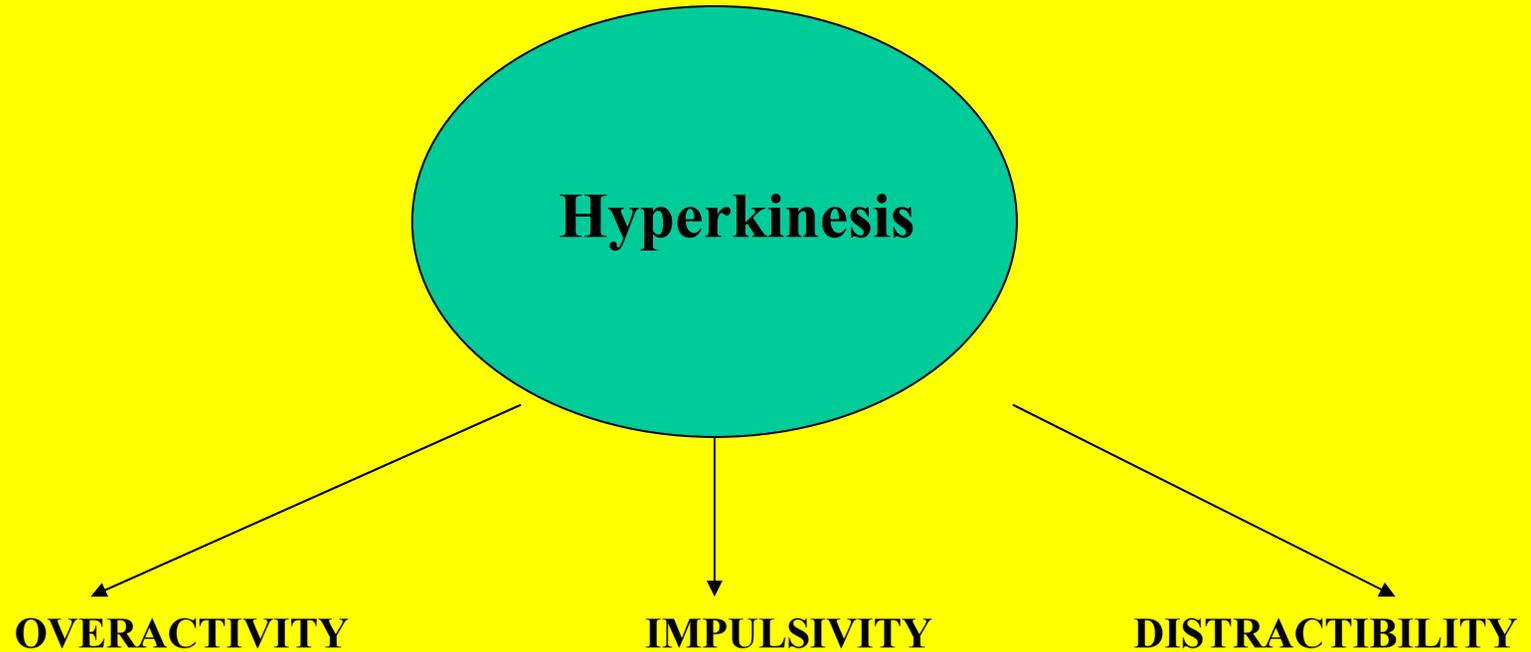


Executive Functioning and ADHD

ADHD 100 YEARS OF RESEARCH

George Still “Some abnormal psychical conditions in children” The Lancet 1902

Refined Phenotype of ADHD/Hyperkinesis



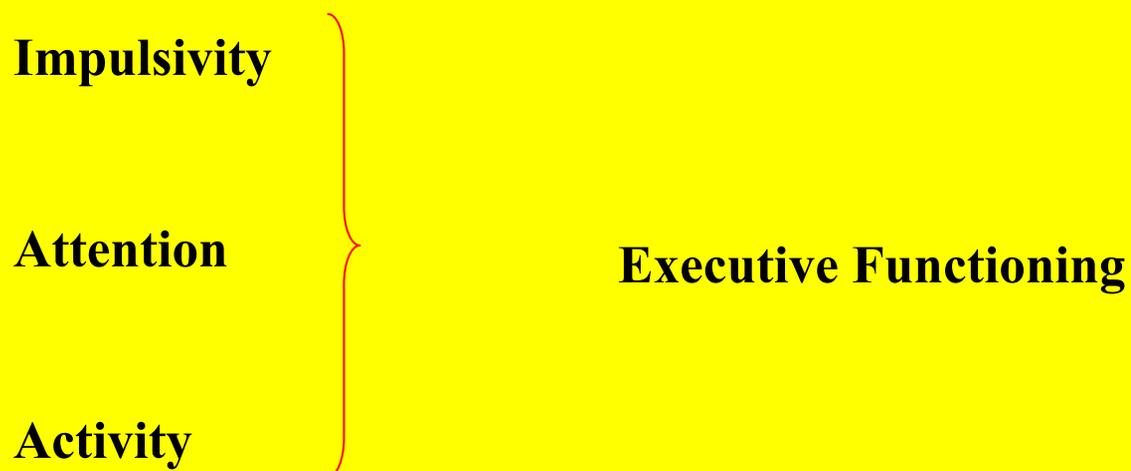
How do we go from ADHD to Executive Functioning?

