

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

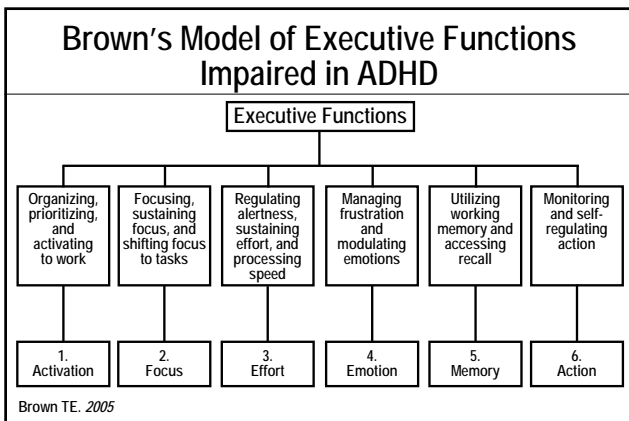
- ◆ In DSM-IV “inattention” symptoms of ADHD
 - Do not mean
 - Unable to focus as in holding the camera still to take a photo of an unmoving object
 - Do mean
 - Unable to focus as in focusing on the task of driving a car

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;">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?

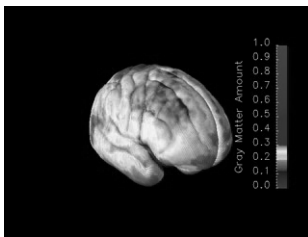
- ◆ Some are obvious very early and are noticeable in preschool years
- ◆ Some are not noticeable until middle elementary or junior high
- ◆ Some are not apparent until child leaves home to go to college or later

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)



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

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

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

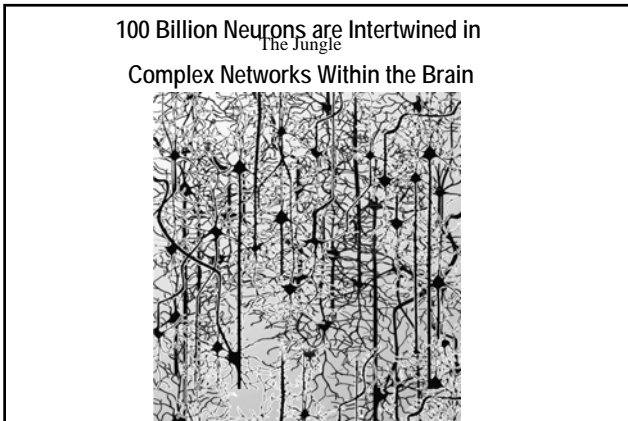
A Chemical Problem

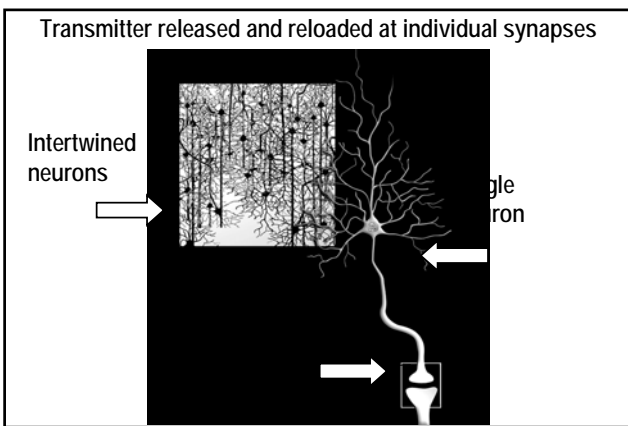
- ADHD is fundamentally a chemical problem
- Most effective treatment is to change the chemistry with medication
- Unless the problematic chemistry is changed, other interventions are not likely to be very effective

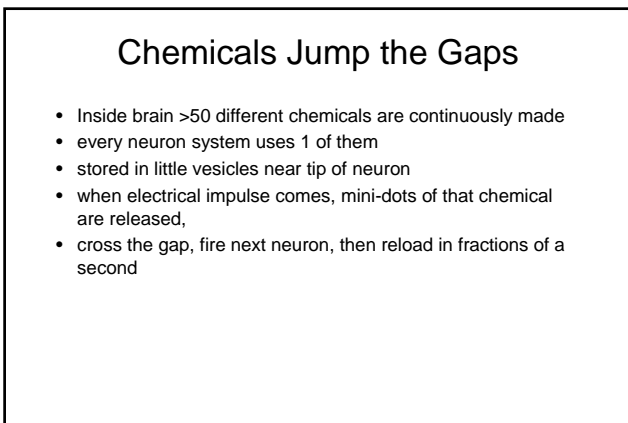
In the Human Brain

- 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.

