

Sophia Children's Hospital

# The effects of acquired brain injury on cognition and behaviour.

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# **Acquired brain injury**

An acquired brain injury is defined as:

Damage to the brain, which occurs after birth and is not related to a congenital or a degenerative disease. These impairments may be temporary or permanent and cause partial or functional disability or psychosocial maladjustment.

- World Health Organization (Geneva 1996)



# Brain in development: children are no adults.

Developmental vs mature functions :

Removal of the left hemisphere may lead to aphasia in adults but in children language functions could be (partly) spared. Plasticity of the brain.

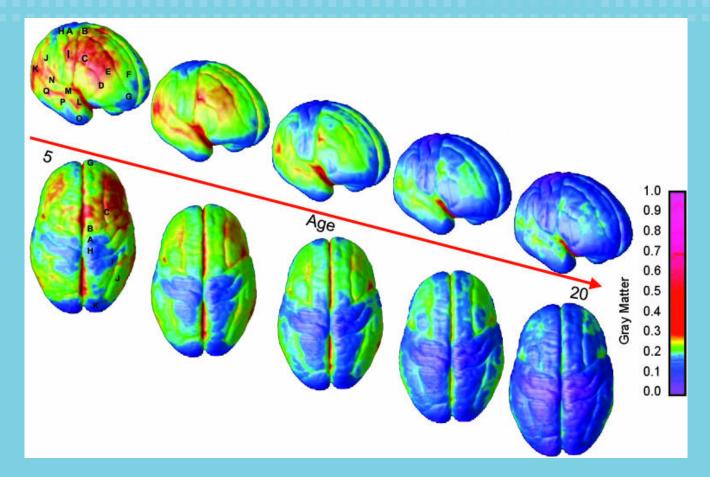
Diffuse vs discrete consequences:

consequences are often generalised and concern more basal neuropsychological functions such as attention, motor functions, and learning ability.

 Developmental vs acute acquired disorder: growing into deficit



# Phenomenon of "Growing into deficit"



Cogtay, Giedd, Lusk et al (2004)



# Neuropsychological problems due to

- Location of the lesion?.
  - Syndrome or diseases?
  - Medical treatment?

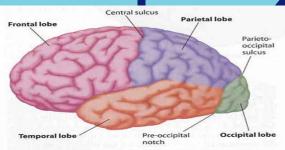


## Location of the lesion

Behaviour Speech/Language Motor Working memory

Recognition of information Reading/spelling/ arithmetics Drawing

#### Integration Short-term memory



Inhibition Impulsivity Planning Social cognition Figure 3.9 Four lobes of the cerebral cortex, in lateral view of the left hemisphere. See text for details.

Receptive language Long-term memory Visual-spatial abilities Emotions Auditive functions

**Visual functions** 



#### **Executive functions problems after frontal lobe lesion**



# Neuropsychological profiles by diseases

	Epilepsy	Brain tumours	Hydrocepha Ius	Stroke	Meningitis /Septic Shock
Intelligence		+	+		
Attention	+	+	+	+	+
Speed	+	+	+	+	+
Memory	+	+		+	+
Visual- spatial		+	+		+
Speech/ language		+		+	
Executive		+			+



# **Epilepsy**

## Cognitive problems

- Attention disorders
- Speed problems
- Memory deficits

#### **Predictors**

- Cryptogenic epilepsy
- Seizure control
- Anti-Epileptic Drugs
- Parental stress
- Neurological signs

#### Behaviour problems

- ADHD
- Depressive Disorder
- Anxiety
- Social problems

Oostrom et al, Brain 2003

Salpekar et al, Ped Neur 2007



# **Stroop Colour-Word test**

BLUE		YELLOW	ORANGE
GREEN	BLUE	PURPLE	RED
PURPLE	YELLOW	RED	BLUE
ORANGE	BLUE	YELLOW	RED
RED	GREEN	ORANGE	BLUE
PURPLE	YELLOW	BLUE	ORANGE