Impulsivity

Attention

Activity

Executive Functioning

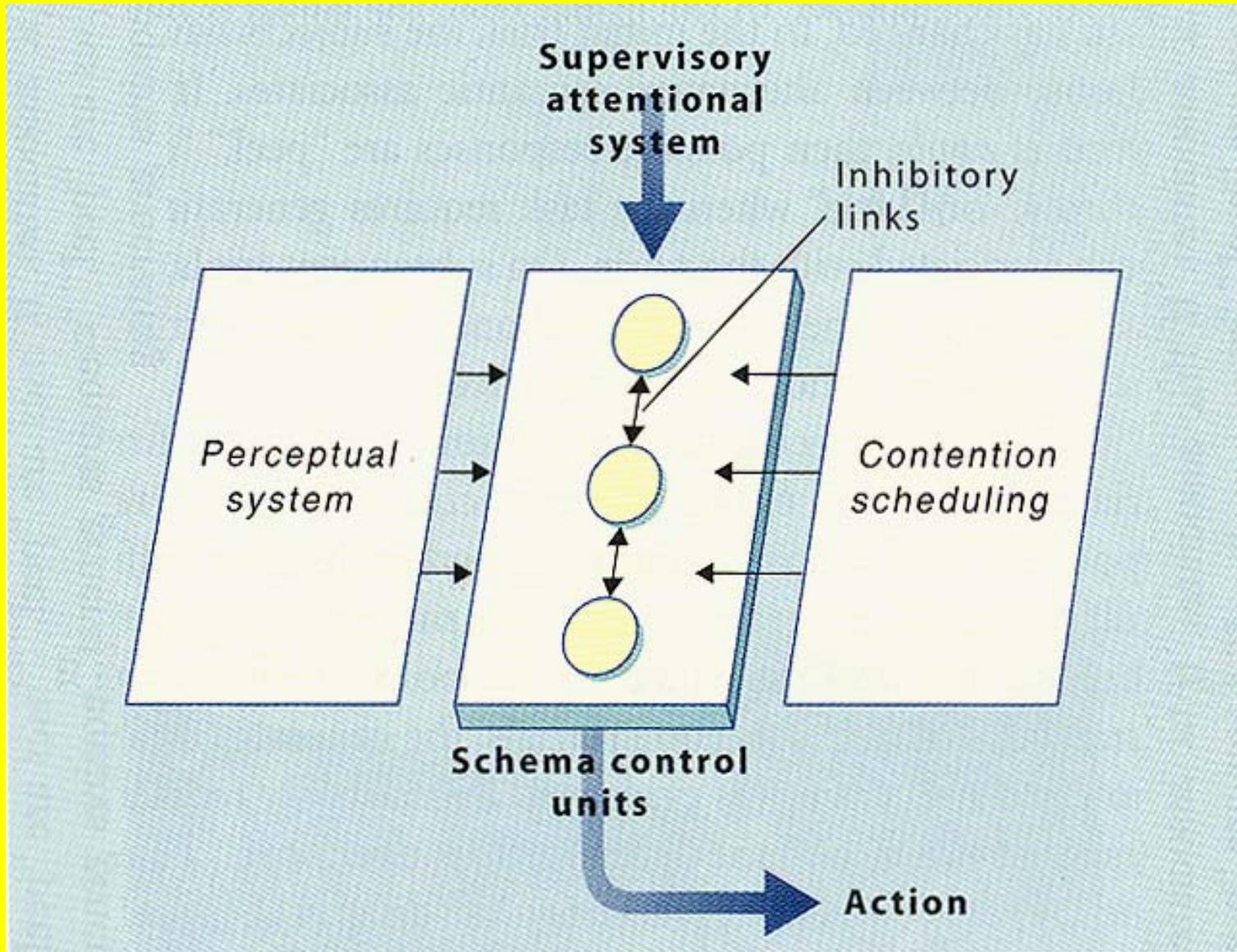


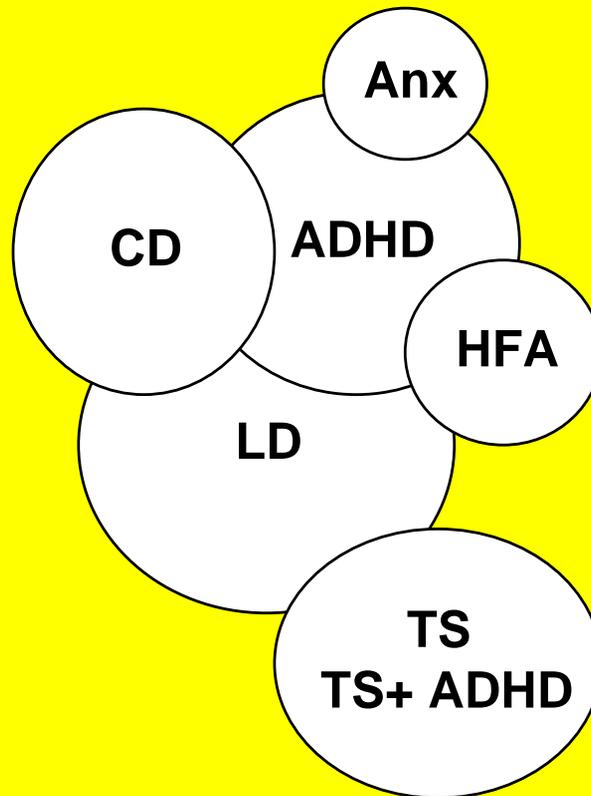
WHAT IS EXECUTIVE FUNCTIONING?

- **Working memory, self-regulation of affect-motivation-arousal, internal speech, behavioural analysis-synthesis (Barkley, 1997)**
- **Set Shifting, Planning, Working memory, Contextual Memory, Inhibition & Fluency (Pennington & Ozonoff, 1996)**
- **Problem representation, planning, motor execution, error detection (Zelazo et al, 1997)**
- **Eslinger: 33 definitions of Executive Functioning**

**EF IS ASSOCIATED WITH FRONTAL LOBES
BUT also INVOLVES THE BASAL GANGLIA**

INHIBITORY CONTROL





**THE ISSUE OF COMORBIDITY:
DEFINING THE SPECIFIC NATURE OF THE DISORDERS**

WHAT ARE THE DEFICITS SPECIFIC FOR

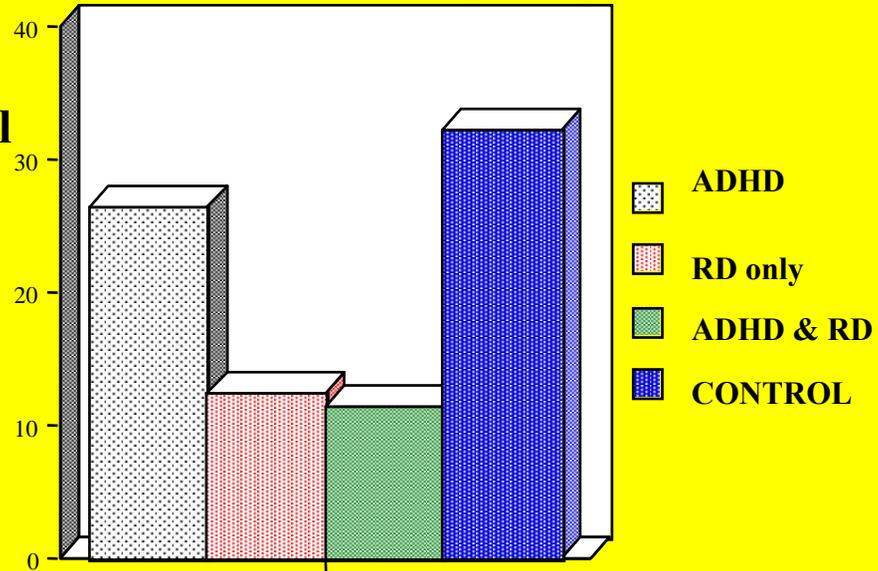
- **ADHD**
- **LEARNING DISABILITY**
- **AGGRESSION?**

The functions:

- **PHONETIC PROCESSING**
- **MOTOR SELECTION**
- **INHIBITION**
- **WORKING MEMORY**
- **PLANNING**
- **Error detection-correction**

ADHD & RD Phonological processing

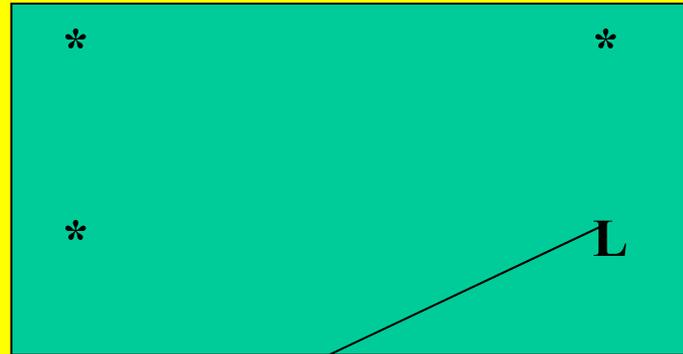
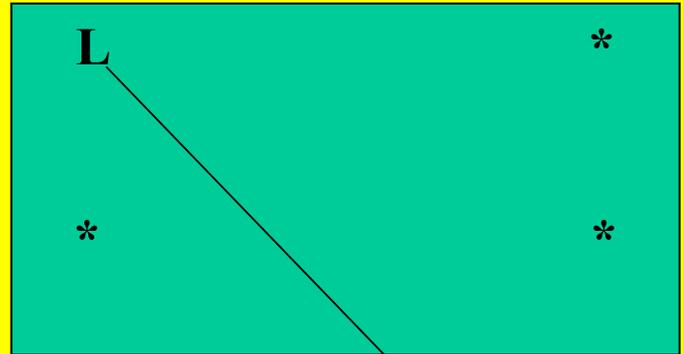
**Phonological
Word score**