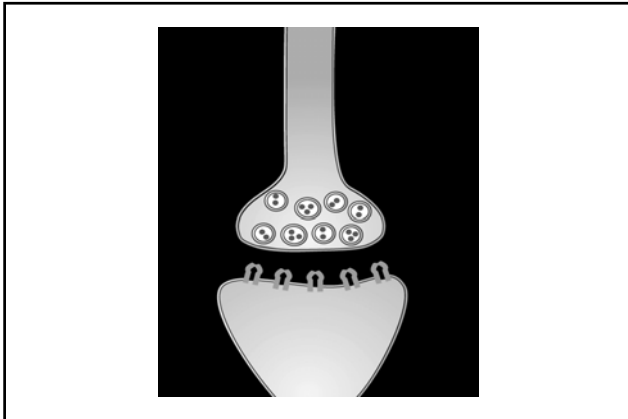
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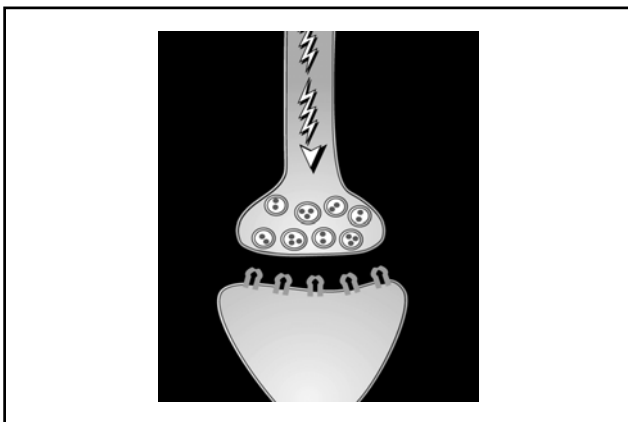


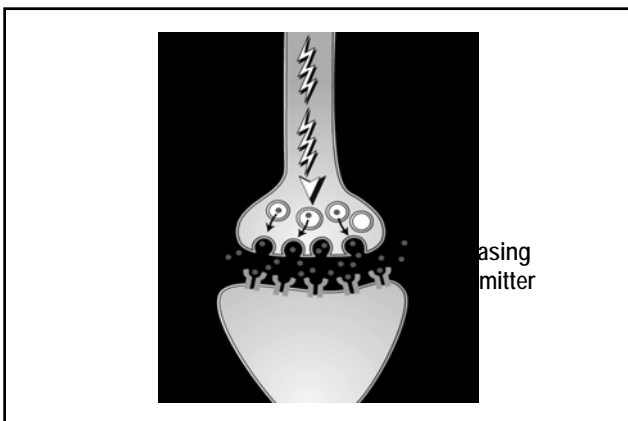




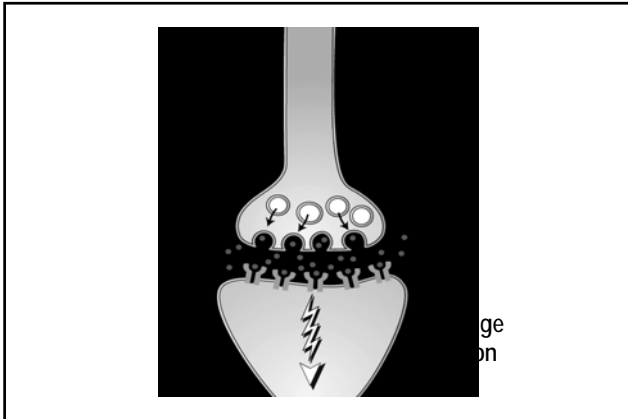
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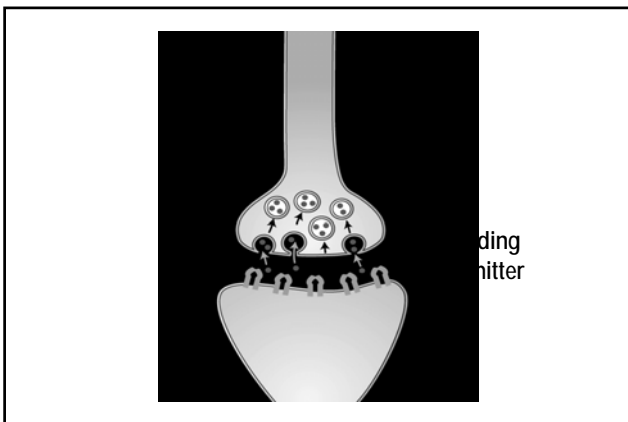


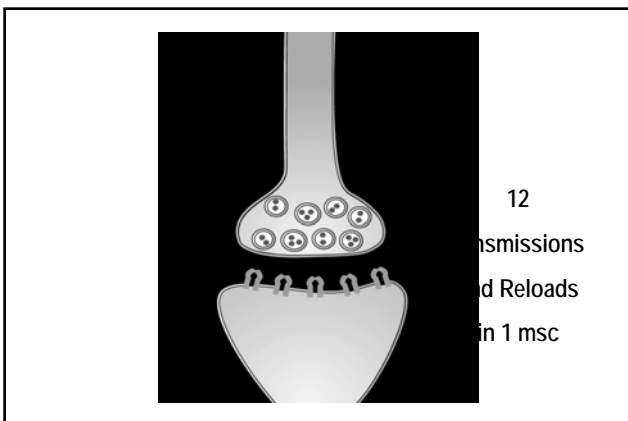




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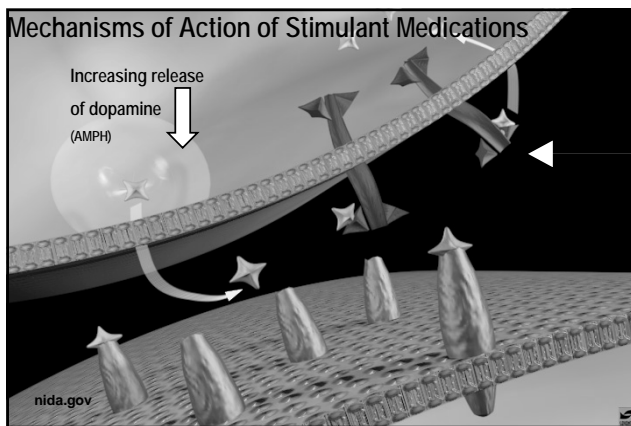


What changes in ADHD from Preschool to Adulthood?

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>
