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# The Neuroscience of Related Trauma and Evidence-Based Intervention


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# The Foundations of Prosperity and Sustainability Begin in Early Childhood

The healthy development of young children provides a strong **foundation for healthy and competent adulthood**, responsible citizenship, economic productivity, strong communities, and a just and fair society.

# Rethinking social inequality

## A developmental perspective

The conventional measures of family disadvantage are number of parents and family income.

Evidence from developmental psychology and neuroscience suggests that these measures are very crude proxies for the real determinants of child outcomes.

The major determinant of child disadvantage is the quality of the nurturing environment rather than just the financial resources available or the presence or absence of parents

Heckman 2012

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# UNICEF ranking of economic, health and educational well-being of children

Average Rank

Top Third

Bottom Third

| | | Dimension 1 | Dimension 2 | Dimension 3 | Dimension 4 | Dimension 5 | Dimension 6 |
|---|---|---|---|---|---|---|---|
| **Dimensions of child well-being** | Average ranking position (for all 6 dimensions) | Material well-being | Health and safety | Educational well-being | Family and peer relationships | Behaviours and risks | Subjective well-being |
| Netherlands | 4.2 | 10 | 2 | 6 | 3 | 3 | 1 |
| Sweden | 5.0 | 1 | 1 | 5 | 15 | 1 | 7 |
| Denmark | 7.2 | 4 | 4 | 8 | 9 | 6 | 12 |
| Finland | 7.5 | 3 | 3 | 4 | 17 | 7 | 11 |
| Spain | 8.0 | 12 | 6 | 15 | 8 | 5 | 2 |
| Switzerland | 8.3 | 5 | 9 | 14 | 4 | 12 | 6 |
| Norway | 8.7 | 2 | 8 | 11 | 10 | 13 | 8 |
| Italy | 10.0 | 14 | 5 | 20 | 1 | 10 | 10 |
| Ireland | 10.2 | 19 | 19 | 7 | 7 | 4 | 5 |
| Belgium | 10.7 | 7 | 16 | 1 | 5 | 19 | 16 |
| Germany | 11.2 | 13 | 11 | 10 | 13 | 11 | 9 |
| Canada | 11.8 | 6 | 13 | 2 | 18 | 17 | 15 |
| Greece | 11.8 | 15 | 18 | 16 | 11 | 8 | 3 |
| Poland | 12.3 | 21 | 15 | 3 | 14 | 2 | 19 |
| Czech Republic | 12.5 | 11 | 10 | 9 | 19 | 9 | 17 |
| France | 13.0 | 9 | 7 | 18 | 12 | 14 | 18 |
| Portugal | 13.7 | 16 | 14 | 21 | 2 | 15 | 14 |
| Austria | 13.8 | 8 | 20 | 19 | 16 | 16 | 4 |
| Hungary | 14.5 | 20 | 17 | 13 | 6 | 18 | 13 |
| United States | 18.0 | 17 | 21 | 12 | 20 | 20 | – |
| United Kingdom | 18.2 | 18 | 12 | 17 | 21 | 21 | 20 |

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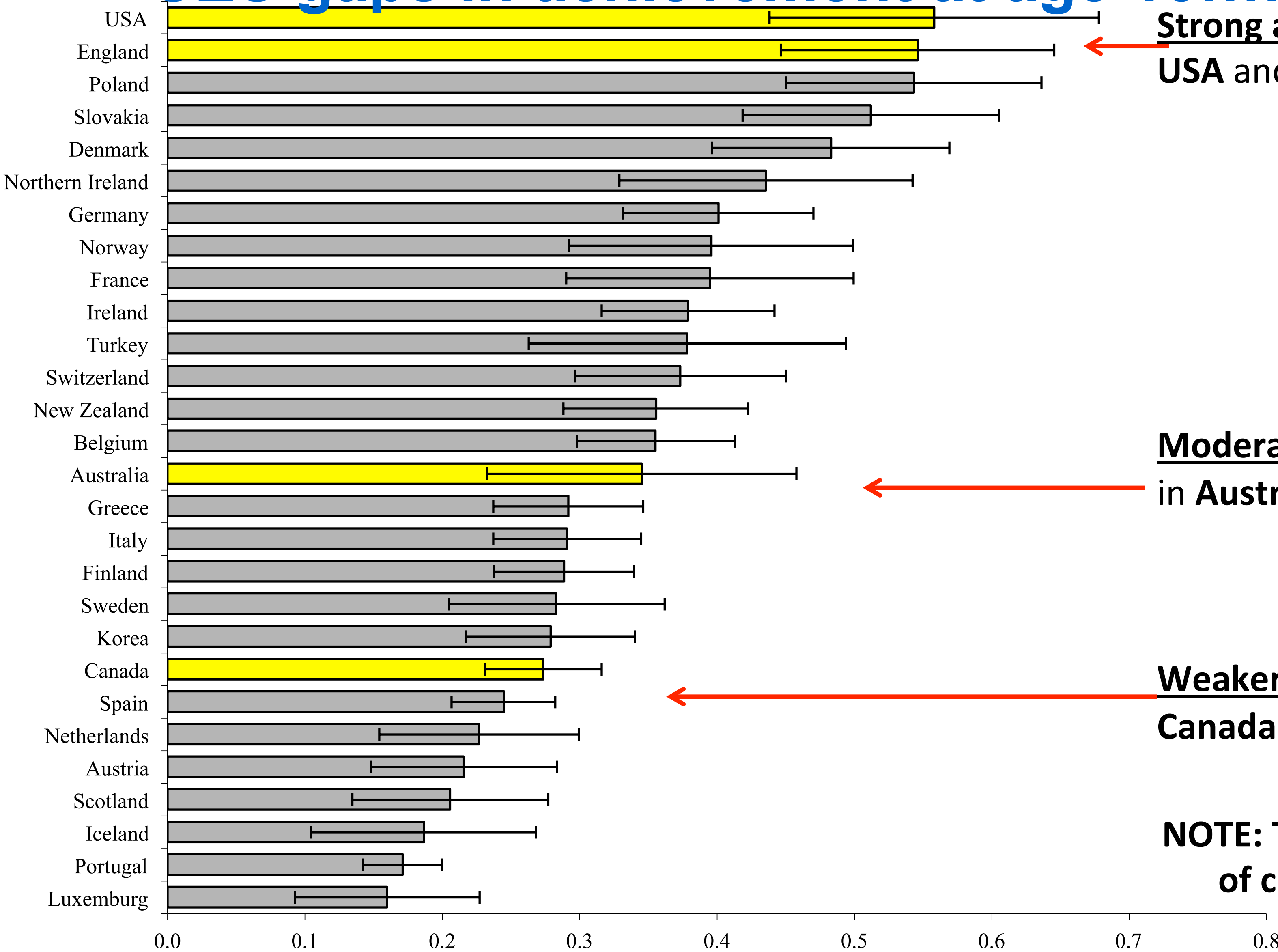
# SES gaps in achievement at age 15……..




**Strong association** in **USA** and **England**

**Moderate association** in **Australia**

**Weaker association** in **Canada**

**NOTE: This ranking of countries**

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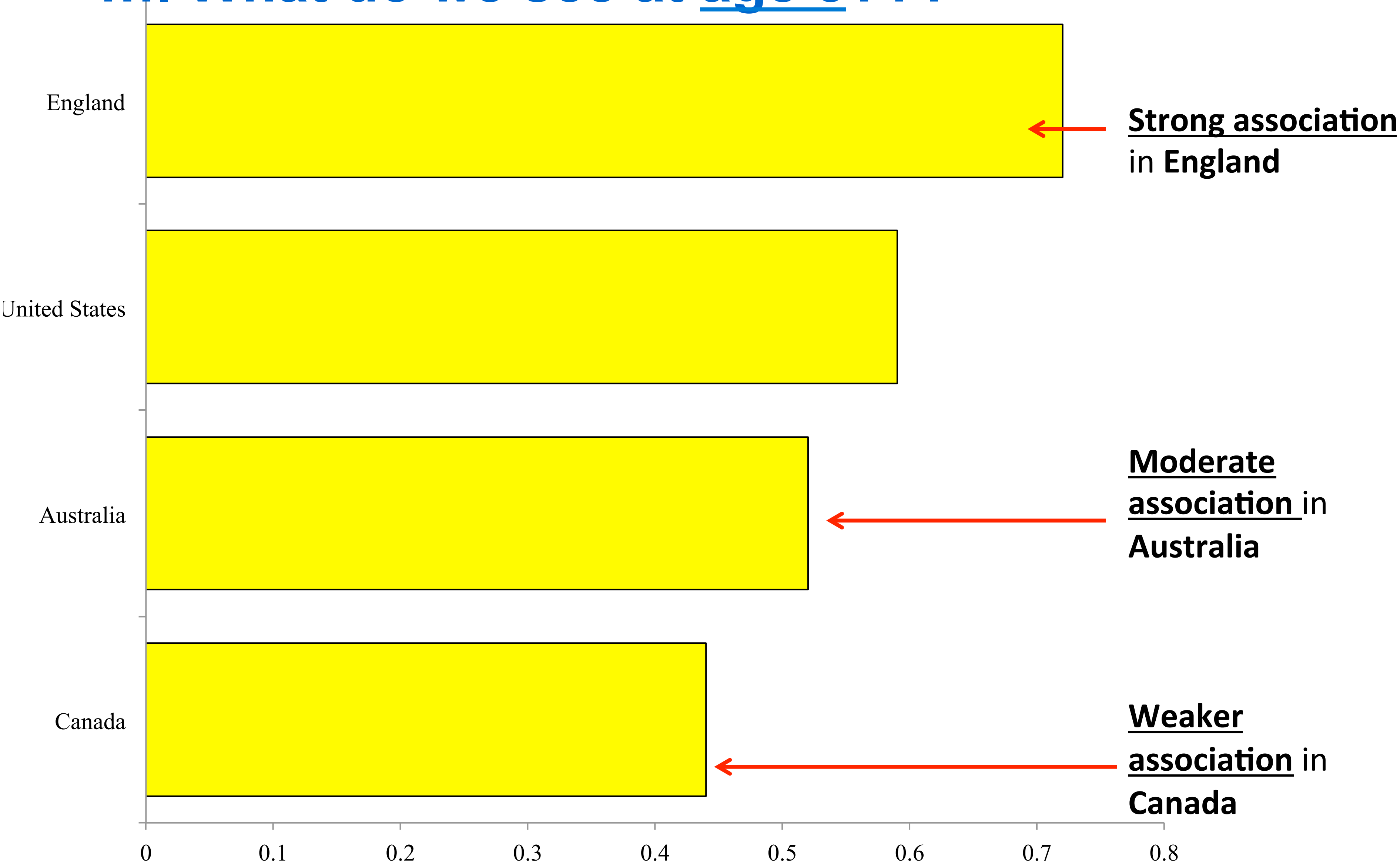
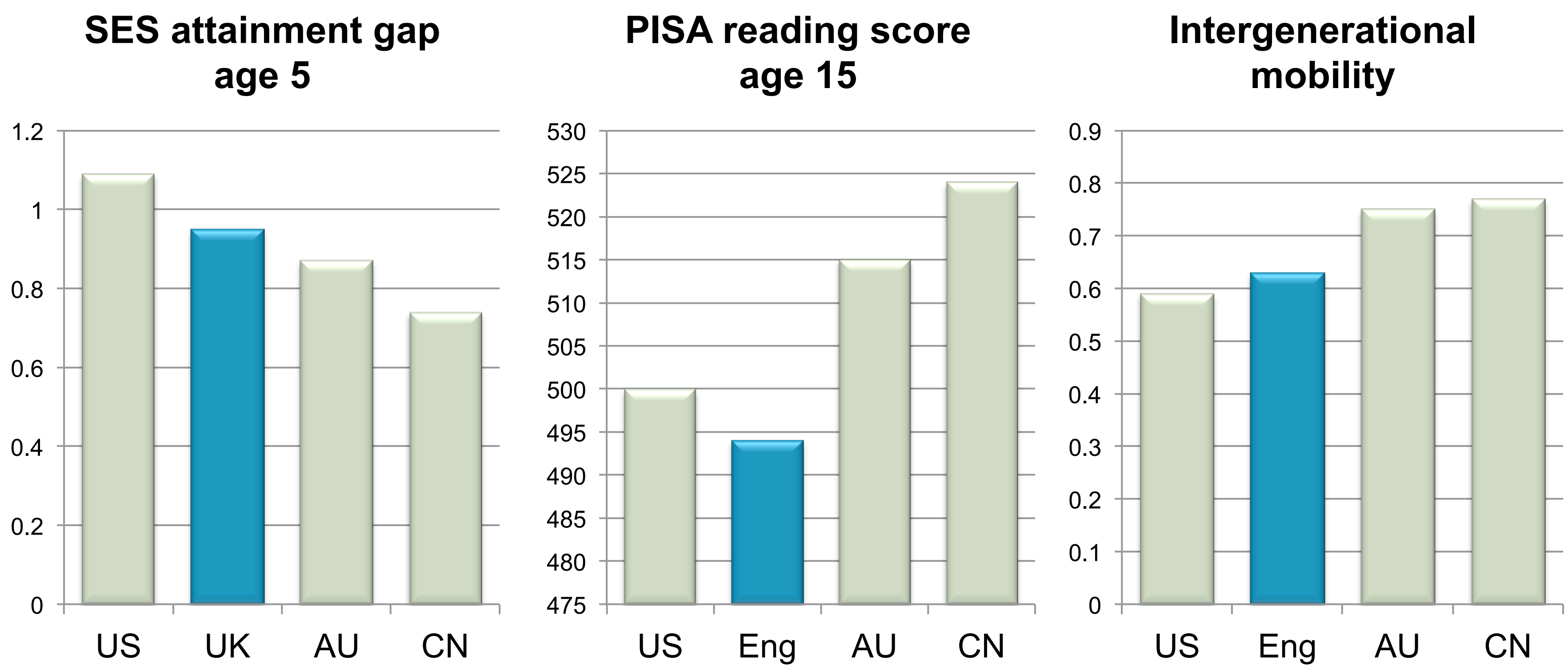
# …. What do we see at age 5???



# An international perspective

- Australia and Canada have lower inequality in early childhood outcomes than the UK or the US alongside higher academic achievement and greater social mobility into adulthood.