Compatible

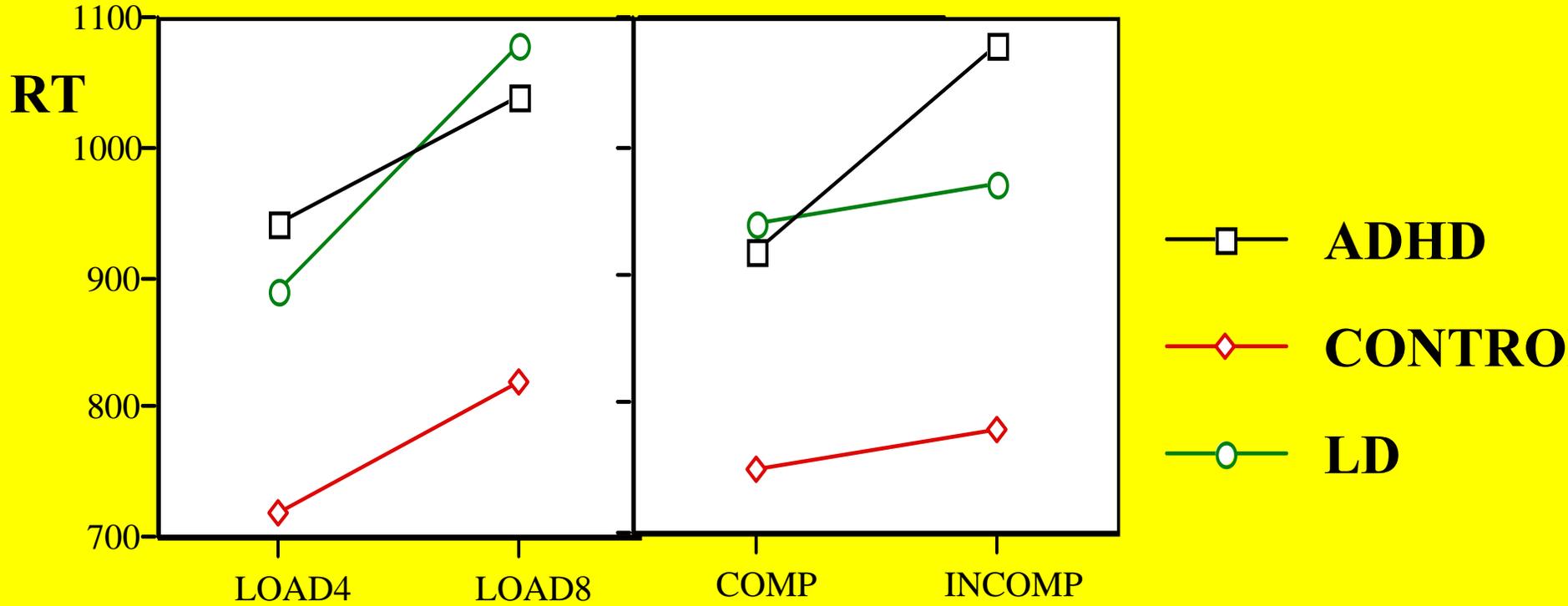


Incompatible



Response button

ADHD DEFICIT OF RESPONSE SELECTION



Stop Task: Measure of Inhibition



Delay

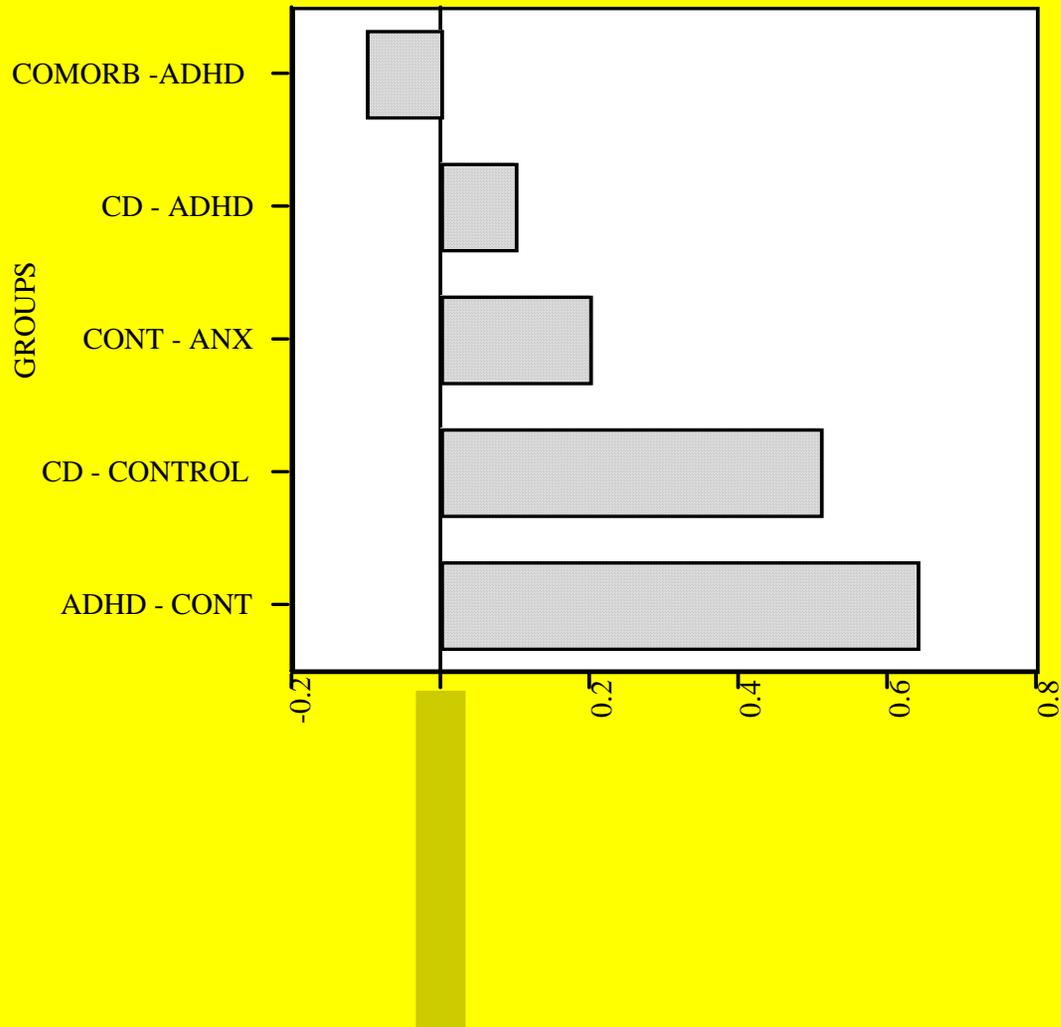


GO

STOP

50%

INHIBITION STOP SIGNAL TASK (SSRT)



Meta-analysis "Stop Task"

Oosterlaan et al (1998)



