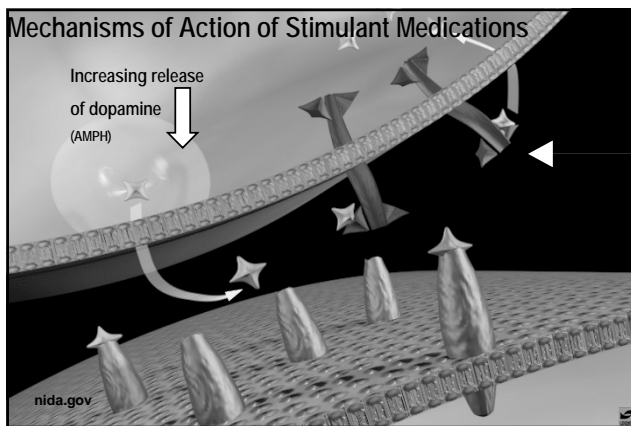


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Executive Function Networks Depend primarily on 2 chemicals

dopamine and norepinephrine

- control most functions impaired in ADHD
- brain of person with ADHD makes these chemicals
- but does not release & reload effectively
- → control messages often not connecting
- For 80% medications improve this problem.



How Do Medications Alleviate ADHD Sx?

- Meds slow reuptake +/- increase release of DA or NE
- Not a cure (eyeglasses, not antibiotic)
- Alleviate sx only for duration of action
- Effective amount of stim not related to age, weight or sx severity
- "Fine-tuning" of meds essential (to optimize dose and timing)

Reward System Impairments in ADHD

- ◆ Imaging study (PET) of ADHD adults vs healthy controls
- ◆ Compared binding of D_2D_3 in reward centers of brain
- ◆ Reduced binding in adults with ADHD in reward/motivation areas of brain

(Volkow, Wang, Kollins, et al. JAMA, Sept. 2009)

Increasing Dopamine can Enhance Interest

- ◆ PET scans of NC doing boring math task with and without MPH
- ◆ When doing math task with MPH, Ss reported increased interest in task
- ◆ MPH during math task increased DA levels in the synapses
- ◆ MPH enhanced saliency of task by increasing DA in brain.

(Volkow, et al, 2004)

MPH Normalizes Brain Functions associated with motivation & attention

- ◆ fMRI study compared children with ADHD vs healthy matched controls
- ◆ Those with ADHD had too little activation on some tasks, too much on others
- ◆ MPH increased motivation & attention where needed and reduced excesses for both "hot" and "cool" motivation

(Rubia, Halari, Cubillo, et al. 2009, Neuropharmacology, doi 10.1016)

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What Changes? Interactions of:
<ul style="list-style-type: none">◆ Brain development◆ Unfolding of genetic influences◆ Environmental demands◆ Environmental stressors and supports

My Website
<ul style="list-style-type: none">◆ To see more info◆ To download articles◆ To sign up for free email newsletter <p style="text-align: center;">www.DrThomasEBrown.com *****</p>