Source: Bradbury et al (2012); Jerrim (2012)

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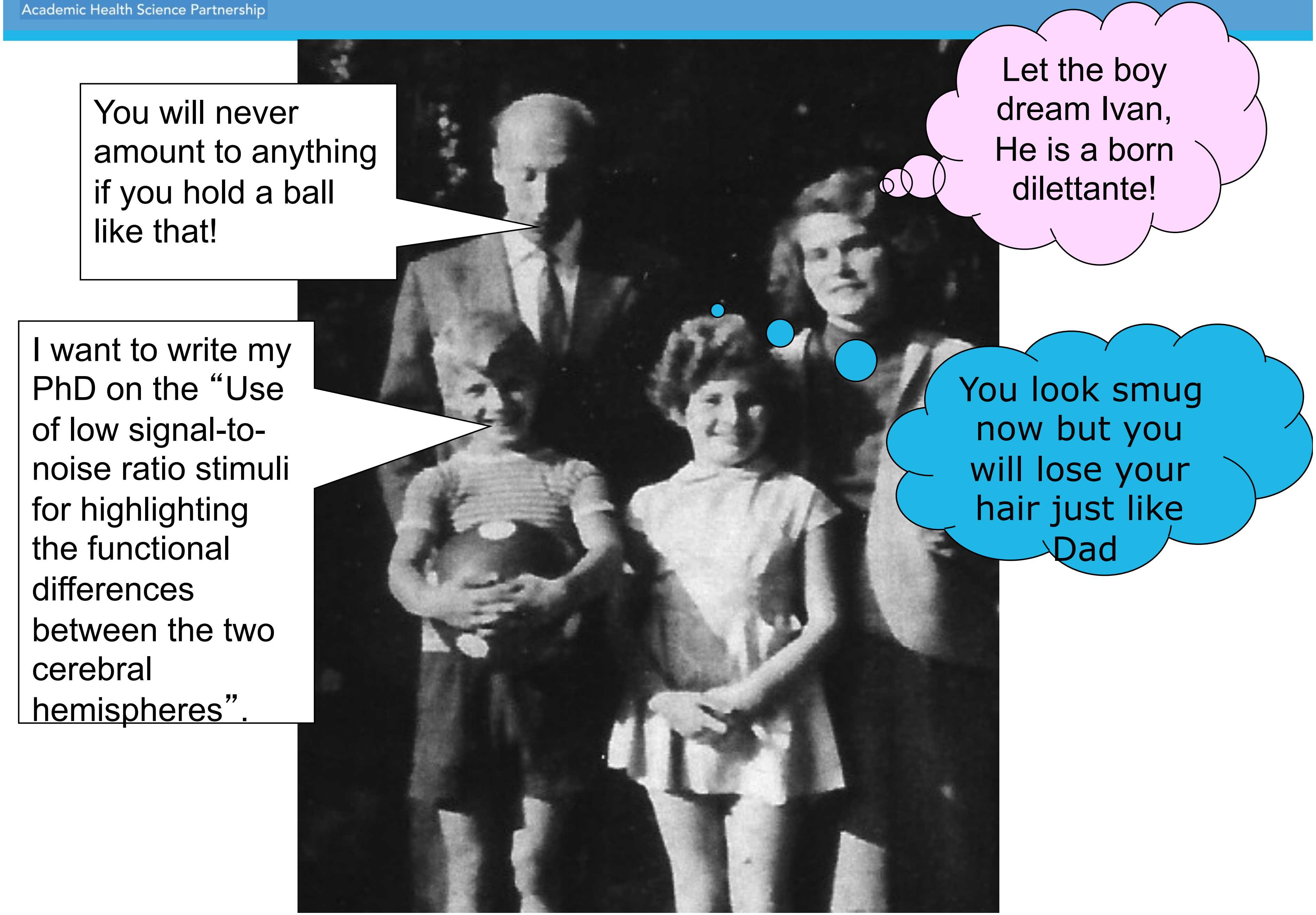
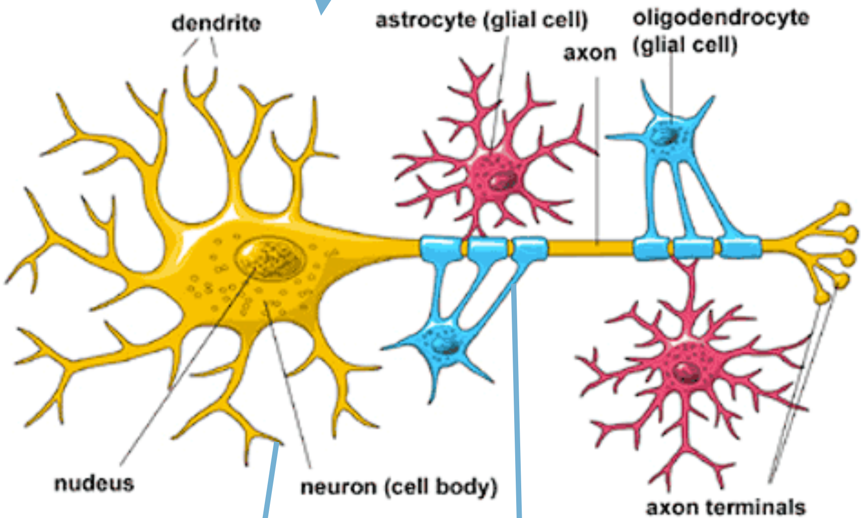
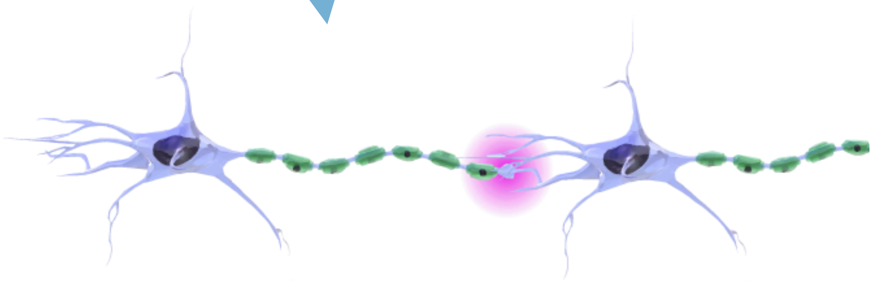
# A Few Core Concepts of Brain Development


You will never amount to anything if you hold a ball like that!
I want to write my PhD on the “Use of low signal-to-noise ratio stimuli for highlighting the functional differences between the two cerebral hemispheres”.
Let the boy dream Ivan, He is a born dilettante!
You look smug now but you will lose your hair just like Dad

# Structure or function?



**Grey or white matter**

http://outreach.mcb.harvard.edu/animations/actionpotential.swf

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# Brain development

- **Proliferation** (rapid **growth** of brain matter and the formation of new connections within the brain)

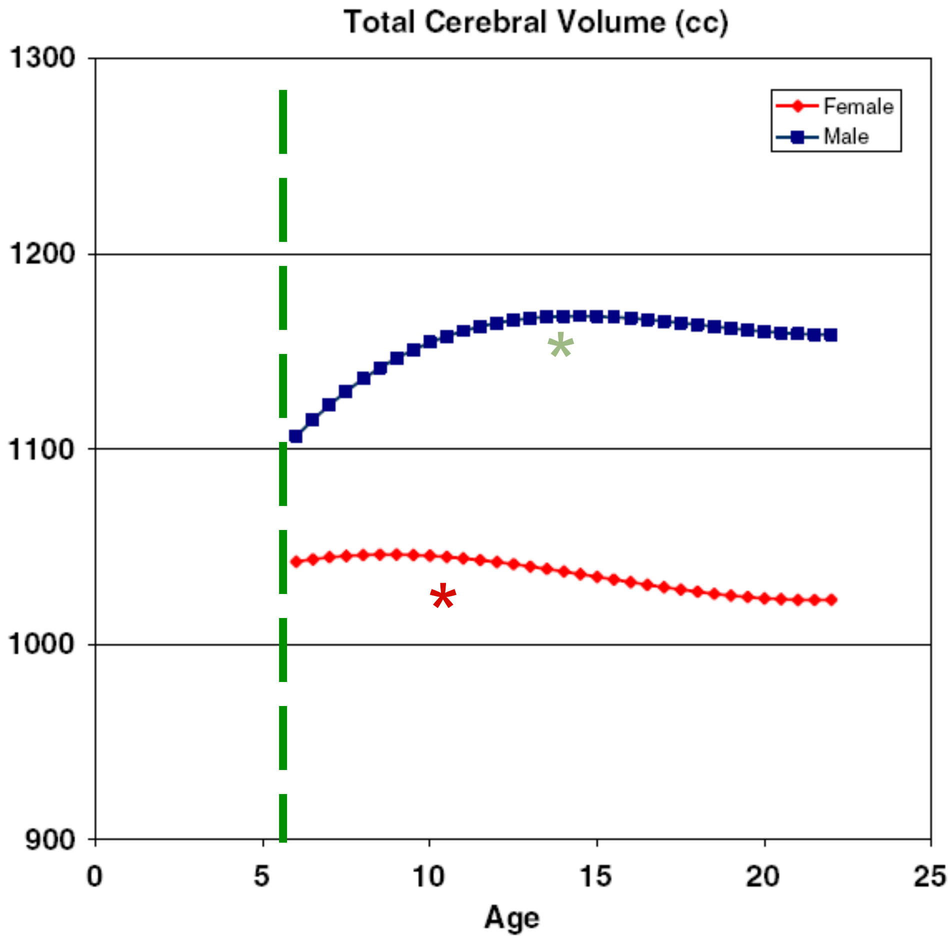
- **Pruning** (cutting away of **unused** or unimportant **connections**)

- **Myelination** (**insulating** of brain pathways to make them faster and more stable)

**(Sowell et al., 1999; Sowell et al., 2001)**

# Brain development

## Proliferation: Total brain **volume**




By **age 6**, the brain is about 95% of its maximum size.

It reaches its maximum size at **11.5 years** in **girls***, and at **14.5 years** in **boys***.

***Boys** brains are **larger** (on average) than **girls** brains.

**Lenroot & Giedd (2006)**

The tissue of the brain can be divided into two types of matter, **grey** and **white**. These tissues **grow** and **mature** at **different rates**.

Grey matter looks **grey** to the naked eye. It is composed of **neuron cell bodies, dendrites, and glial cells**.

It constitutes the brain's **processing** centres.

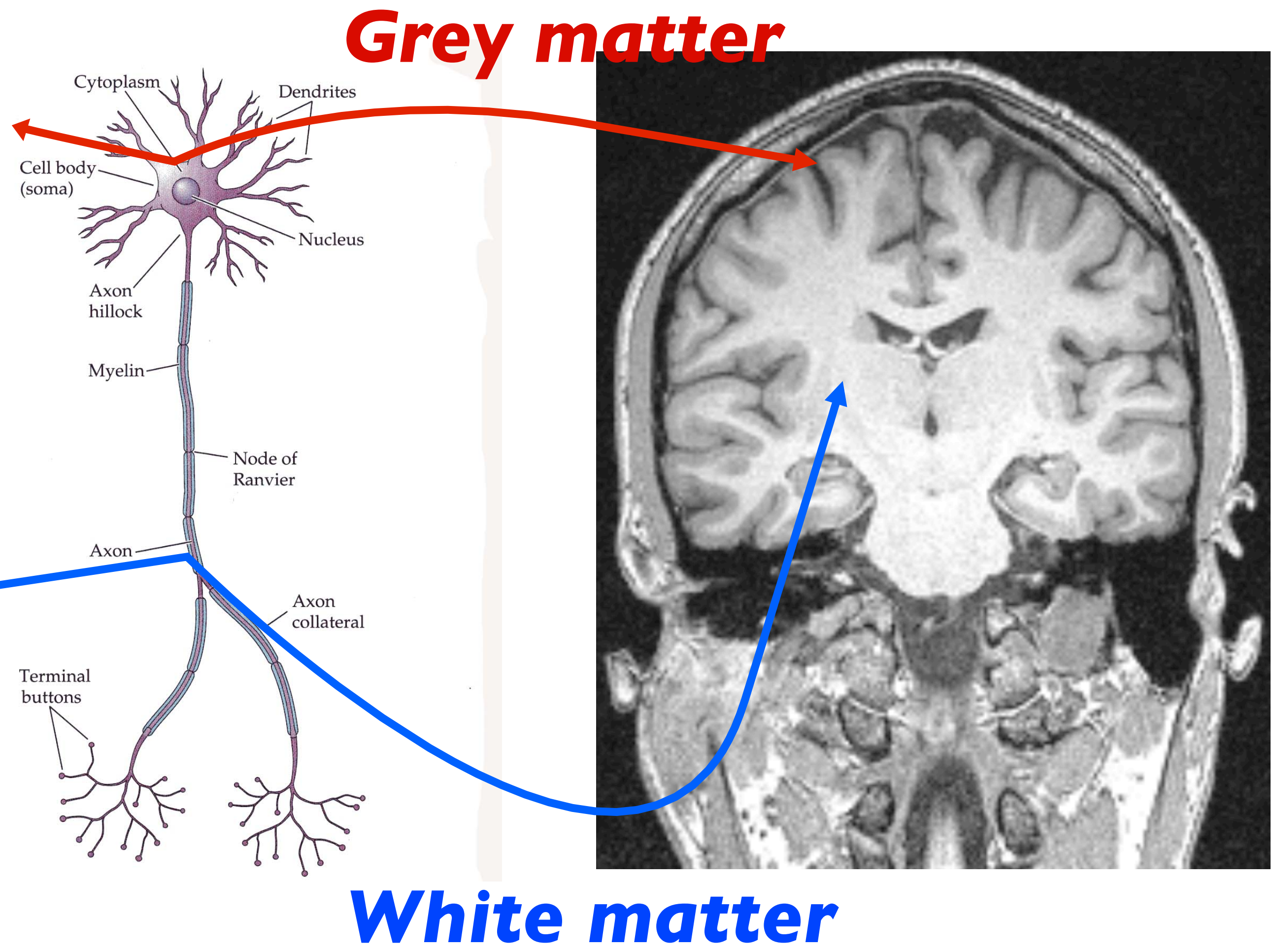
White matter looks **white** to the naked eye, and is made up of **axons**.

It is responsible for **transporting information** from one part of the brain to another.