ADHD-Controls

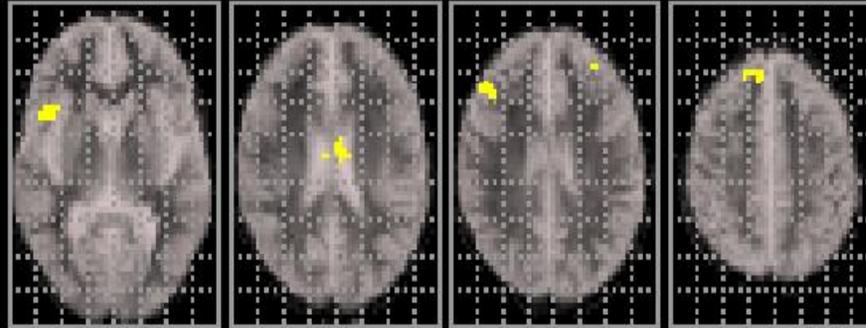
STOP
TASK

+4

+20

+26

+42



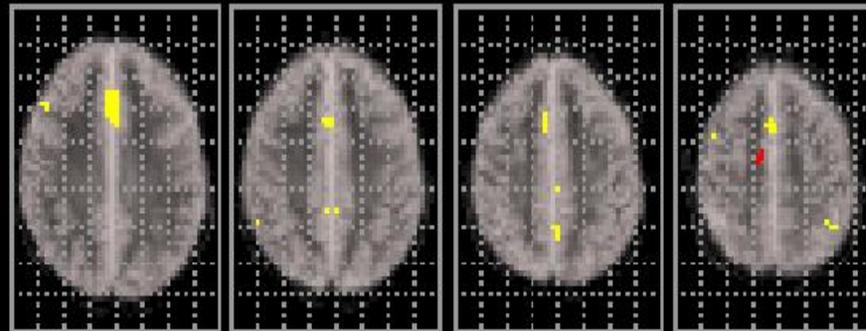
DELAY
TASK

+31

+37

+42

+48



$P < .05$

Stroop: Measure of Cognitive Inhibition in Response Conflict

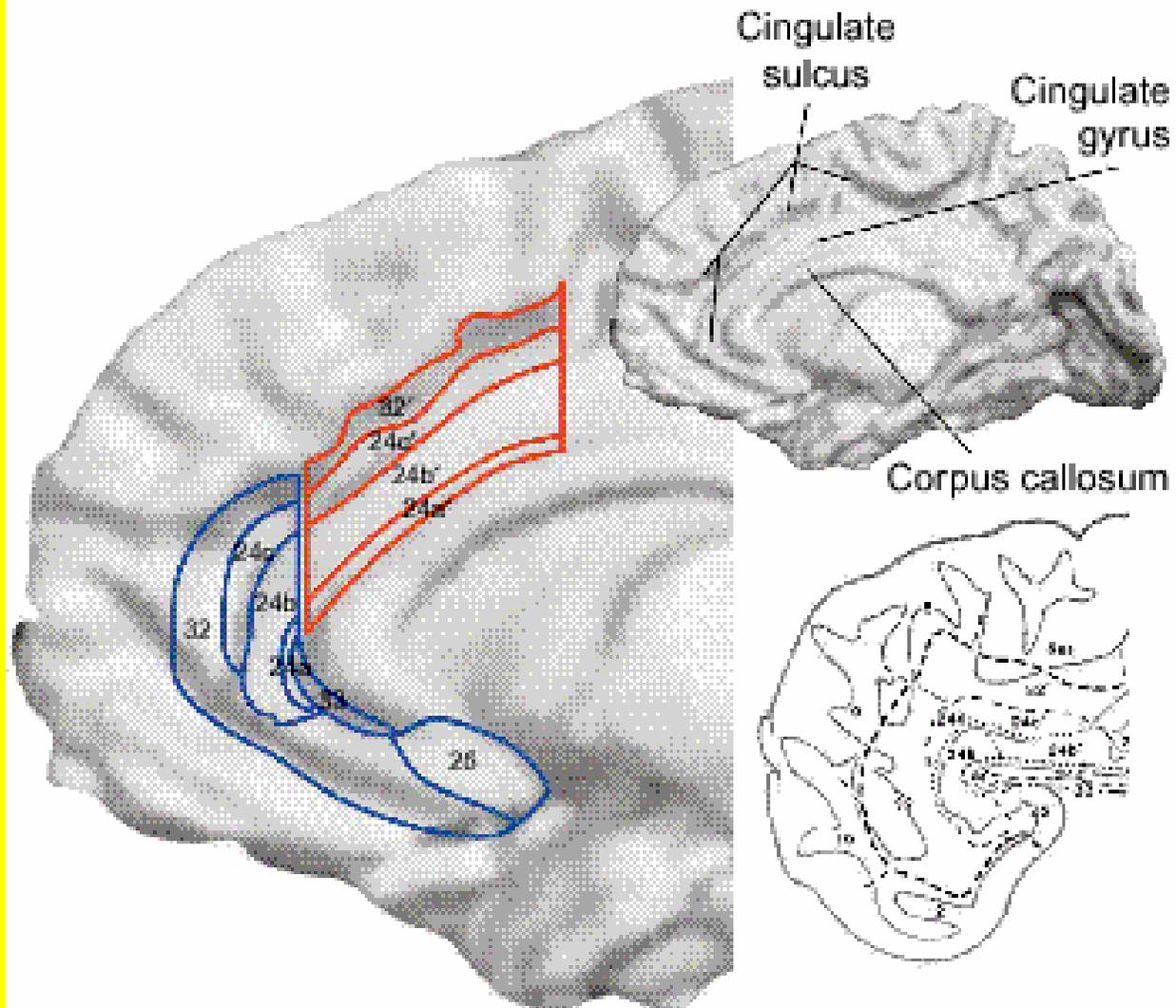
Rosa	Giallo	Verde	Blu
Giallo	Verdi	Blu	Rosa
Verdi	Blu	Rosa	Giallo
Blu	Rosa	Giallo	Verde

Stroop:

Anterior cingulate

Dorsolateral prefrontaal cortex



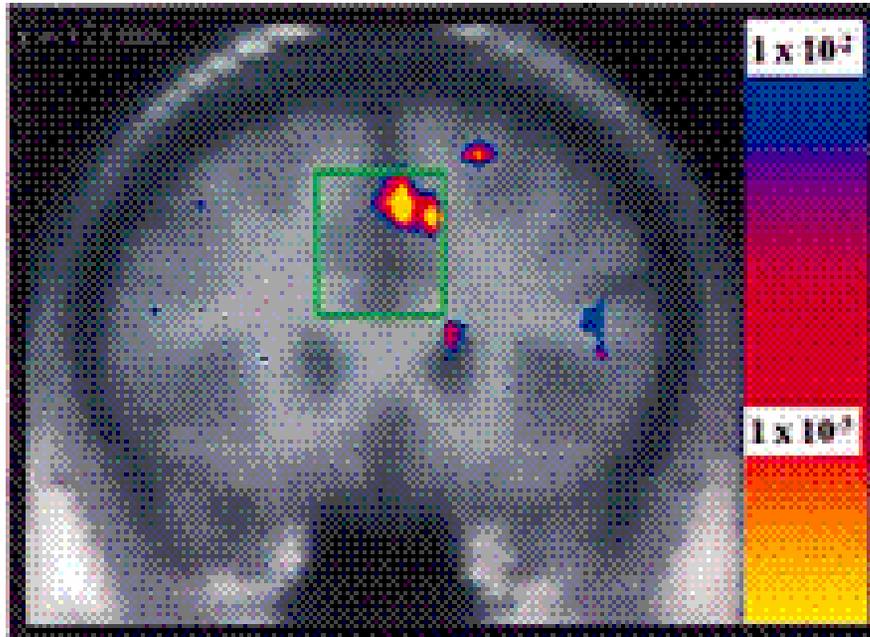


4
4 4 4
4

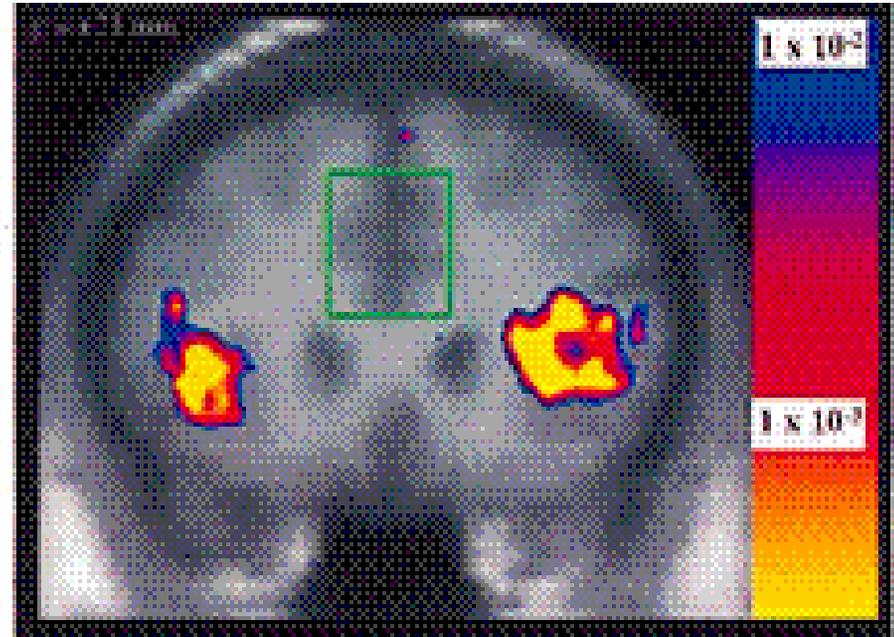
Di Cinque!