# **Brain tumours**

#### Cognitive problems

- Attention
- Speed
- Subnormal IQ
- Memory
- Executive functioning
- Visual-spatial functions
- Speech/language

#### **Predictors**

- Hydrocephalus
- Age
- Radiotherapy < 7jr
- CMS

Aarsen *et al,* Neurology 2004 Aarsen *et al,* JCO 2009

#### Behaviour problems

- ADHD
- Emotional lability
- Anxiety
- Social problems
- Introverted
- Infantile behaviour
- Binge-eating
- Obsessive behaviour

#### **Predictors**

- Age at diagnosis
- Location of the tumour
- Cancer recurrence

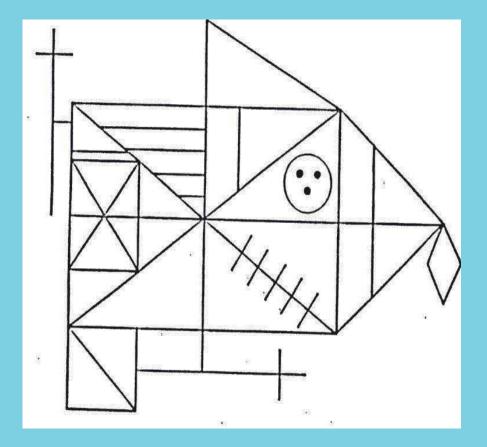
Aarsen et al, Cancer 2006

Jennekens-Schinkel A, Neuropsychology of

neurologic disease in childhood, 2008



# **Right Parietal Tumor**





# **Hydrocephalus**

### Cognitive problems

- Attention
- Speed
- Visual-spatial functions
- Lower performance IQ

#### **Predictors**

- Epilepsy
- Arnold Chiari Malformations

#### **Behaviour Problems**

- ADHD
- Autism
- Conduct problems
- Anxiety

#### Predictors

- Epilepsy
- Mental Retardation

Lindquist et al, Eur Child Adolesc Psychiatry 2006

Vinck et al, JNNP 2006



# **Cookie Test**



# **Stroke**

### Cognitive problems

- Speed
- Attention
- Memory
- Visual-spatial
- Language

#### **Predictors**

- Epilepsy -> lower IQ
- Age
- Stroke in right hemisphere

#### Behavioural problems

- ADHD
- Anxiety
- Emotional lability
- Sleeping disorders
- Fatigue
- Social problems

#### **Predictors**

- Cortical and subcortical stroke

Steinlin et al, Eur J Pediatrics 2004

Steinlin *et al*, Eur J Pediatrics 2004 Pavlovic *et al*, Neuropediatrics 2006 Hajek *et al*, J Child Neurol 2014



# **Continuous Performance Test**

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# **Meningitis or Septic Shock**

#### Cognitive problems

- Attention
- Speed
- Memory
- Executive functioning
- Visual-spatial functioning

#### **Predictors**

- Neurological mild signs
- Age

Koomen *et al*, Dev Med Child Neur, 2004 Vermunt *et al*, Br. J of Clin Psychol, 2009

#### Behaviour problems

 Inattention, hyperactivity or impulsivity

Berg *et al*, Eur J Pediatrics, 2002 Vermunt *et al*, Br J of Clin Psychol 2007



# **Neuropsychology and medical treatment:** Girl with epilepsy and arithmetics problems

Pre-topiramate

After 3 months of Topiramate

Aarsen, Neurology 2006.



#### Late cognitive effects of radiotherapy on the brain

- Depends on dose, location or type radiation
- Speed problems
- Attention disorders
- Memory disorders
- Lower IQ
- Problems with arithmetics.

# Cognitive effects of chemotherapy in children with cancer, juvenile MS, neuro-SLE, Pompe disease.



- Depends on kind of chemotherapy, dose and
- Attention disorders
- Memory problems
- Executive functions problem (Predictor Age)
- Visuomotor integration.



# **Take Home Message**

- Often problems with basal functions like speed and attention.
- Growing into deficit
- Age is an important predictor