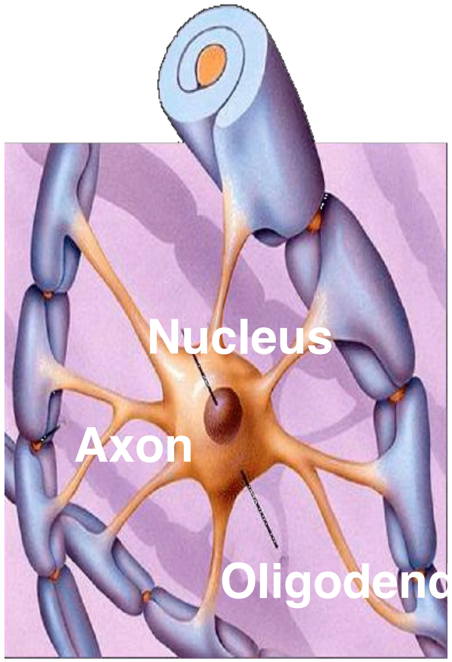
# Brain Tissues

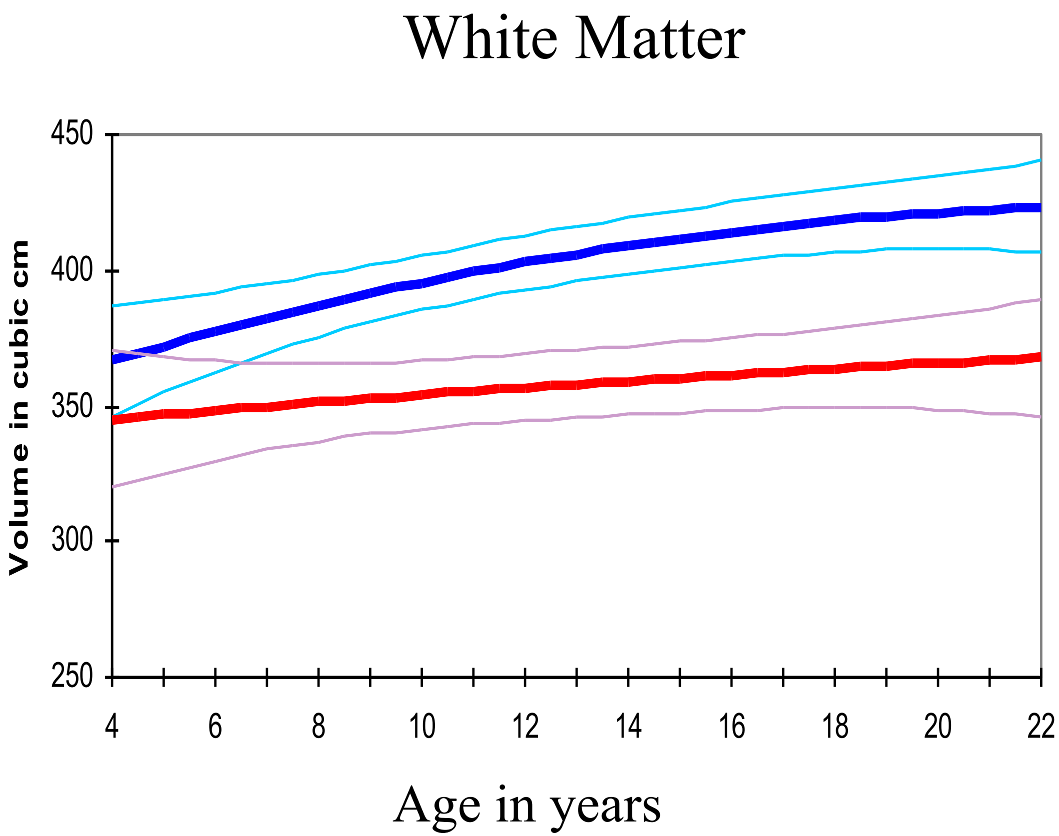
- Cell Body

- Axon



# White Matter



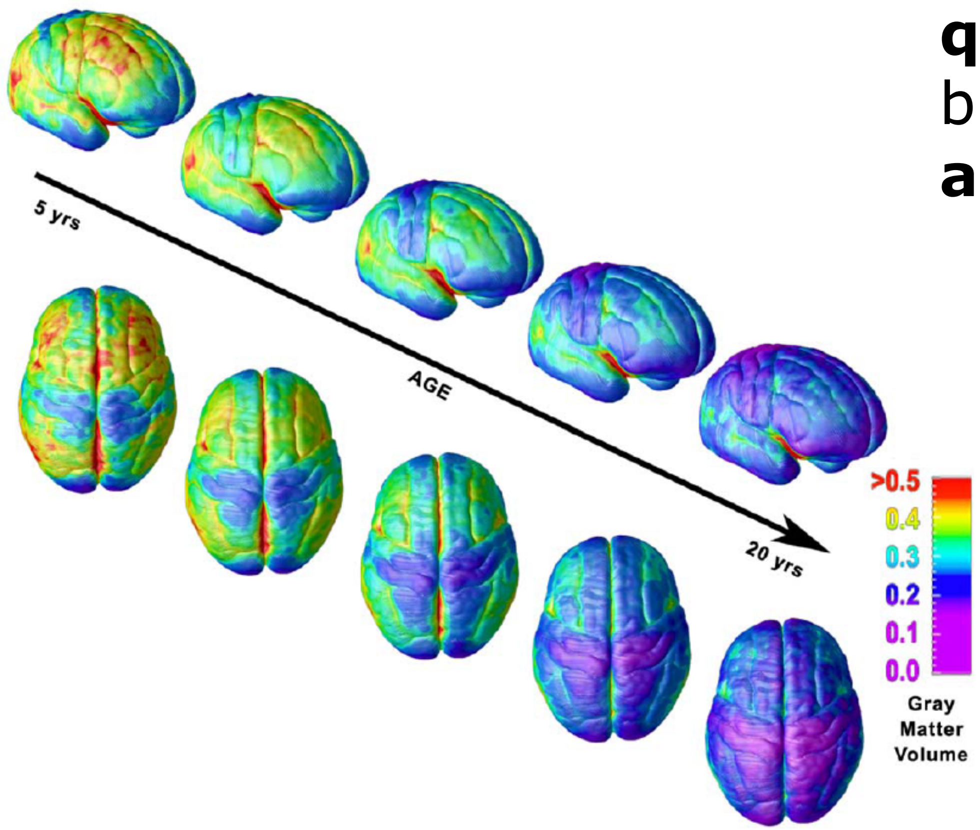




Male (152 scans from 90 subjects)

Female (91 scans from 55 subjects)

95% Confidence Intervals

# Brain development




Grey matter develops **quickly** during **childhood**, but **slows** during **adolescence**.

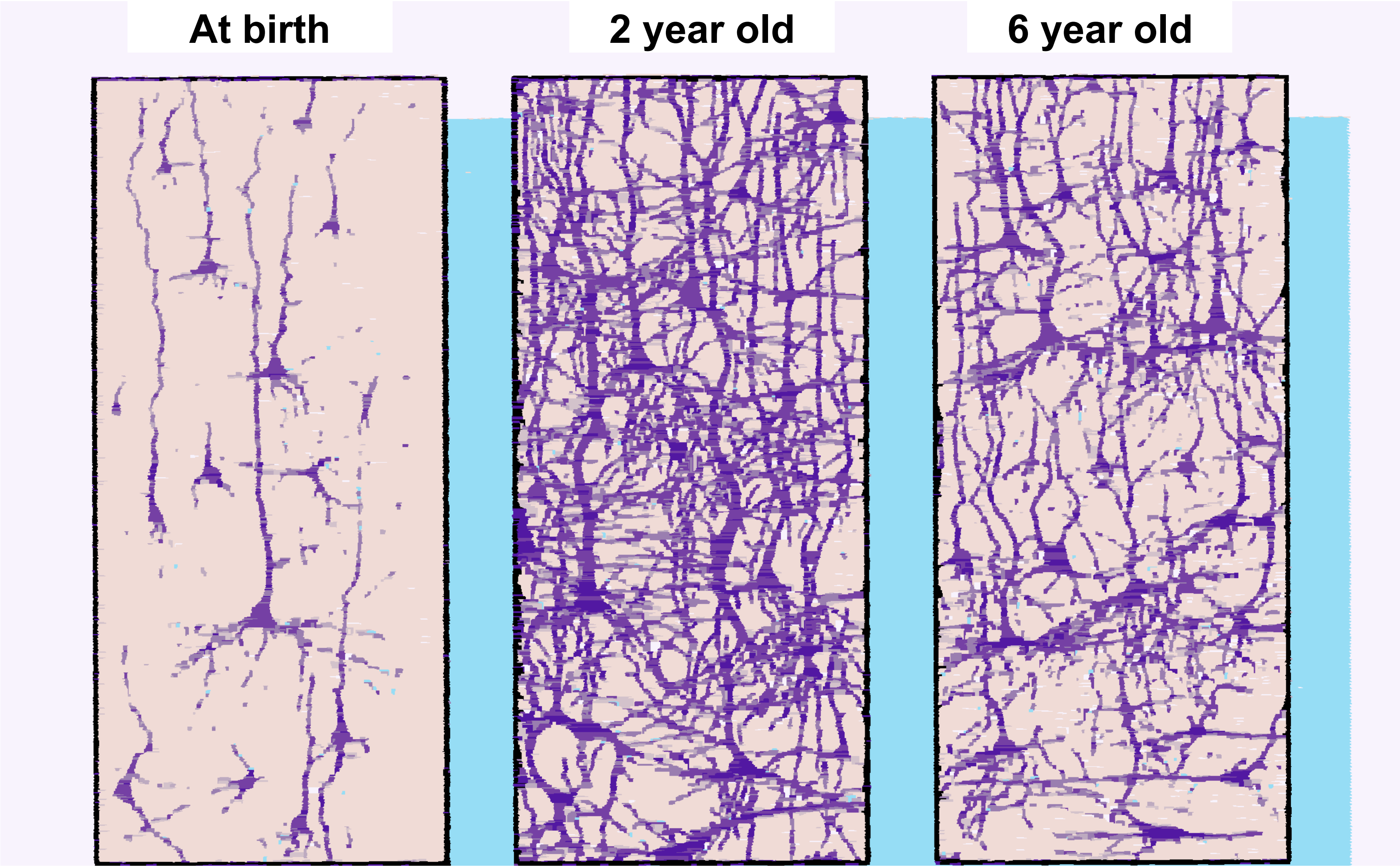
↓

Grey matter **volume peaks** at age **11** in **girls** and at age **13** in **boys**.

↓

Then, the volume of grey matter **begins to decline**.

**Lenroot & Giedd (2006)**




Experience Shapes Brain Architecture by Over-Production Followed by Pruning (700 synapses formed per second in the early years)

# Brain development

## Pruning: Grey Matter Maturation

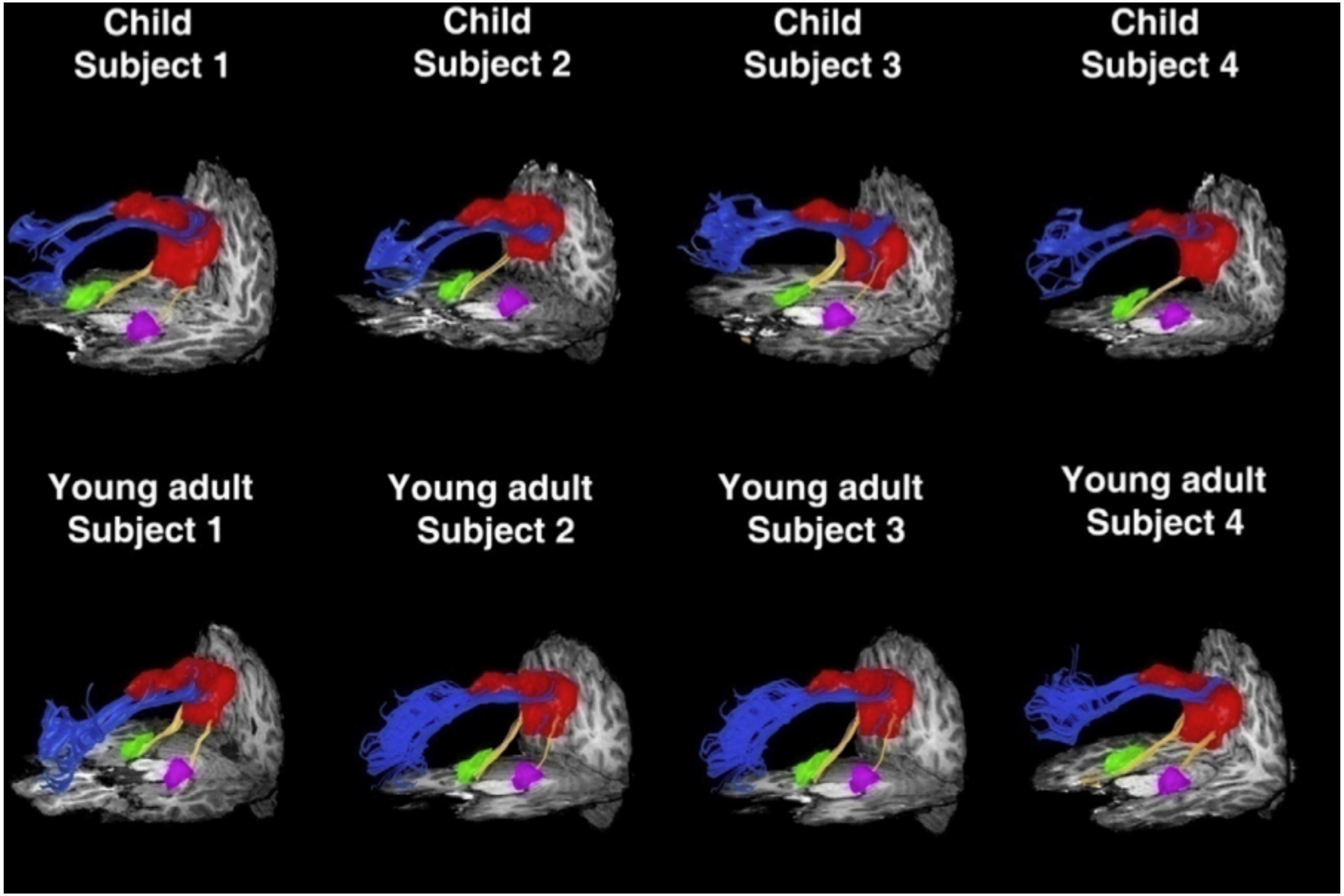
- The maturation of grey matter is best described as a constant "**push and pull**". **New** pathways **grow**, while **others** are **pruned back**.

- Pruning is greatly **influenced by experience**, so it really is a case of "**use it or lose it**"!

- This makes the **brain** extremely **versatile**, and able to make changes **depending** on the **demands** of the environment.