Counting Stroop: Adult ADHD

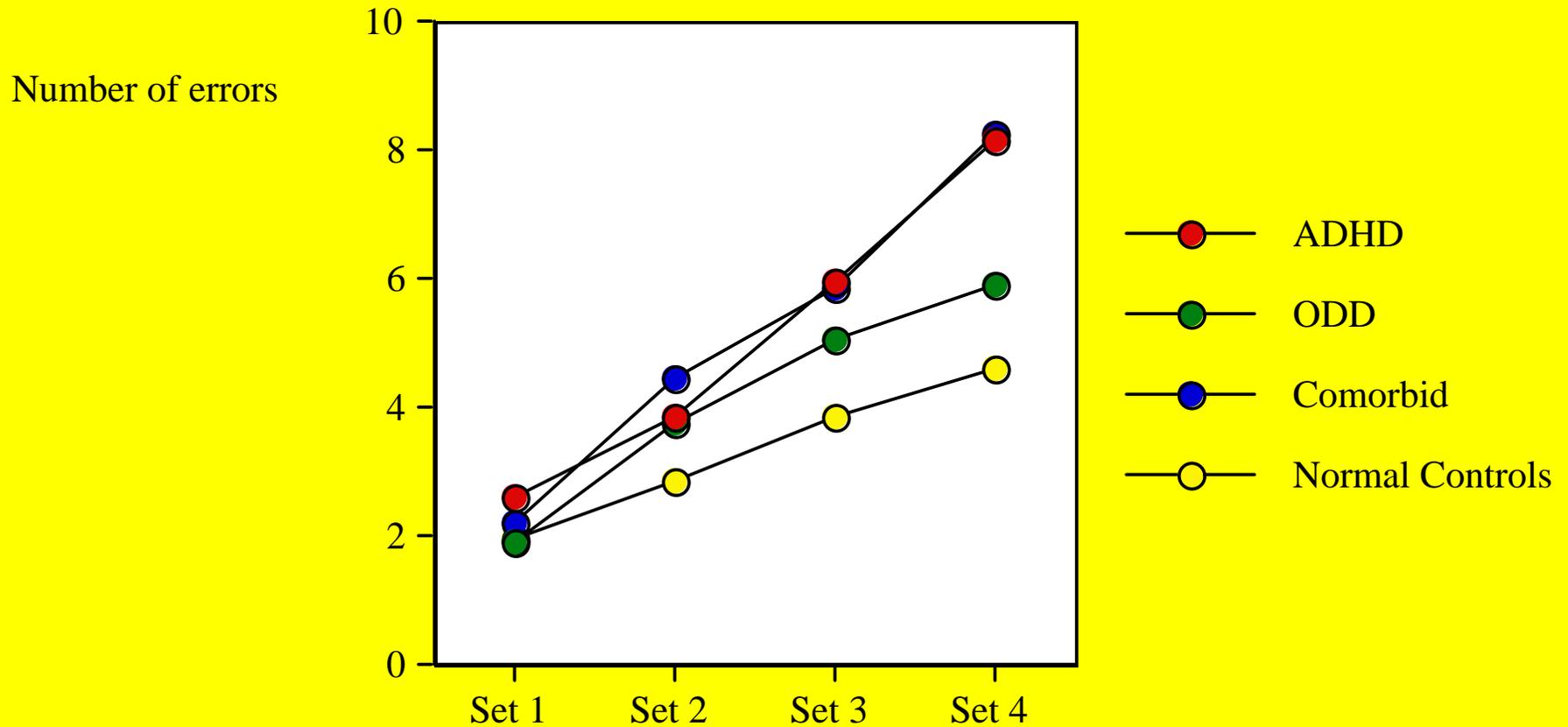
Normal Controls



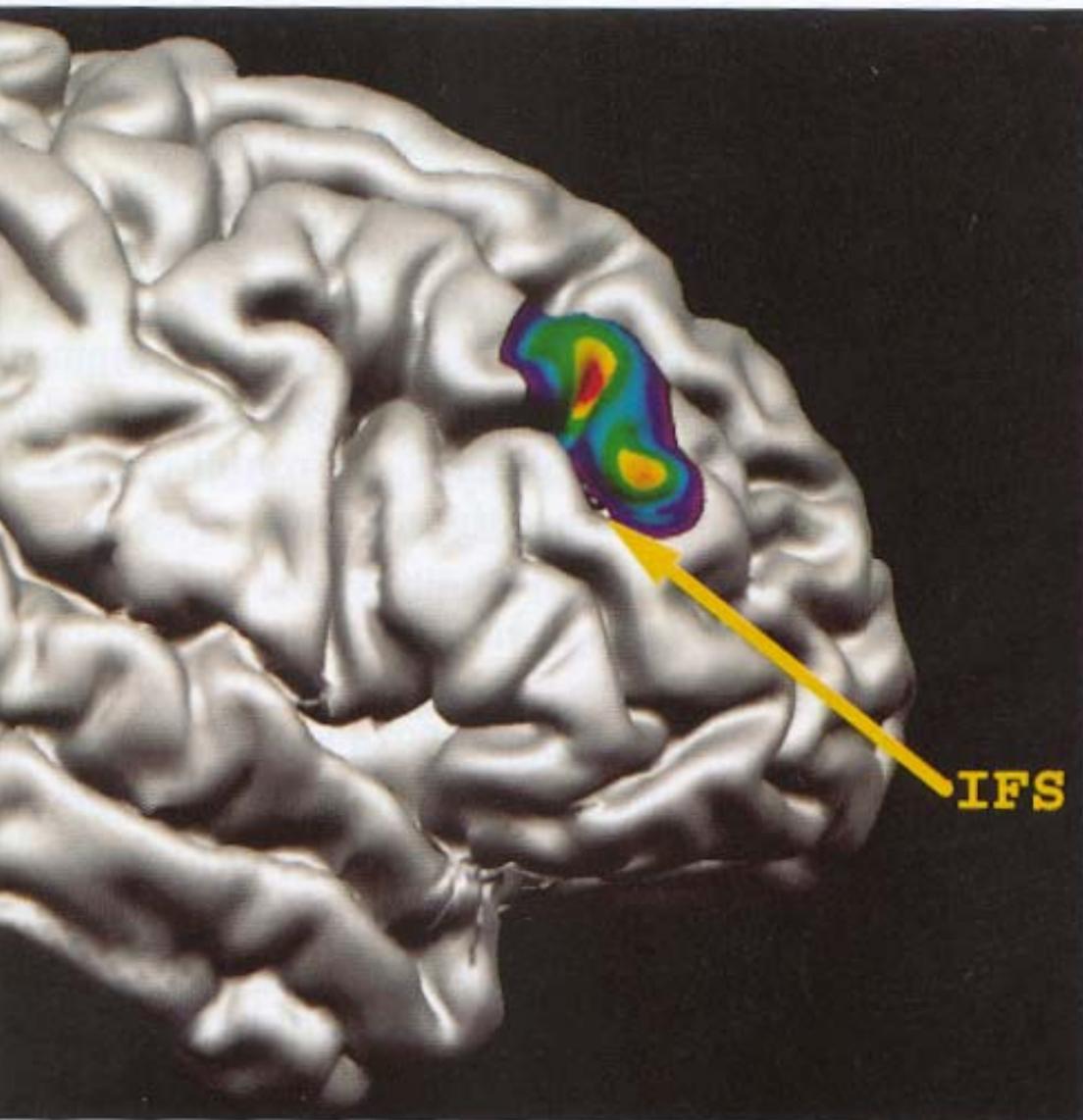
ADHD



Self Ordered Pointing: working memory task



GROUP Effect: AD, CO < NC; AD < OD
Mid-dorsolateral prefrontal cortex



Working Memory:

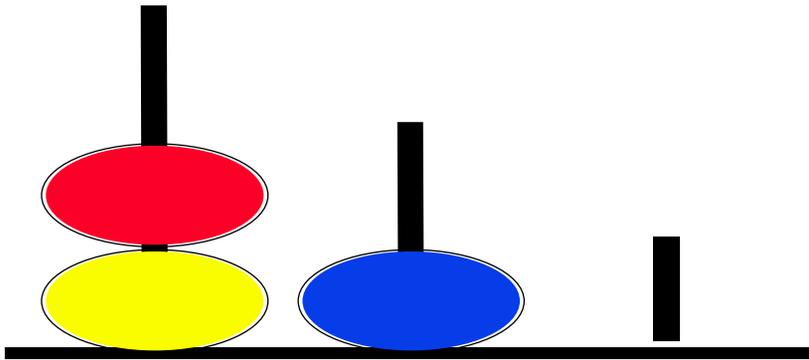
Self-order-Pointing (SOP)

Petrides

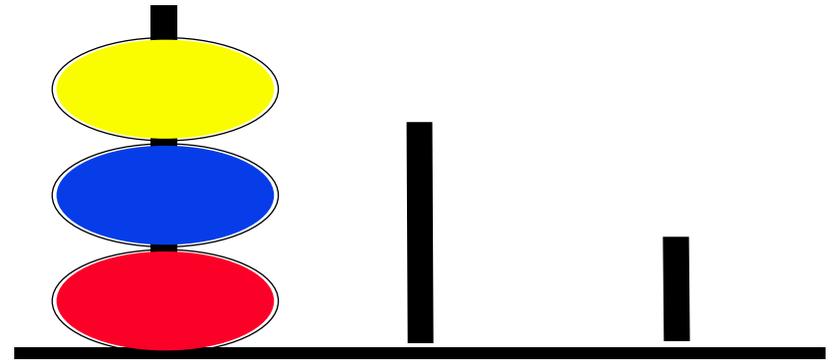
**Middorsolateral prefrontal
cortex (BA 46 and 9/46)**

**Increase in activation above
the Inferior Frontal Sulcus**

Tower of London: Planning



Start position



Goal position in 5 moves

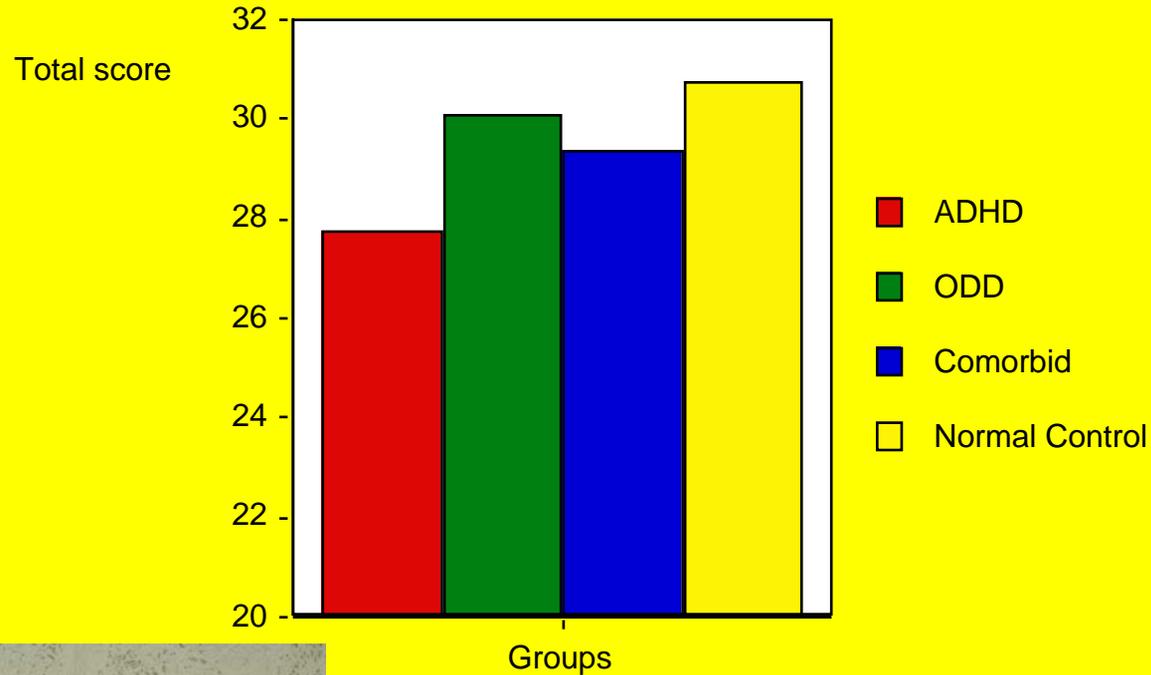
Activation:

Bilaterally dorsolateral prefrontal cortex (BA 9/46);

Frontopolar (BA 10)

Bilateral occipito-parietal lobes

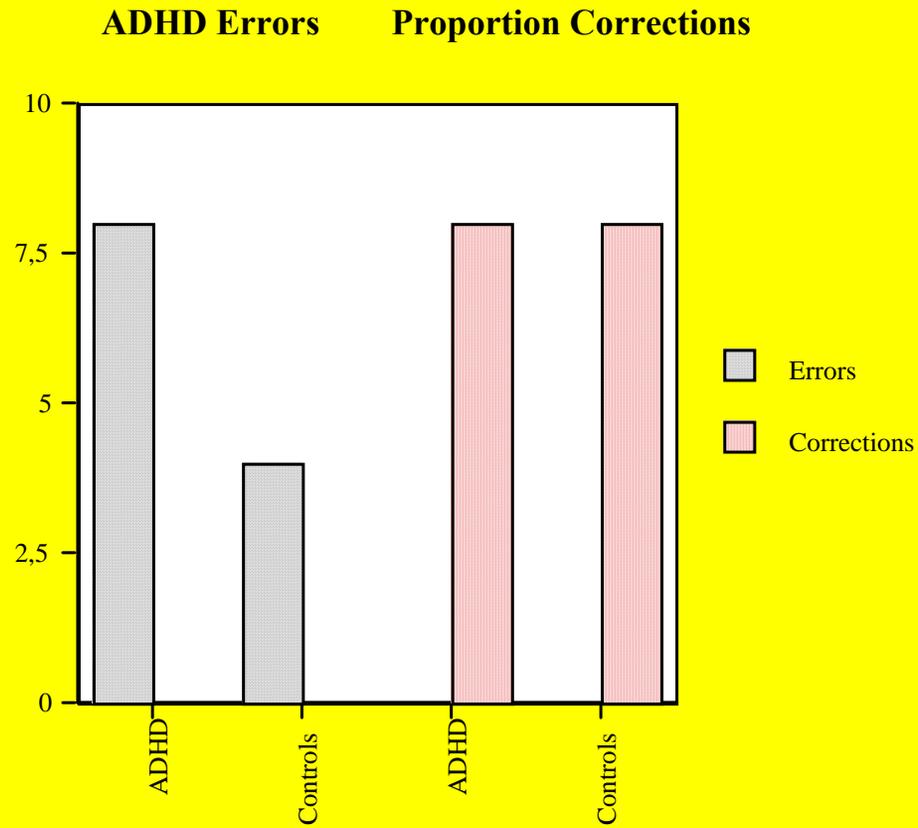
Tower of London: Total score



GROUP EFFECT: ADHD < Controls,
ODD



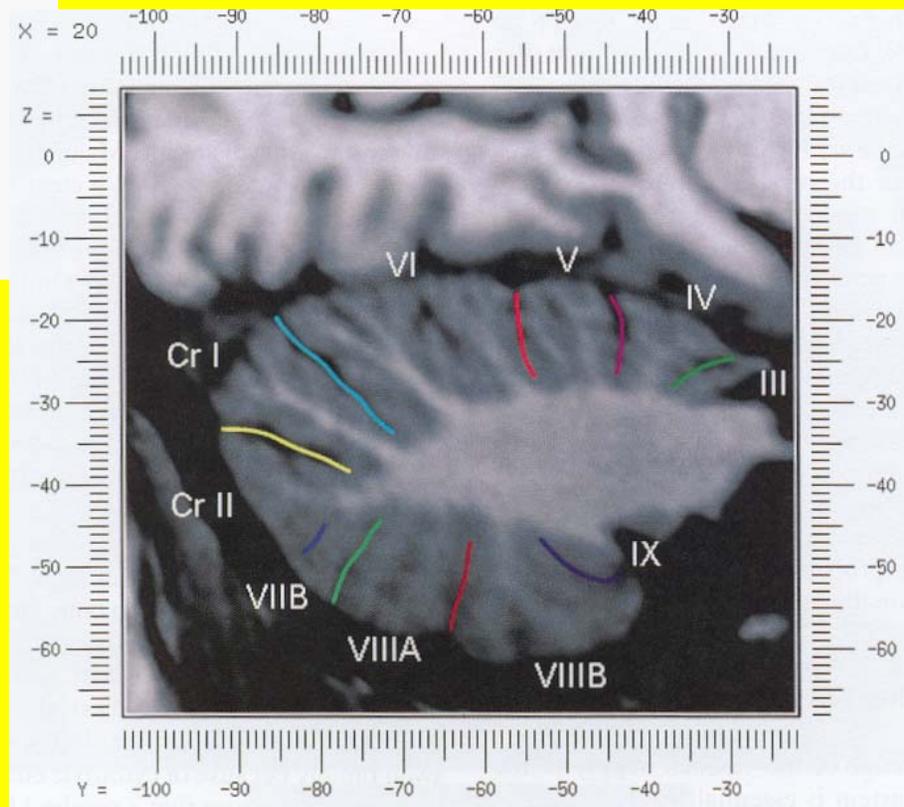
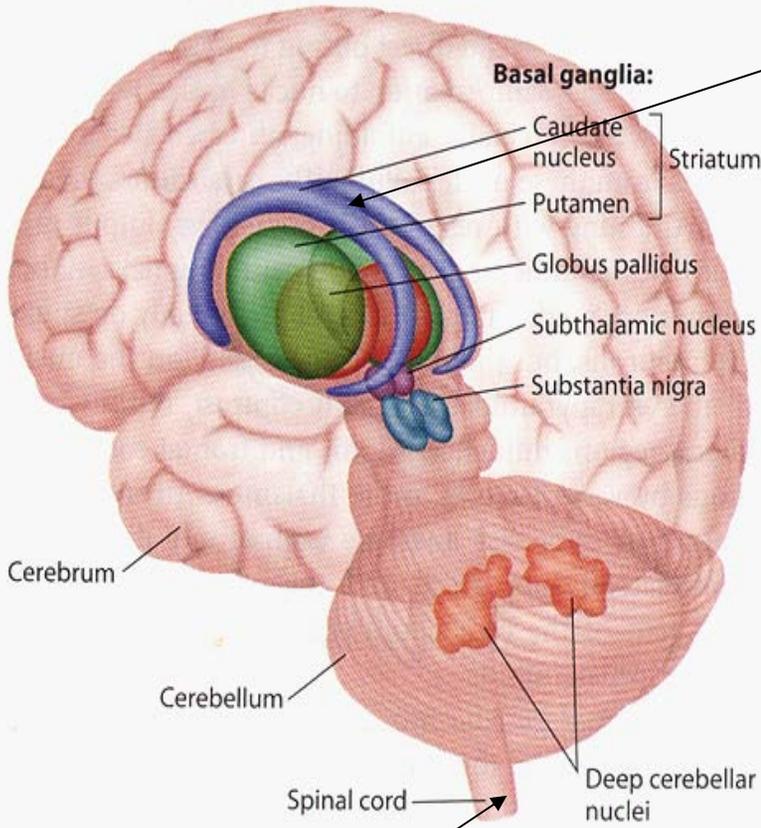
Self-monitoring: Error correction



Smaller left caudate
(Baumgardner; Castellanos, Filipek; Gied; Hynd)