# Structural Connectivity

Supekar et al, Neuroimage, 2010

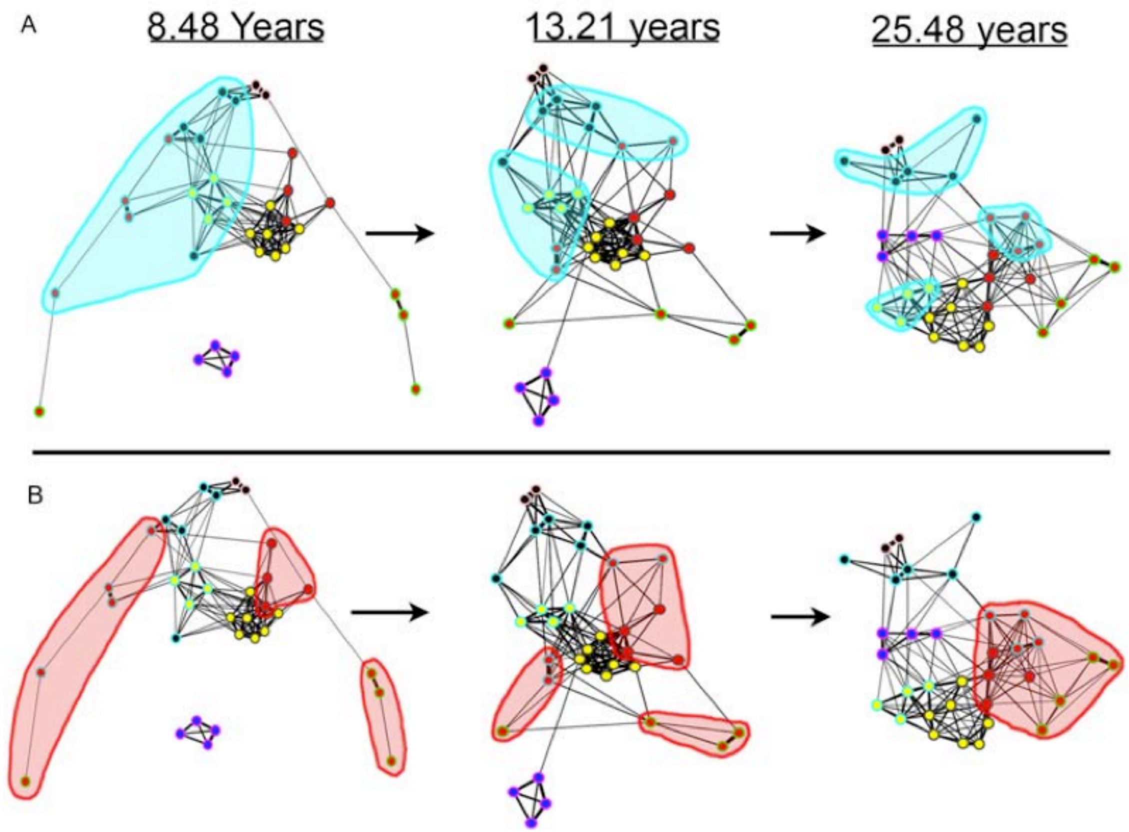


# Functional Connectivity

Fair et al., Plos Computational Biology, 2009

From local to distributed
Ex: **Frontal Lobe**

Evolution of the "**Default**" network



# Myelin Speeds Up Neurons 100x

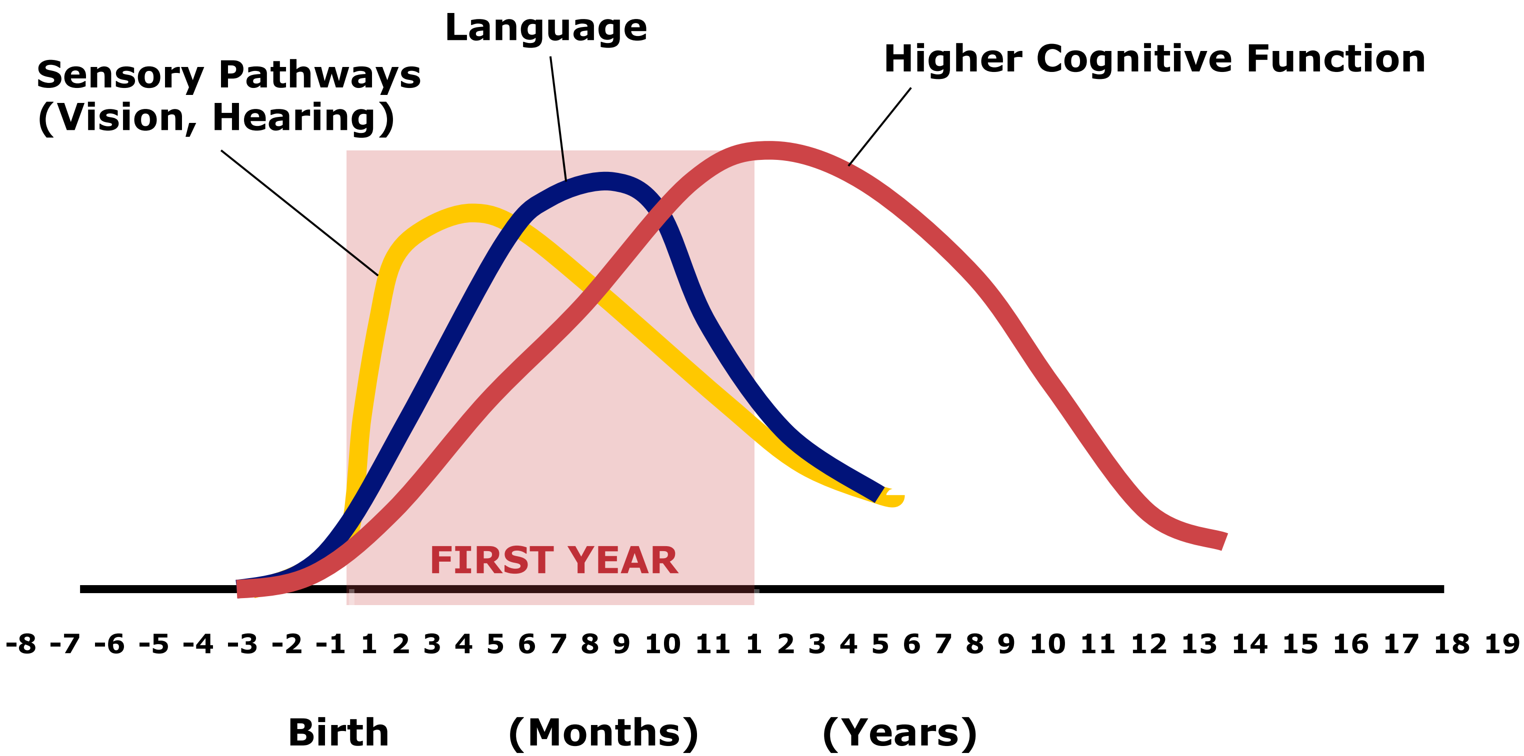
- **Newborns: few myelinated axons**
  - Different  regions at different ages
- **Wernicke (language comprehension) - 6 months earlier (terrible 2's)**
- **Broca (speech production) - develop speech, grammar**
  - Need to understand language before producing it

# Brain development

## Structure and organization

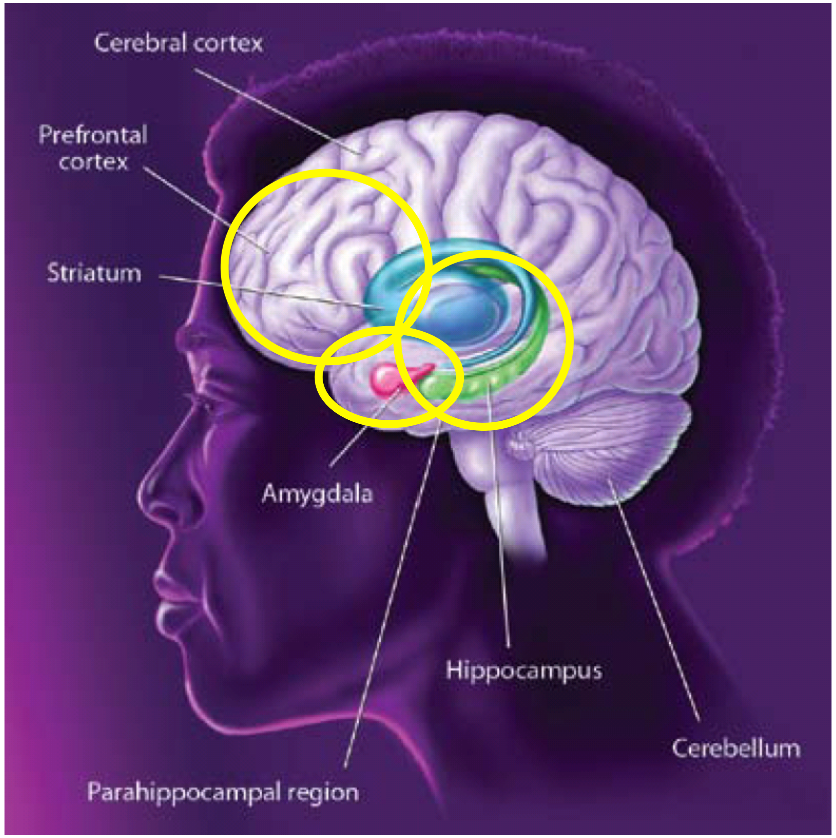
- Higher/Complex areas control the more reactive primitive lower parts of the brain—less reactive, more thoughtful and less impulsive
- Lower-Excitatory
- Higher-Modulating
- “Inside-out” and “Bottom-up”

# Neural Circuits are Wired in a Bottom-Up Sequence

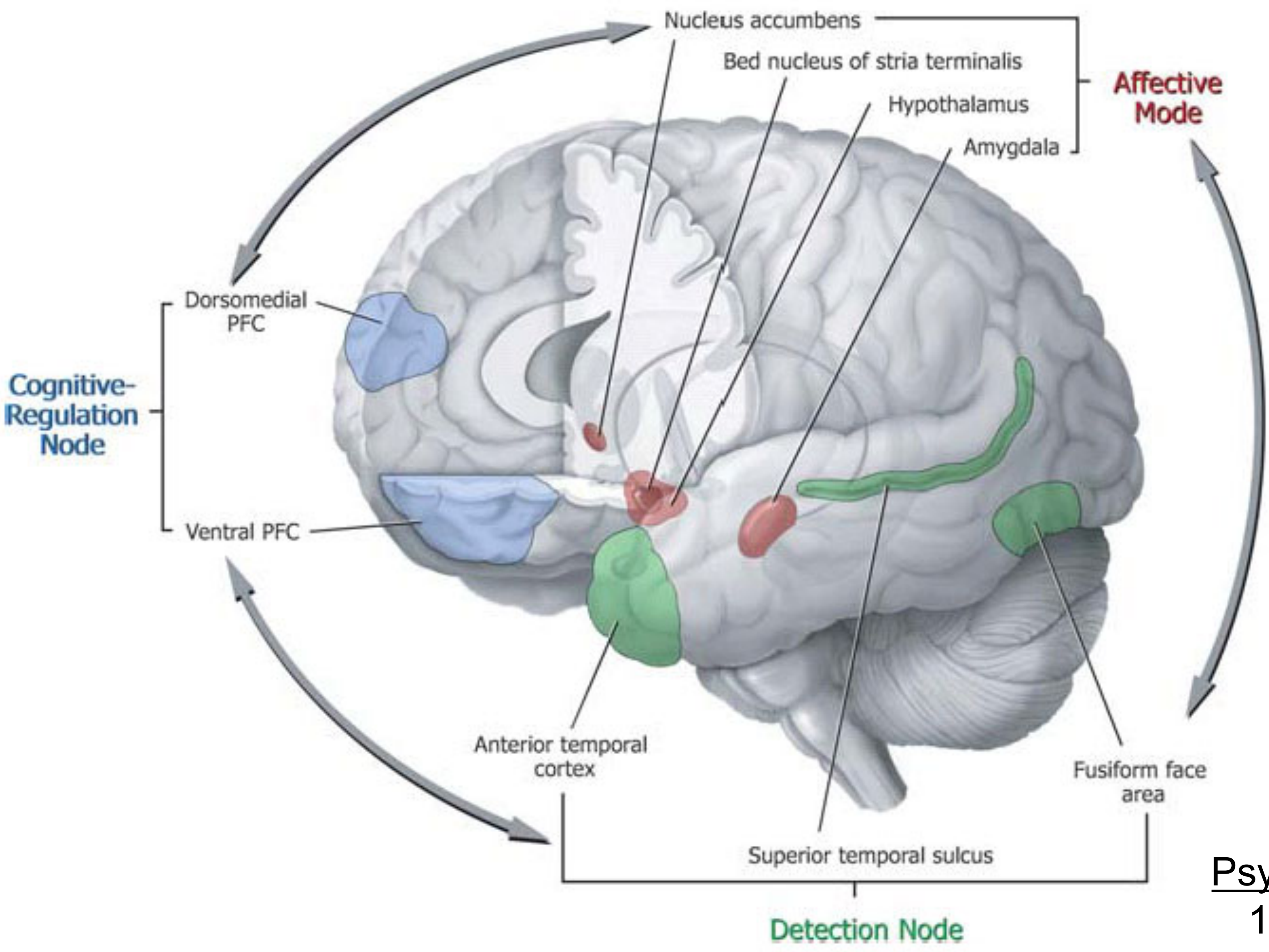



Source: C.A. Nelson (2000)
Developmental Science, 3, 115-136

# Cognitive, Emotional, and Social Capacities Are Inextricably Intertwined Within the Architecture of the Brain

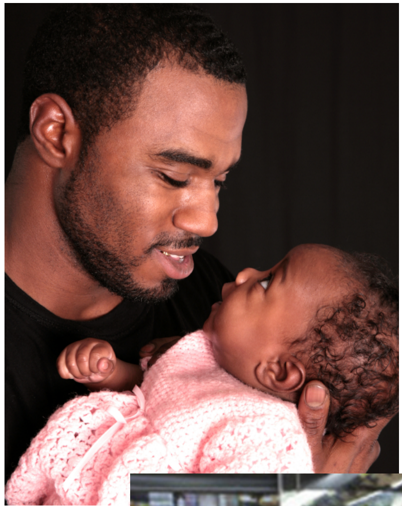


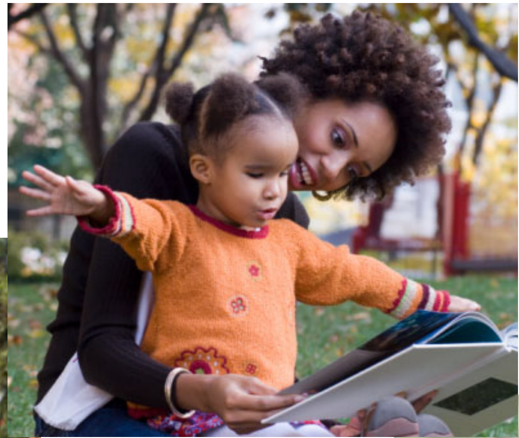
## …tion of the interaction of the 3 nodes of the social information processing network (SIPN)*




*Nelson et al Psychol Med 35: 163-174, 2005

# Brains and Skills are Shaped by the "Serve and Return" Nature of Human Interaction





# Understanding the environmental effect in brain development

There are **two ways** the environment affects the development of the brain:

1. **Experience-expectant** development: Involves processes which will only develop in the presence of a particular **experience** during a **critical period**.
   - The need for **visual stimuli** for the development of the visual cortex
   - If normative early stimuli like **touching, talking and affection** are absent, the synapses which process those stimuli are deemed useless and eliminated
2. **Experience-dependent** development: New synapses are produced by an **environmental demand**.
   - Exposing a child to a **particular affective demand** can generate asymmetries in **prefrontal structures**.

Grassi-Oliveira, Ashy & Stein, 2008

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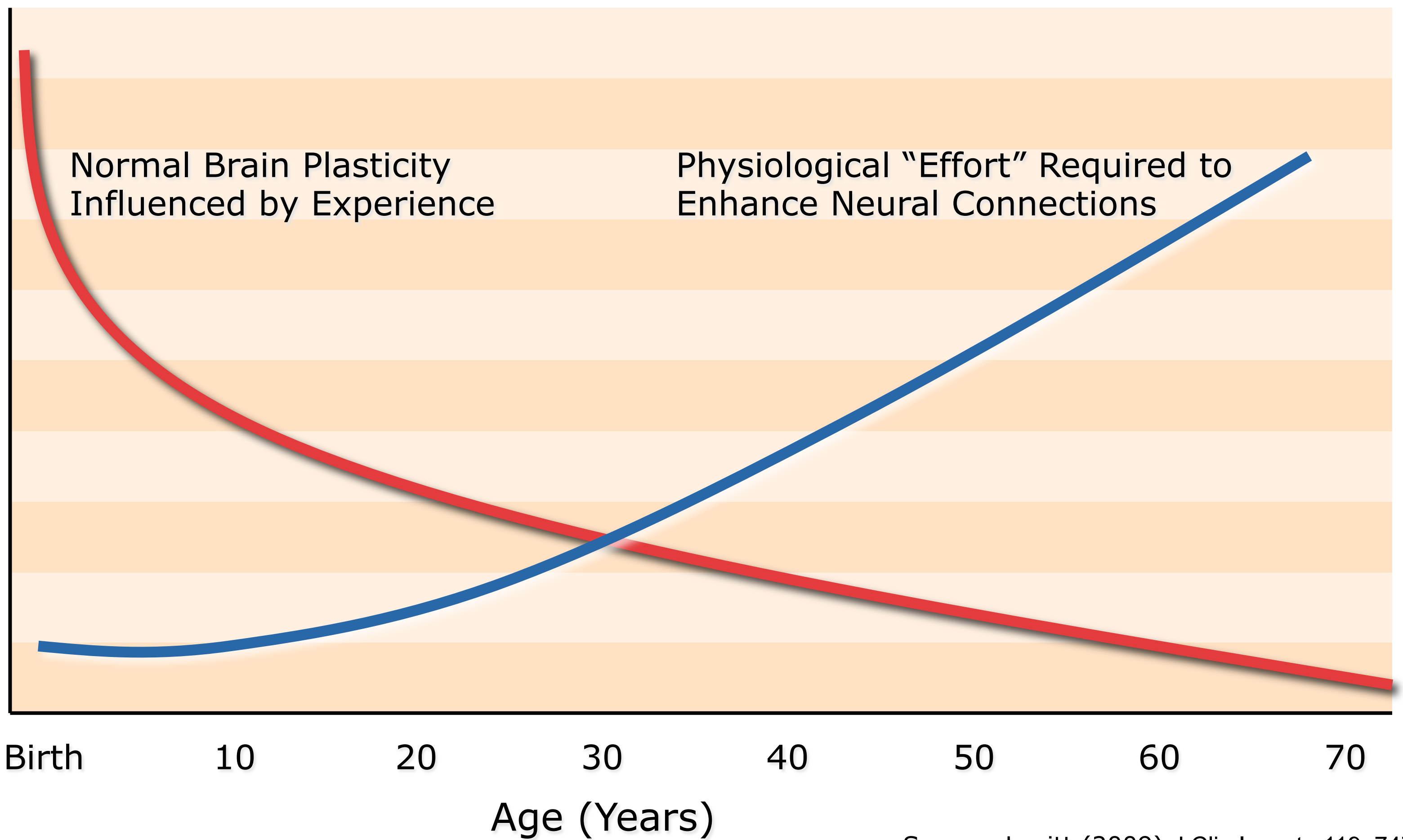
# The Ability to Change Brains Decreases Over Time




Source: Levitt (2009) J Clin Invest., 119, 747-54

# Structural changes in the adolescent brain

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# Brain development

- "*It is moving parts that break*"

- **Windows of vulnerability** = critical time during which brain **hones particular** skills or **functions**

- **Different** windows for different brain **regions**

- **If** the chance to practise a skill is **missed** during the window, a child may **never learn** it (or be impaired)

**(Lupien et al., 2011; Teicher et al., 2008)**

# Brain development

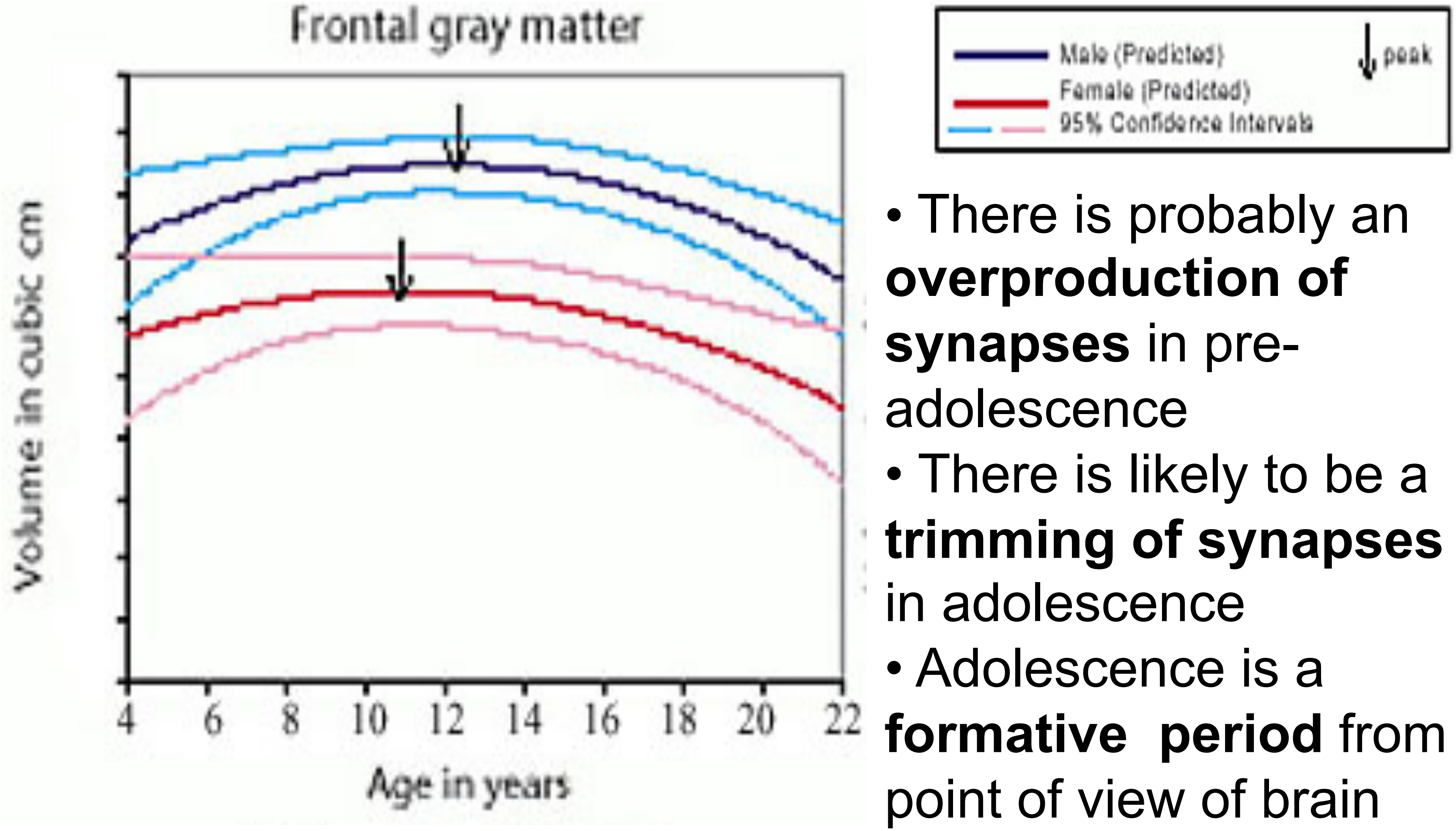
## Linear increases in white matter during adolescence (myelination)

- Higher volume of white matter in the **frontal** cortex, **parietal** cortex, the pathways that connect anterior **speech** regions **to language** regions and corpus callosum

## Non-linear increases in gray matter

- **Inverted-U** shaped curve
- Increases in preadolescence with peak around **12 in frontal** parietal-lobe and **17 yrs for temporal** lobes

# Brain Development in Adolescence




- There is probably an **overproduction of synapses** in pre-adolescence
- There is likely to be a **trimming of synapses** in adolescence
- Adolescence is a **formative period** from point of view of brain development

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# IQ and cortical thickness

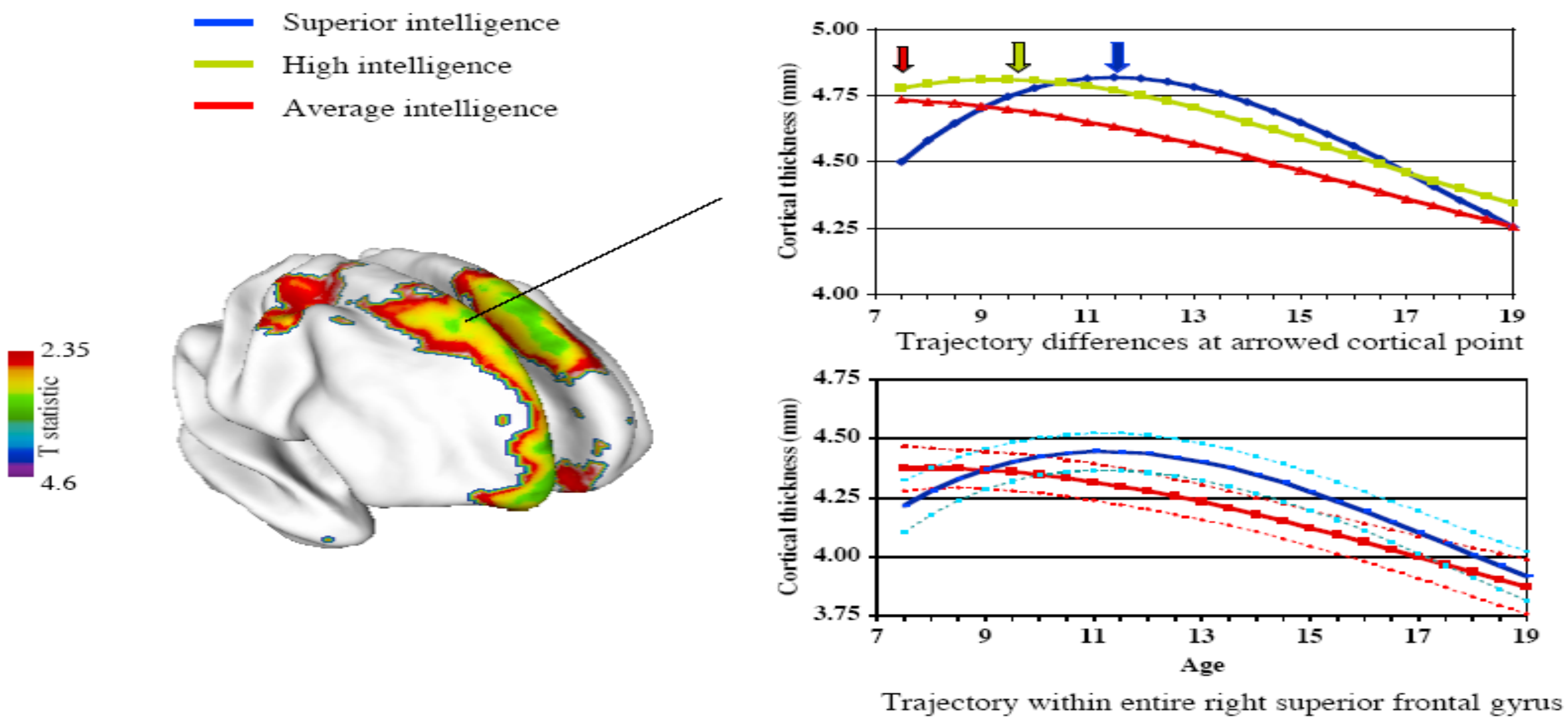



Figure 2: the brain template gives a right lateral view of regions where the superior and average intelligence groups differ significantly in the trajectories of cortical development (a t statistic map shows where there was a significant interaction between the IQ groups and the cubic age term, adjusted $p<0.05$ ). The top graph illustrates the significant difference in cortical trajectories at a representative cortical point within the right superior frontal gyrus (MNI coordinates x=10,y=44,z=48: shape difference for superior vs high intelligence $P<0.001$; superior vs average intelligence $P=0.001$). The age of peak cortical thickness is shown by arrows. The lower graph illustrates trajectory differences with 95% confidence intervals for the entire right superior frontal gyrus, comparing the superior and average intelligence groups (shape difference $P<0.006$). The average and high intelligence groups did not differ in shape either at the single cortical point in the top graph ($P= 0.56$) or for all points within the right superior frontal gyrus ($P=0.58$).

nature Vol 440|30 March 2006|doi:10.1038/nature04513

LETTERS

# Intellectual ability and cortical development in children and adolescents

P. Shaw[1], D. Greenstein[1], J. Lerch[2], L. Clasen[1], R. Lenroot[1], N. Gogtay[1], A. Evans[2], J. Rapoport[1] & J. Giedd[1]

## Scans Show Different Growth for Intelligent Brains

By NICHOLAS WADE
Published: March 30, 2006

The brains of highly intelligent children develop in a different pattern from those with more average abilities, researchers have found after analyzing a series of imaging scans collected over 17 years.

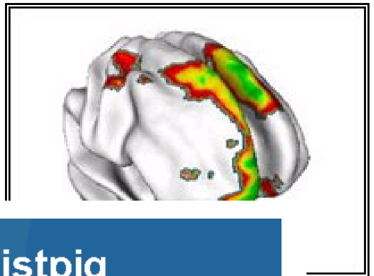
The discovery, some experts expect, will h… understand intelligence in terms of the gene… childhood experiences that can promote it.


RESEARCH NEWS

## Study Makes Case for Late Bloomers

Listen by Jon Hamilton

npr



*All Things Considered*, March 29, 2006 · It usually makes parents proud when their children reach a developmental milestone ahead of other kids. But when it comes to intelligence, researchers say, the smartest children appear to have brains that develop later.

capitalistimperialistpig

897

THOSE WHO WOULD GIVE UP ESSENTIAL LIBERTY TO PURCHASE A LITTLE TEMPORARY SAFETY, DESERVE NEITHER LIBERTY NOR SAFETY - BENJAMIN FRANKLIN

friday, march 31, 2006

## IQ and Brain Growth

One of the most hyped stories of the past few days has been that of how high IQ children's brains grow differently that those of average children.

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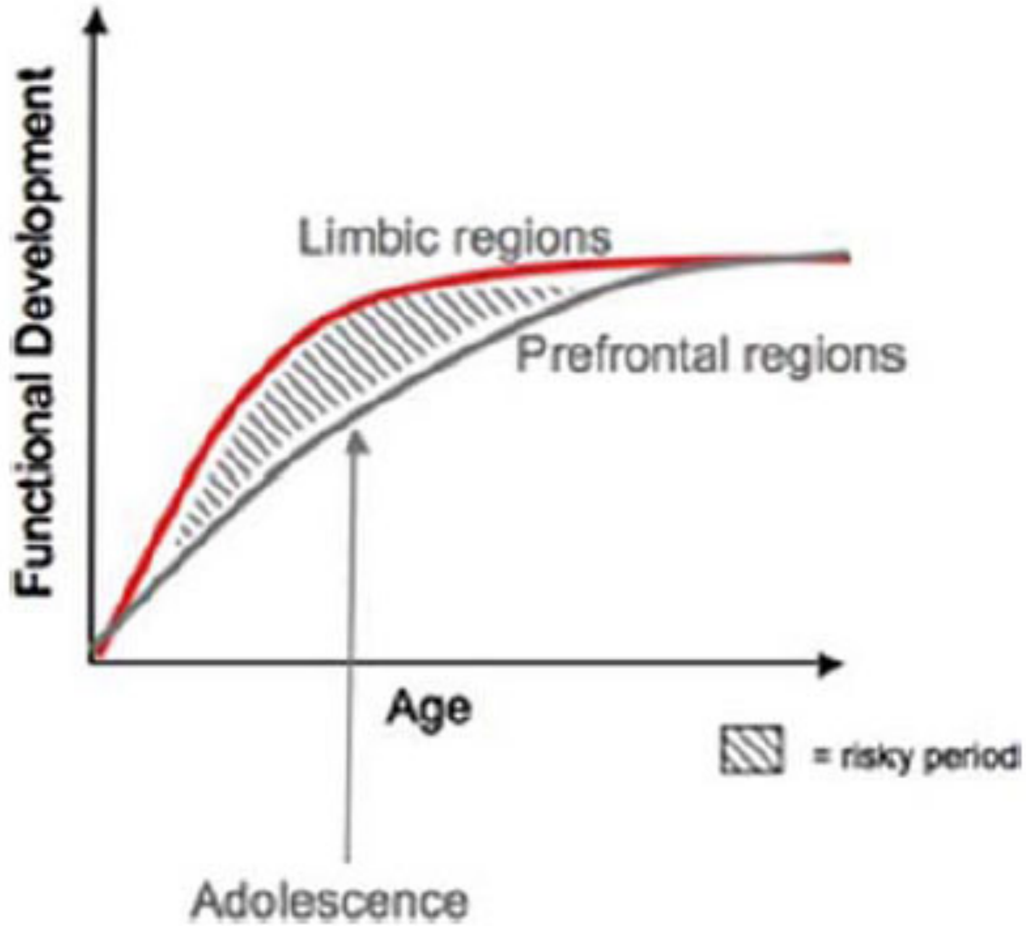
# Summary development during the second decade of life

- **PFC** undergoes a pronounced course of structural development
  - **grey matter** (indicative of synaptic connections being made) **increases in the PFC** up to the onset of puberty but thereafter shows a rapid **decrease in density** that continues throughout adolescence into early adulthood

- **Superior temporal cortex**, including the superior temporal sulcus (STS), is **most protracted**
  - does not follow the pattern in the PFC of a sharp inverted U-curve, but rather grey matter **steadily declines** during adolescence and well into adulthood, reaching **maturity relatively late.**