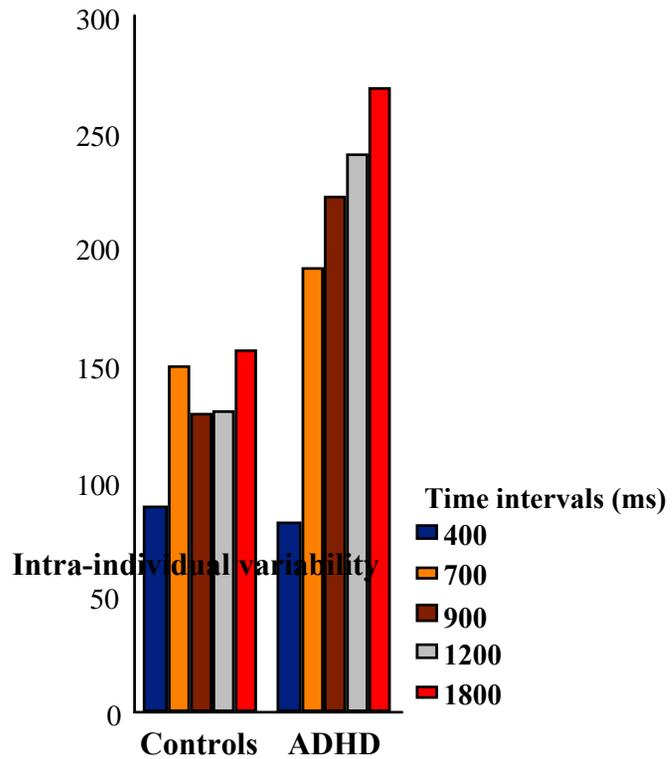
Smaller left caudate, higher Externalizing

In a “go no-go” caudate volume negatively correlated with accuracy for ADHD subjects only.

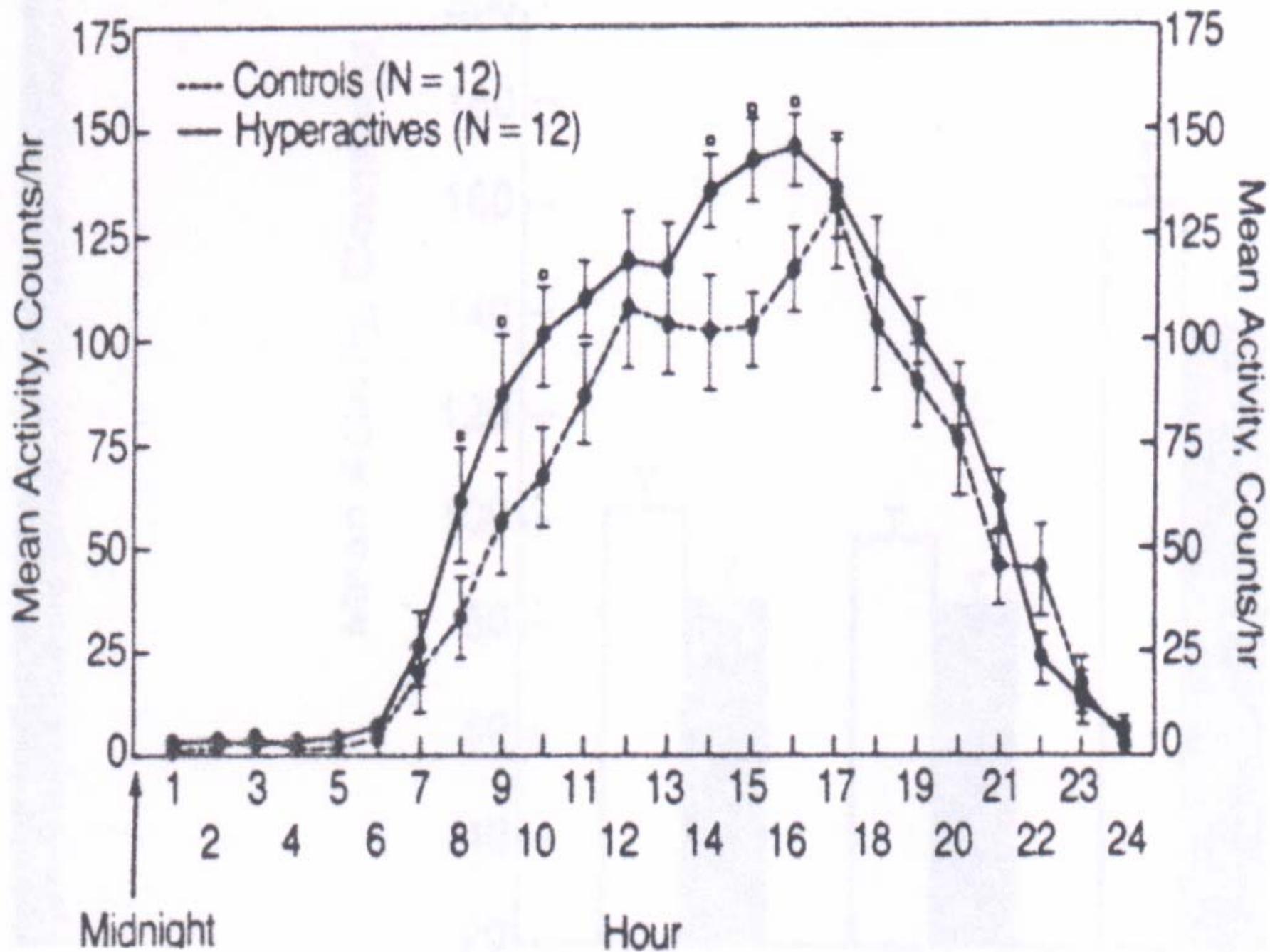


Volume posterior inferior cerebellar vermis lobules VIII-X: smaller in ADHD
(Berquin et al)

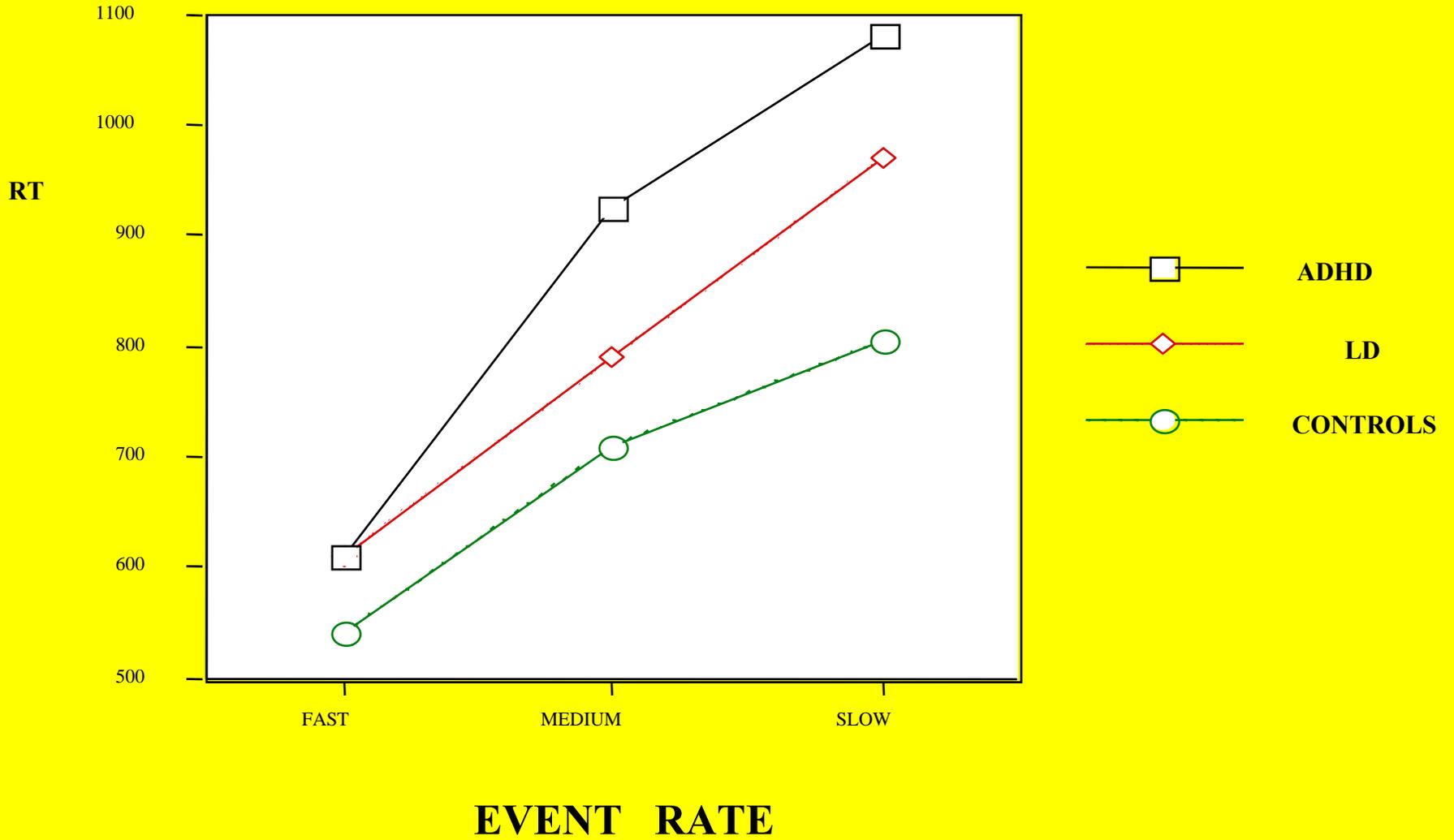
ADHD A DEFICIT IN MOTOR TIMING?