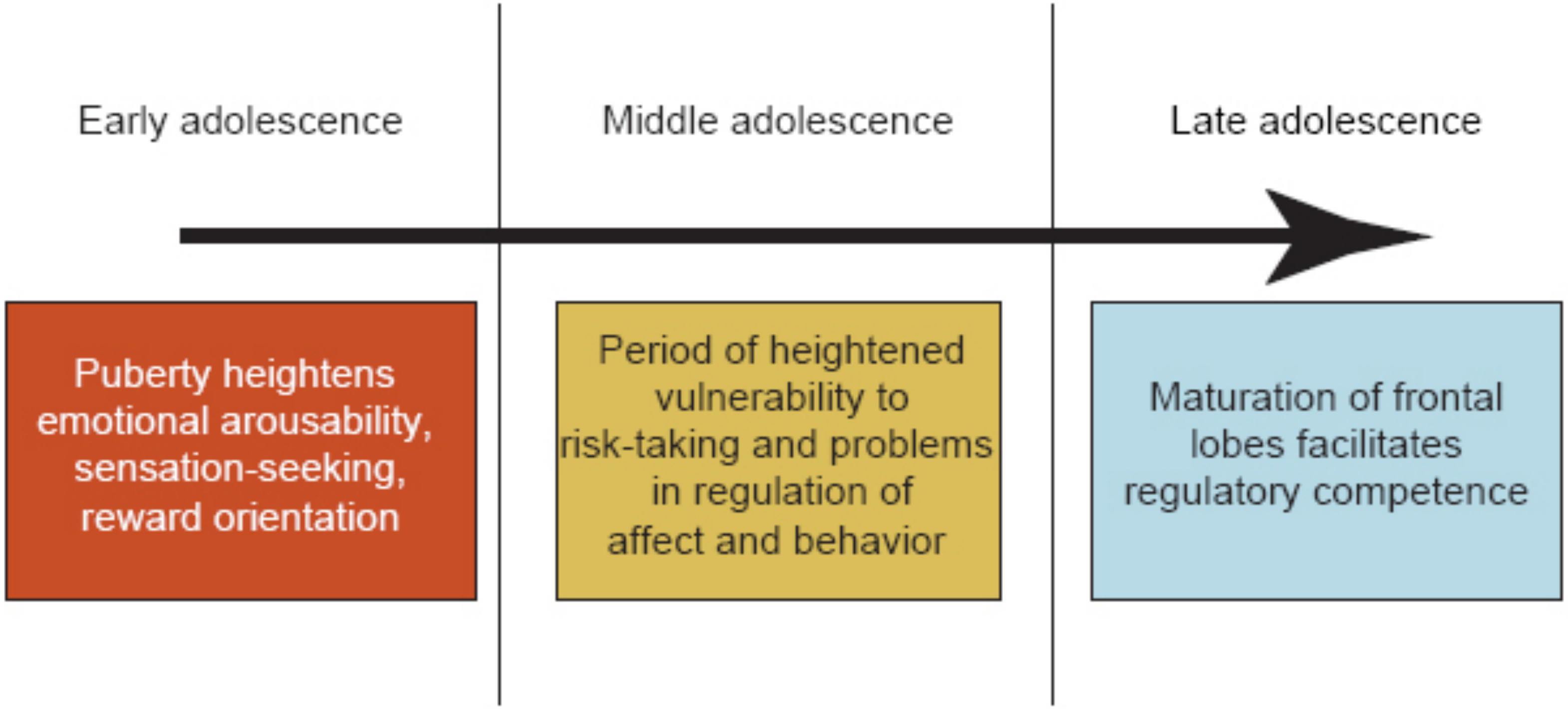
- At the same time, improved connectivity between nerve cells is indicated by an **increase in cortical white matter** density from puberty, throughout adolescence and **into adulthood**

# Developmental trajectories of limbic and prefronta regions (Casey, Jones & Hare 2008)




Adolescents are biased more by **functionally mature limbic regions** during adolescence (imbalance of limbic **relative to prefrontal** control), compared to children, in whom these systems are both still developing, and adults, in whom they fully mature

# Vulnerability to problems in regulation of affect and behaviour in adolescence




**"The developments of early adolescence may well create a situation where one is starting an engine without yet having a skilled driver at the wheel"**
**(Steinberg, Trends Cogn Sci 2005)**

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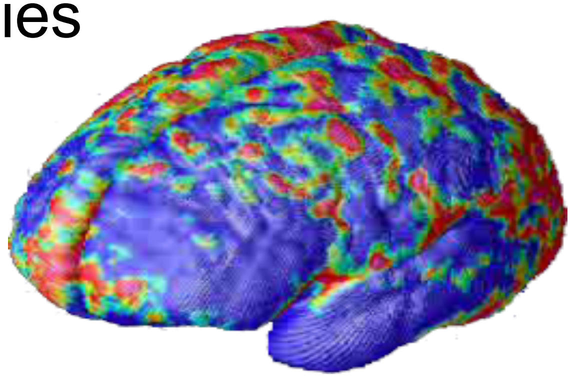
# Risks for psychopathology during adolescence

**Schizophrenia**

Exaggeration of typical regressive changes:
- Delta sleep
- Membrane phospholipids
- Synaptophysin expression
- Synaptic spine density
- Neuropil
- Prefrontal metabolism
- Frontal gray matter

**Typical behaviour changes**

↑ Risk taking
↑ Novelty seeking
↑ Social priorities



**Substance Abuse**

↓Sensitivity to hangover, sedation, and motor impairment
↑ Hippocampal vulnerability

**Depression**

Hormonally mediated limbic effects preceding maturation of cognitive-regulatory system

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# Mismatch of affective and cognitive regulatory nodes

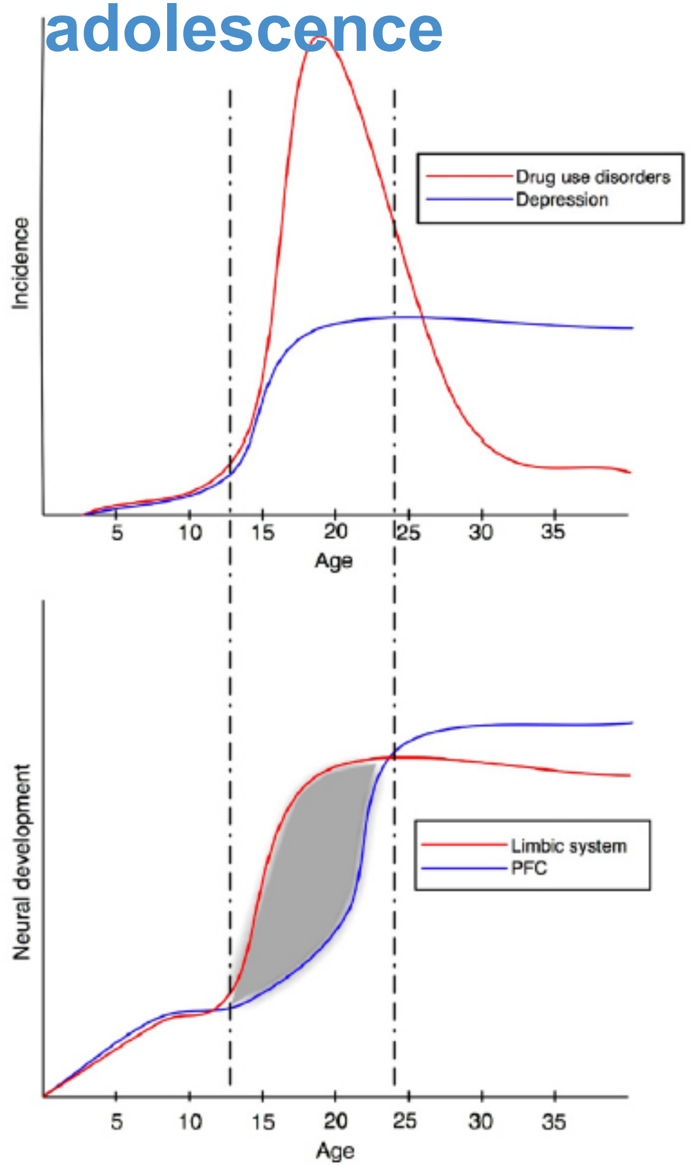
- Individuals with powerful **emotional responses** to social stimuli **cannot**
  - Regulate
  - Contextualise
  - Plan
  - Inhibit

  } **Newly emergent behaviour**
- Emotional and behavioural problems

## Explanations for vulnerability to mental disorder in adolescence (Davey et al 2008)

- **Delay in maturation of prefrontal cortex** compared to earlier-maturing limbic areas has most often been emphasised
- This may help to explain increased rates of dysregulated behaviour, especially **drug use** and **risk taking** in adolescence
- Does **not** explain the **increased** rates of **depression** that start in adolescence and persist in adulthood after the regulatory mechanisms have matured
- **Development of the prefrontal cortex** may itself be central in explaining the rise in vulnerability to depression
- As the PFC comes to be able to **represent** increasingly **complex** and distant **social goals**, vulnerability to **depression** increases **when** goals are **frustrated**

# Explanations for vulnerability to mental disorder in adolescence




**Incidence of ages of onset for depression (blue) and drug use disorders (red) across first four decades of life**

**Development of limbic system (red) and PFC (blue) across first four decades of life**

# Early Life Experiences Are Built Into Our Bodies (For Better or For Worse)

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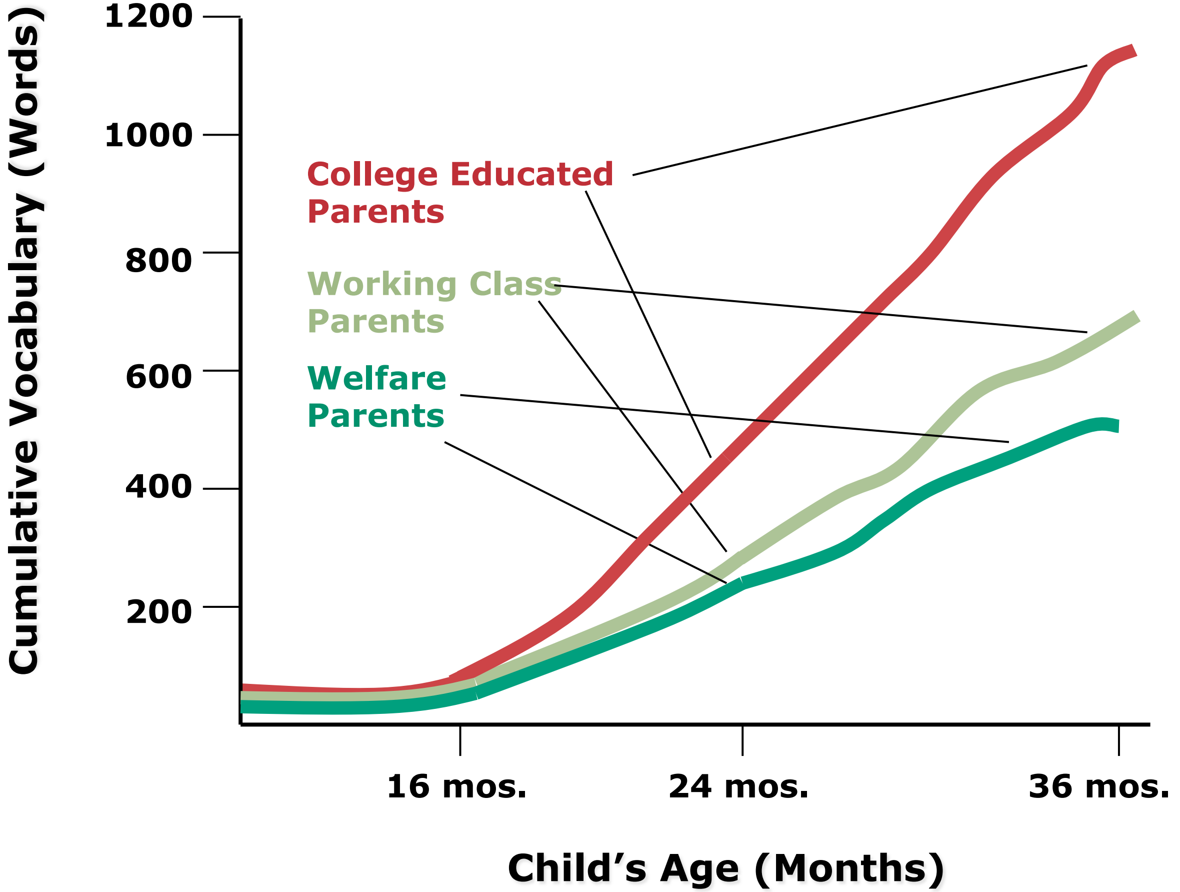
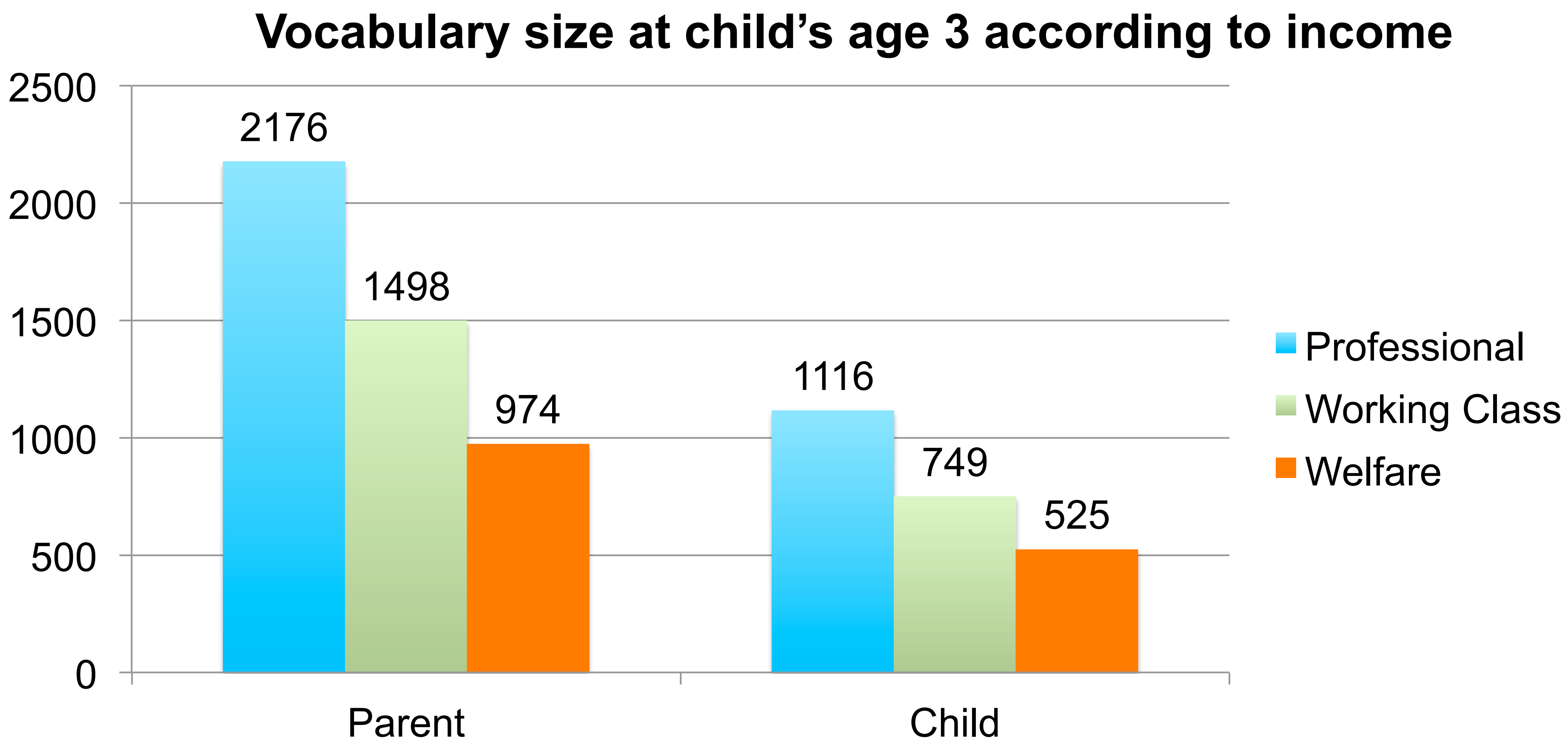
# Barriers to Educational Achievement Emerge at a Very Young Age




Source: Hart & Risley (1995) Meaningful differences in the everyday experience of young American children.

# Family income is mediated by quality of interaction




Hart & Risley, 2003

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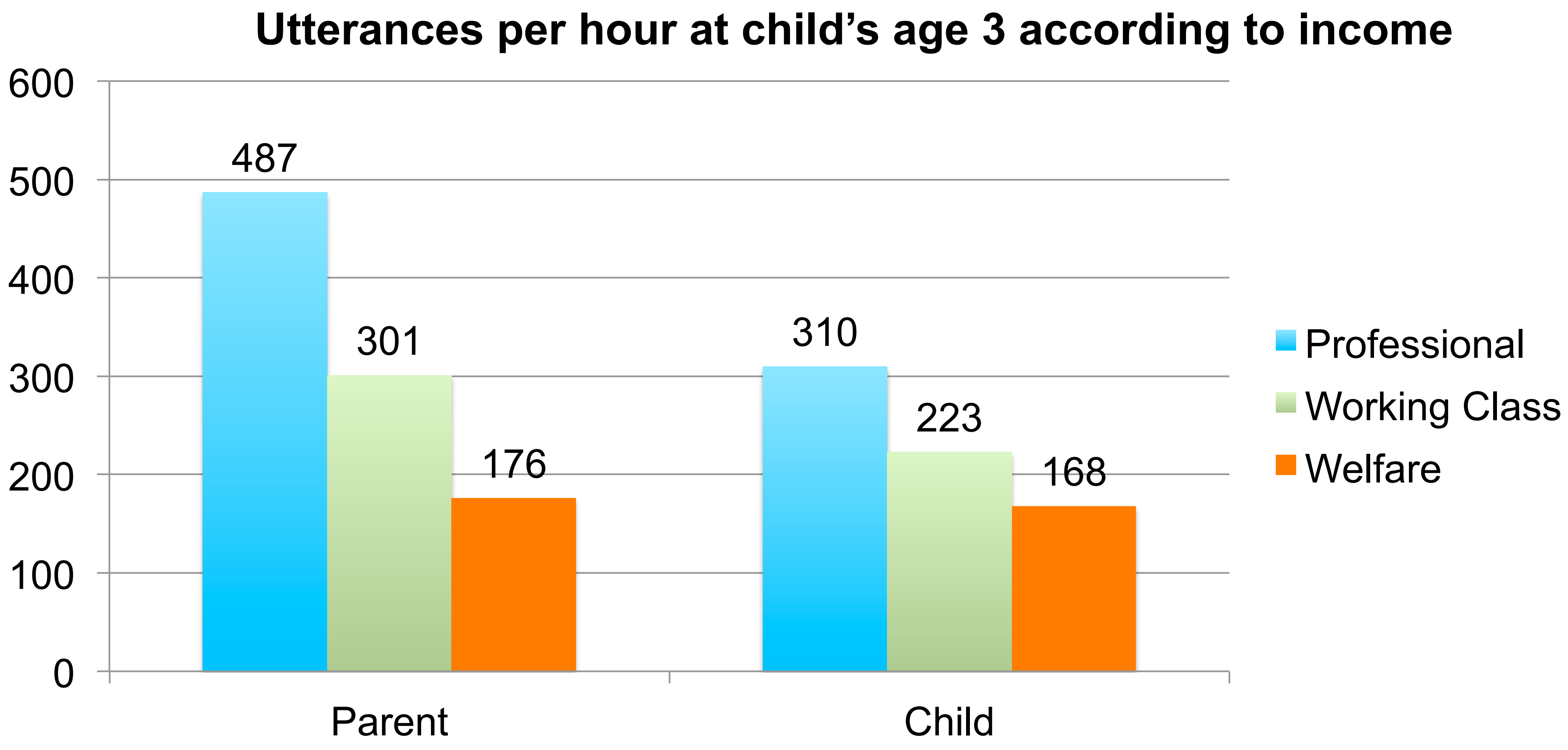


Hart & Risley, 2003

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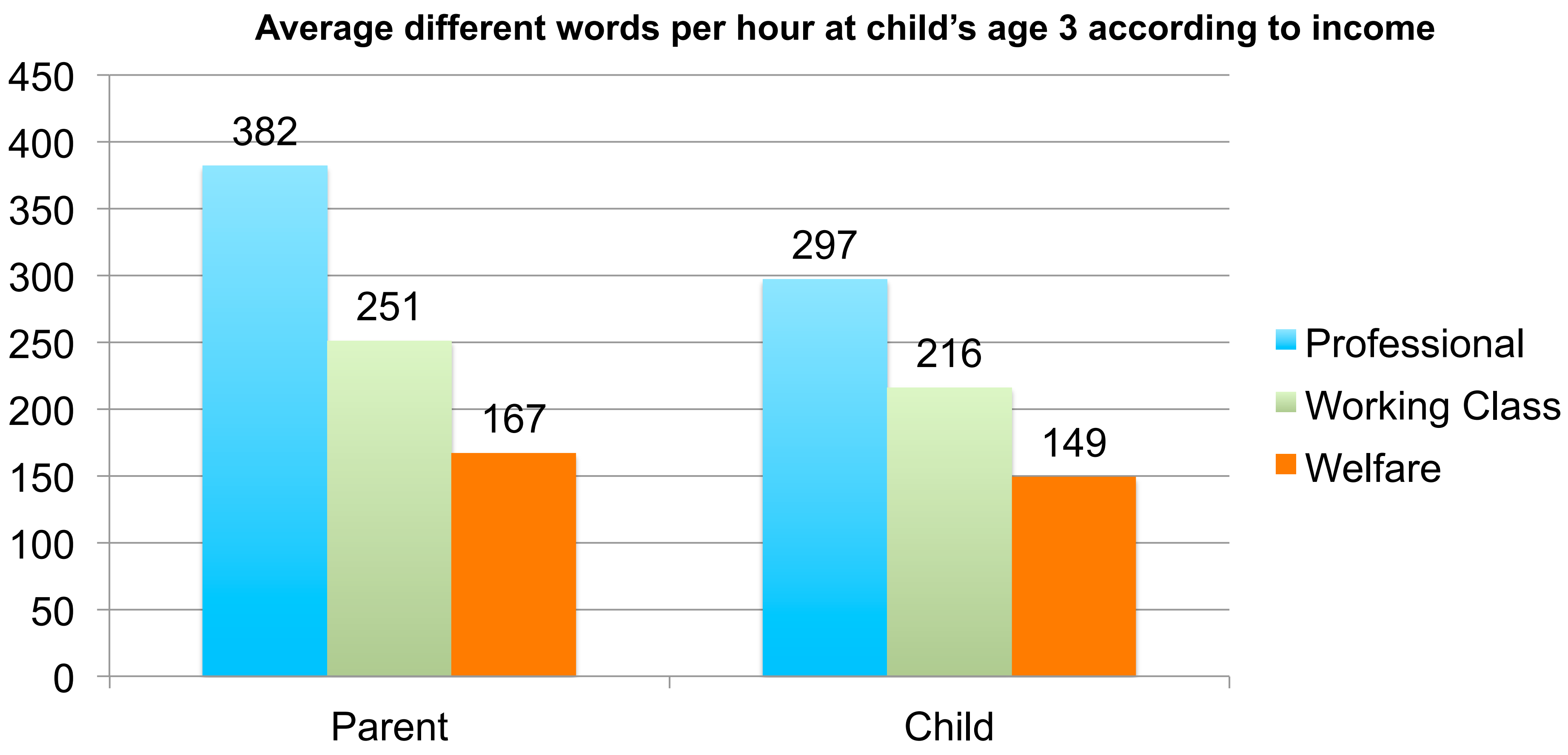
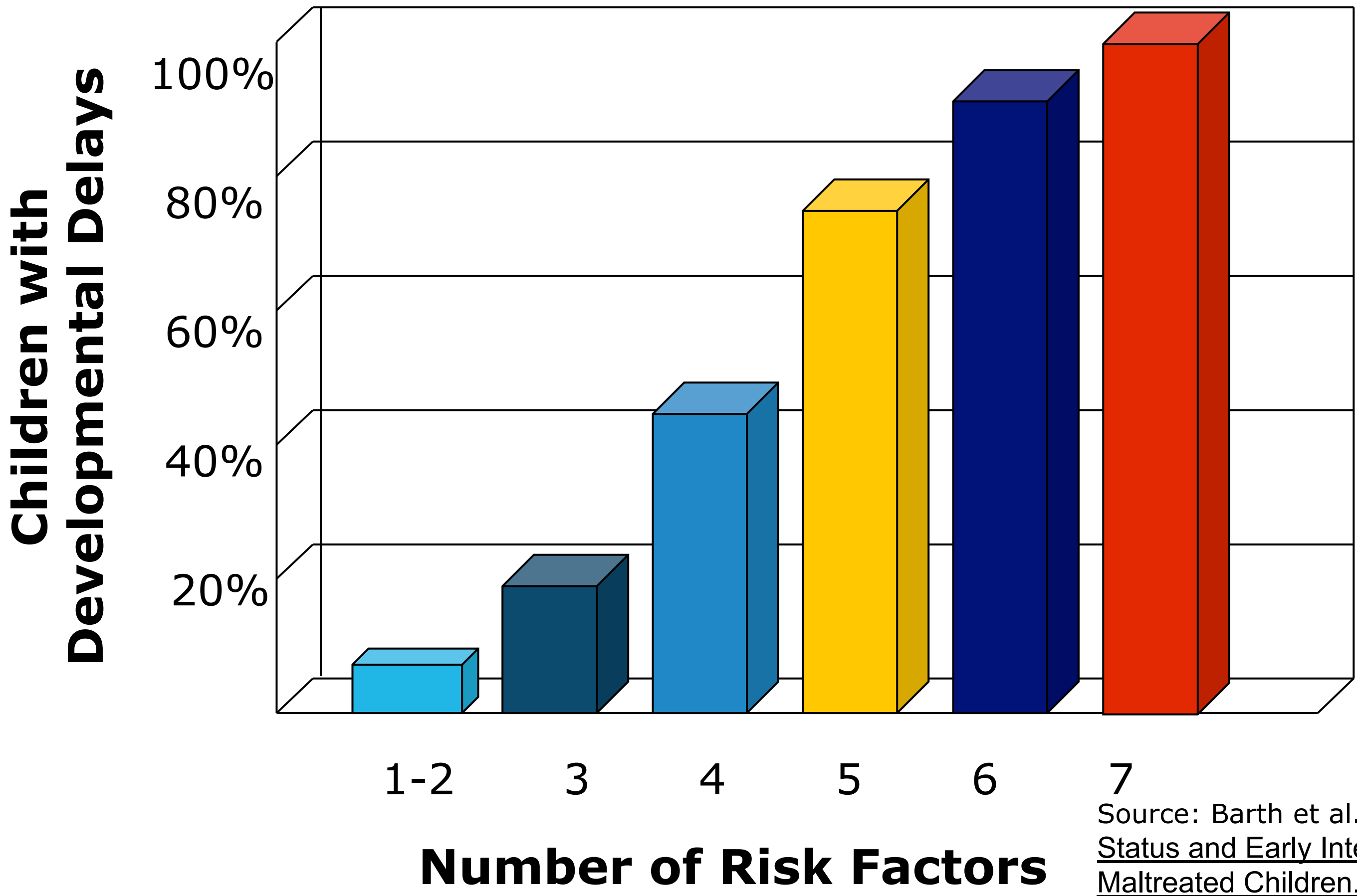



Hart & Risley, 2003

# Significant Adversity Impairs Development in the First Three Years




Source: Barth et al. (2008) Developmental Status and Early Intervention Service Needs of Maltreated Children. Final Report, US Dept of Health and Human Services

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# The Biology of Stress

Increases in heart rate, blood pressure, serum glucose, stress hormones, and inflammatory cytokines fuel the "**fight or flight response**" to deal with acute threat...

…but excessive or **prolonged activation** of stress response systems can lead to long-term **disruptions in brain architecture**, immune status, metabolic systems, and cardiovascular function.