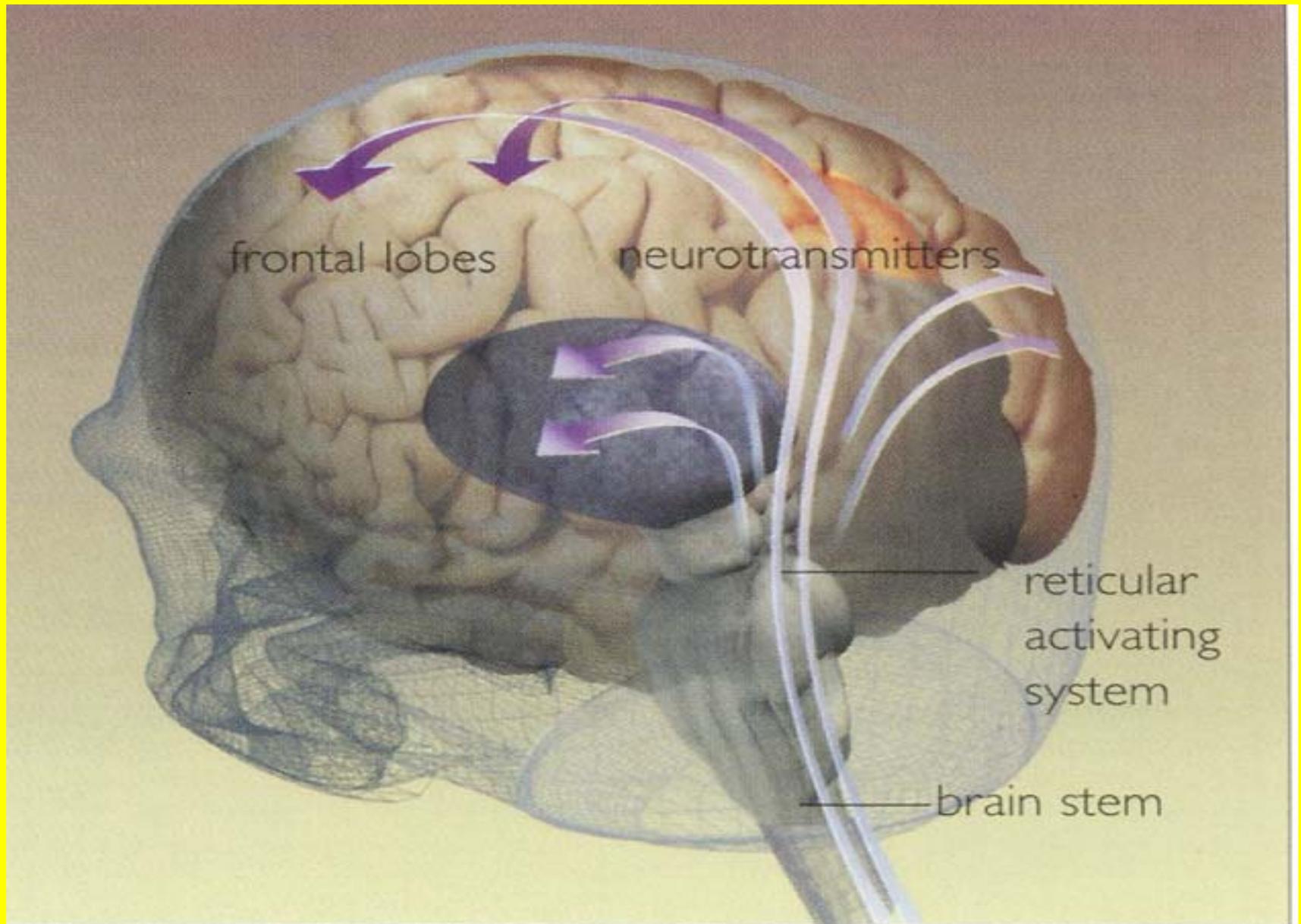






ADHD: A DEFICIT IN ACTIVATION?

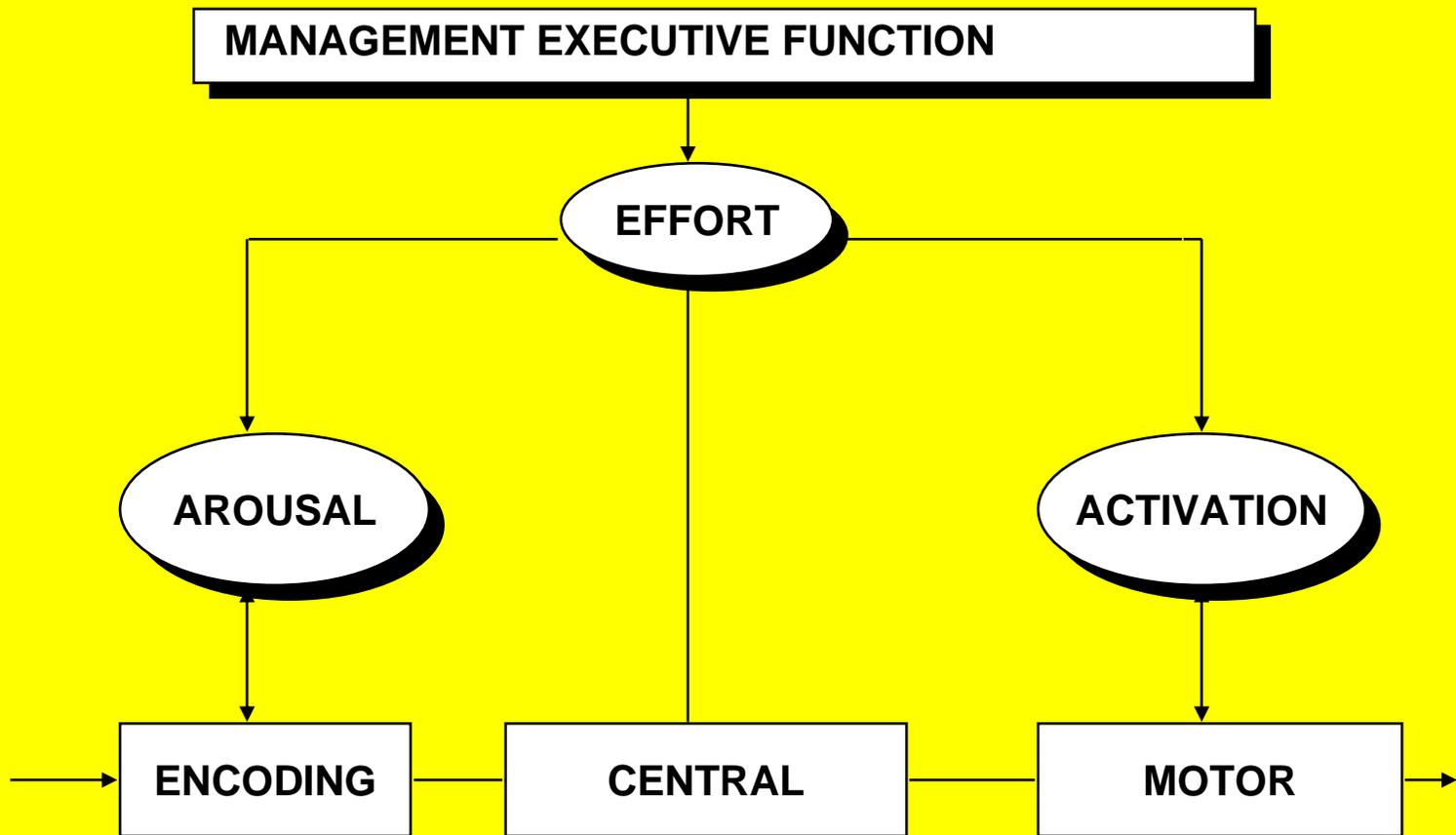




AROUSAL

Summary Functional Deficits

- **PHONETIC PROCESSING** ✓
- **MOTOR SELECTION** Ø
- **INHIBITION** Ø
- **WORKING MEMORY** Ø
- **PLANNING** Ø
- **Error detection-correction** ✓



THE COGNITIVE -ENERGETIC MODEL (SANDERS, 1983)