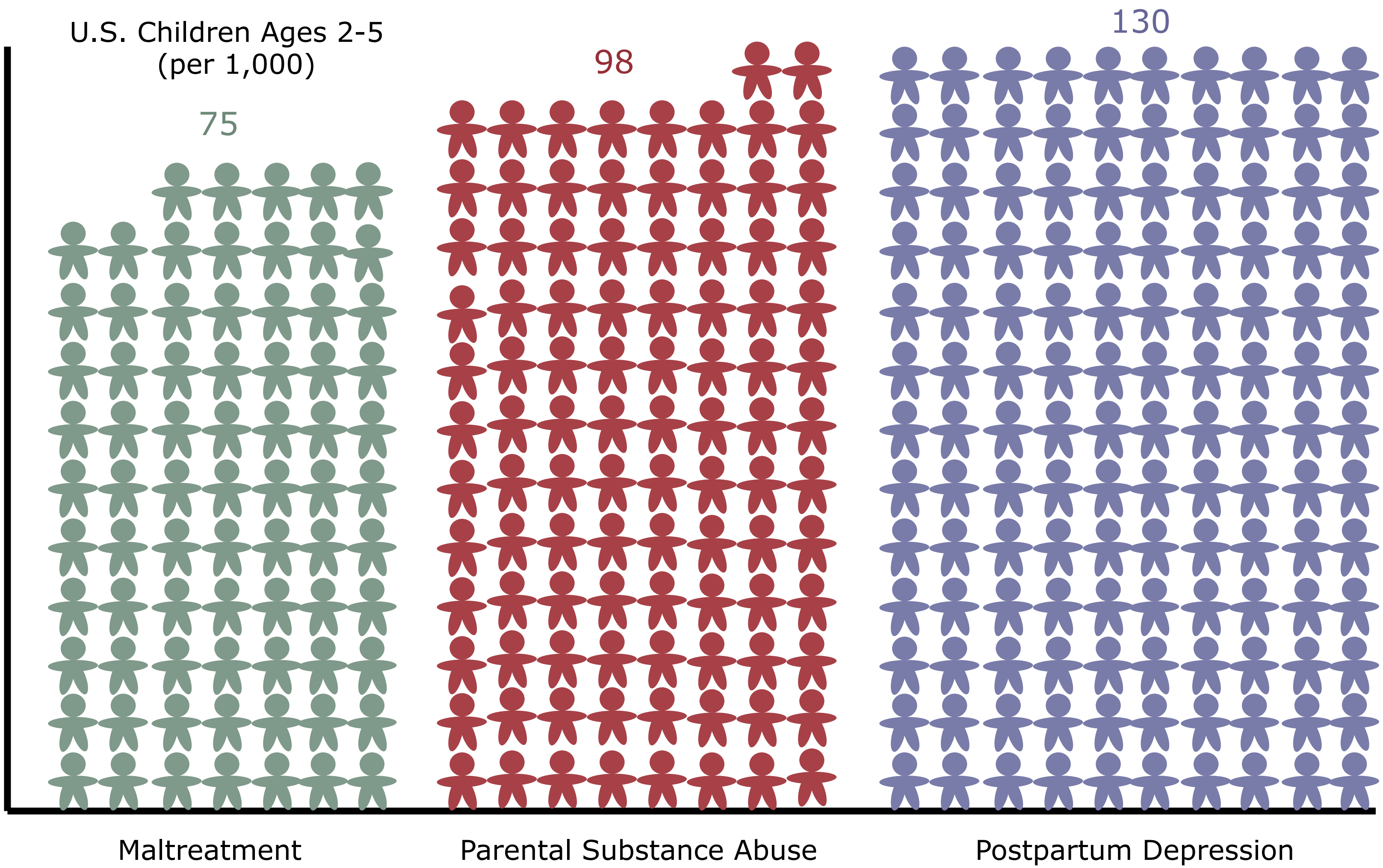
# Three Levels of Stress

**Positive**
Brief increases in heart rate,
mild elevations in stress hormone levels.

**Tolerable**
Serious, temporary stress responses,
buffered by supportive relationships.

**Toxic**
Prolonged activation of stress response systems
in the absence of protective relationships.

# Sources of Toxic Stress in Young Children




Source: Finkelhor et al. (2005) Child Maltreatment, 10, 5-25

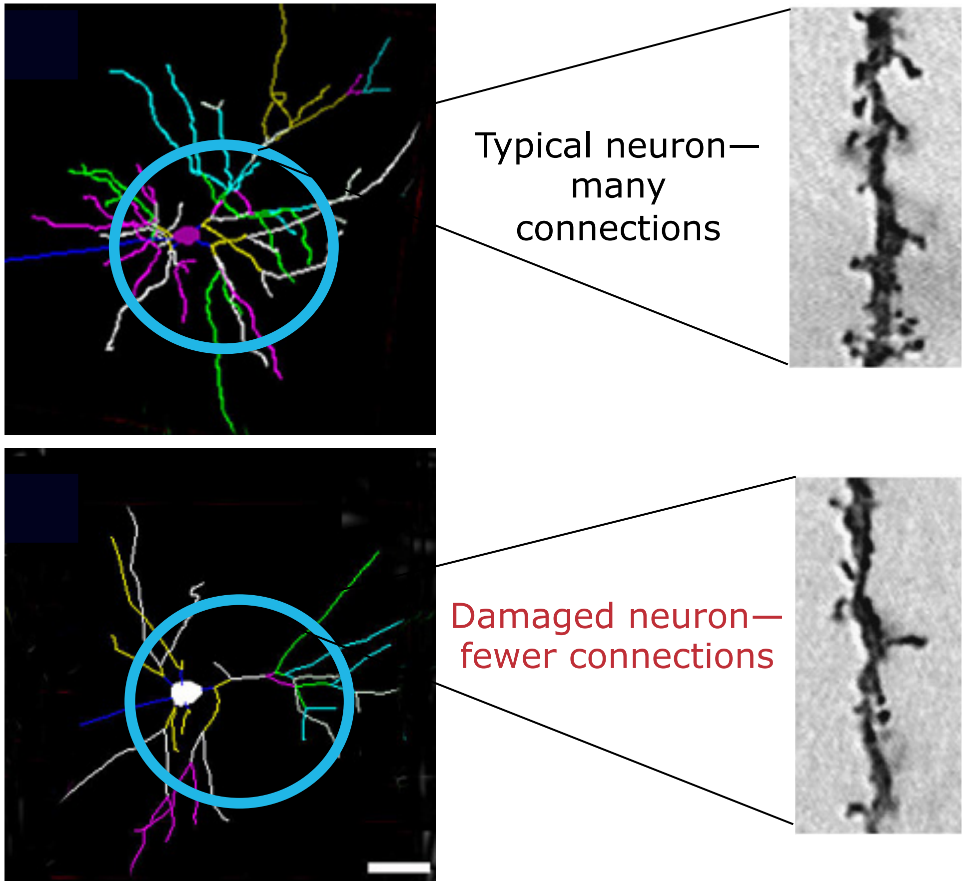
Source: SAMHSA (2002) Meth: What's Cooking in Your Neighborhood? (Video & Booklet)

Source: O'Hara & Swain (1996) International Review of Psychiatry

# Toxic Stress Changes Brain Architecture

Normal

Toxic stress

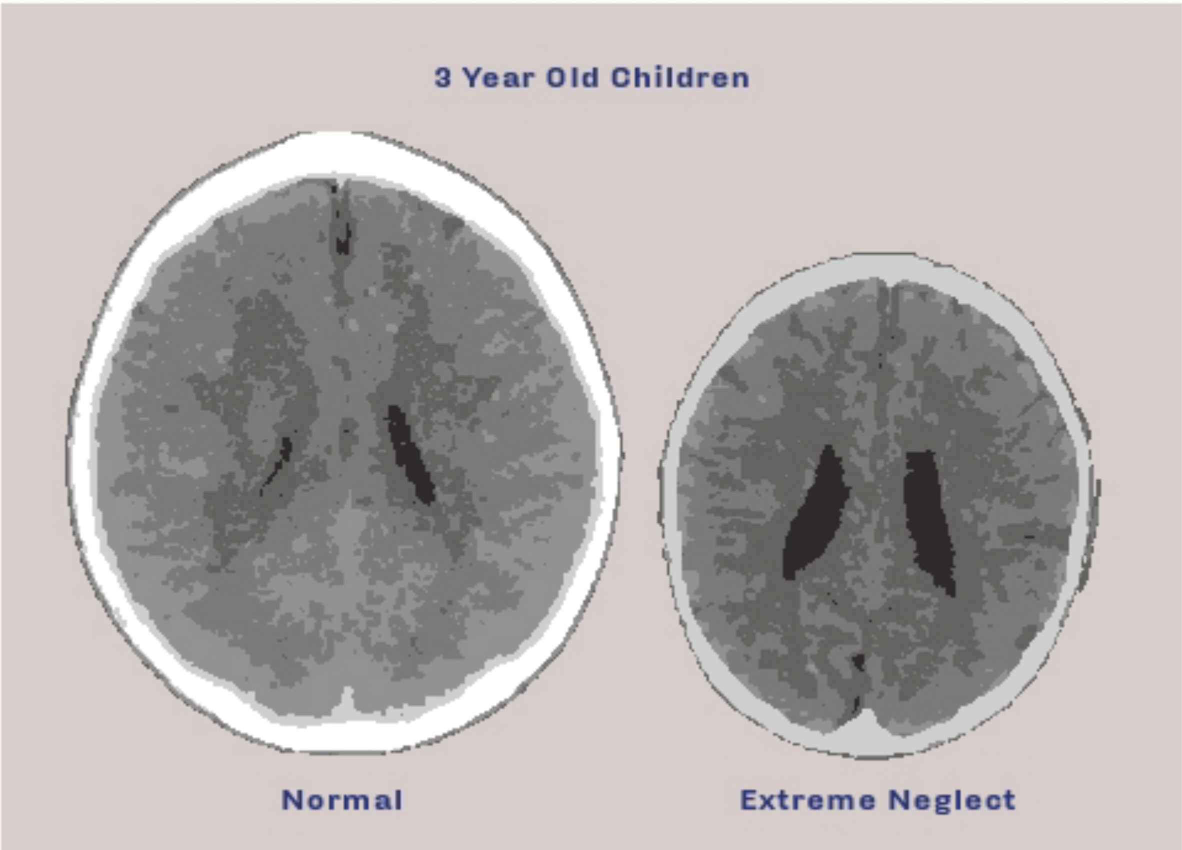



Prefrontal Cortex and Hippocampus

Sources: Radley et al. (2004) Neuroscience, 130, 805

Bock et al. (2005) Cerebral Cortex, 15, 802-8

# Abnormal brain development following sensory neglect in early childhood




**Significant size reduction:**

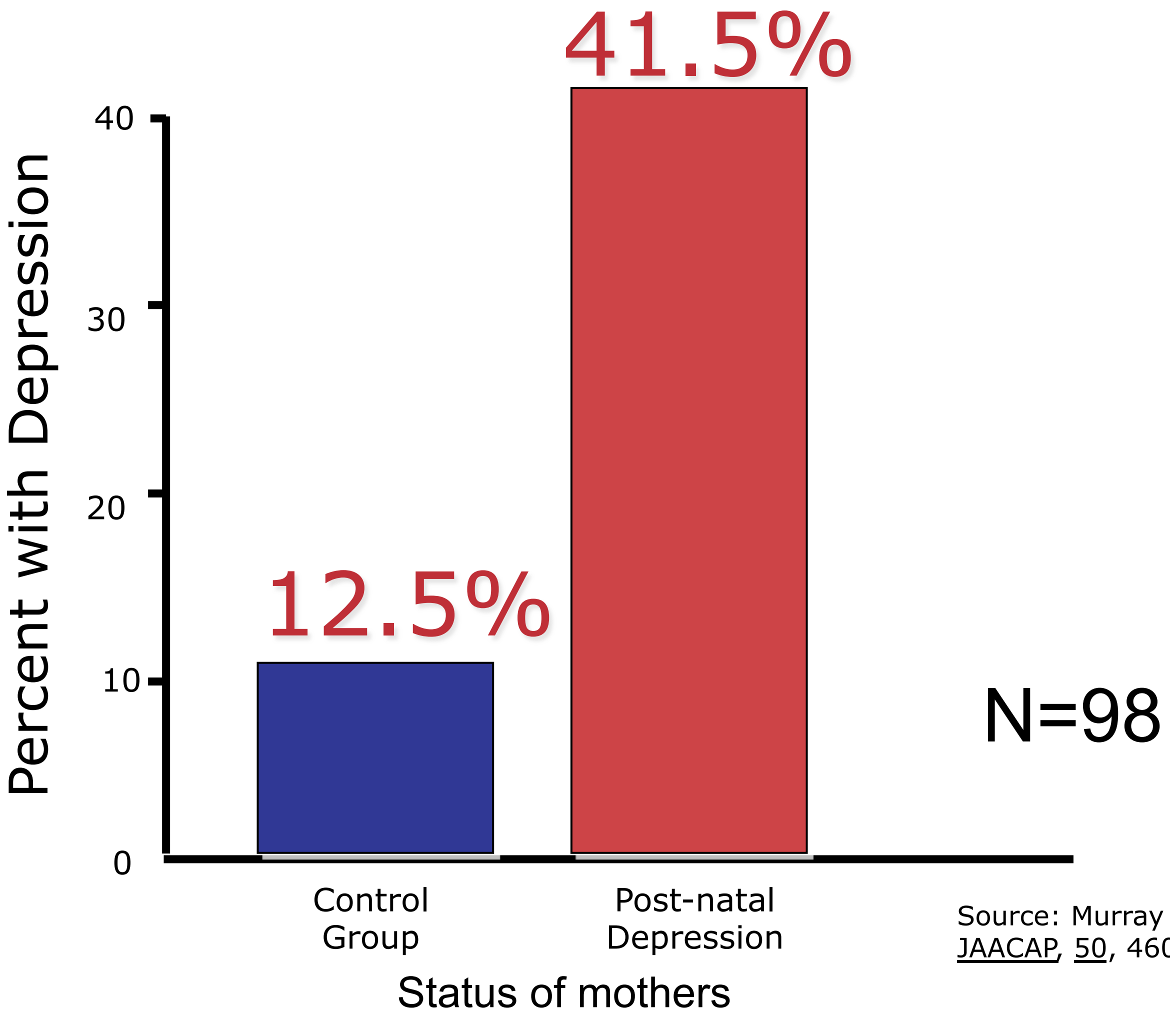
**50th vs. 3rd percentile**

**Enlarged ventricles**

**Cortical atrophy**

Perry, 2002

# Prevalence of depression at age 18 in children of post-natally depressed mothers



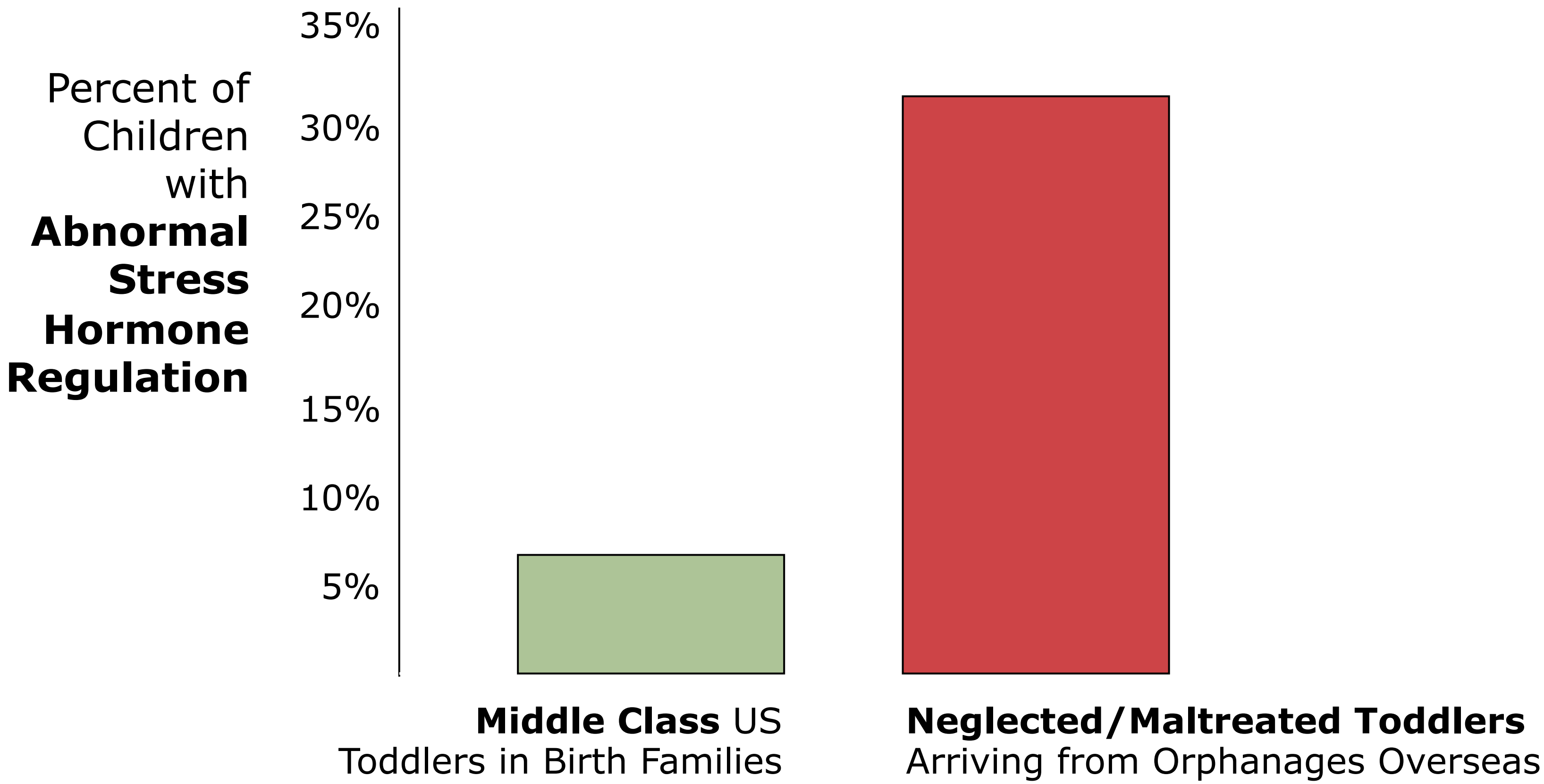

Source: Murray et al. (2011) JAACAP, 50, 460.

# Child Neglect and Abuse

In the United States, almost 3 million allegations of child abuse and neglect are received each year (1 million confirmed)

Mortality: 2,000 deaths per year
Morbidity: 18,000 permanently disabled children per year

# Institutionalization and Neglect of Young Children Disrupts Body Chemistry




Source: Gunnar & Fisher (2006) Development & Psychopathology, 18, 651-677

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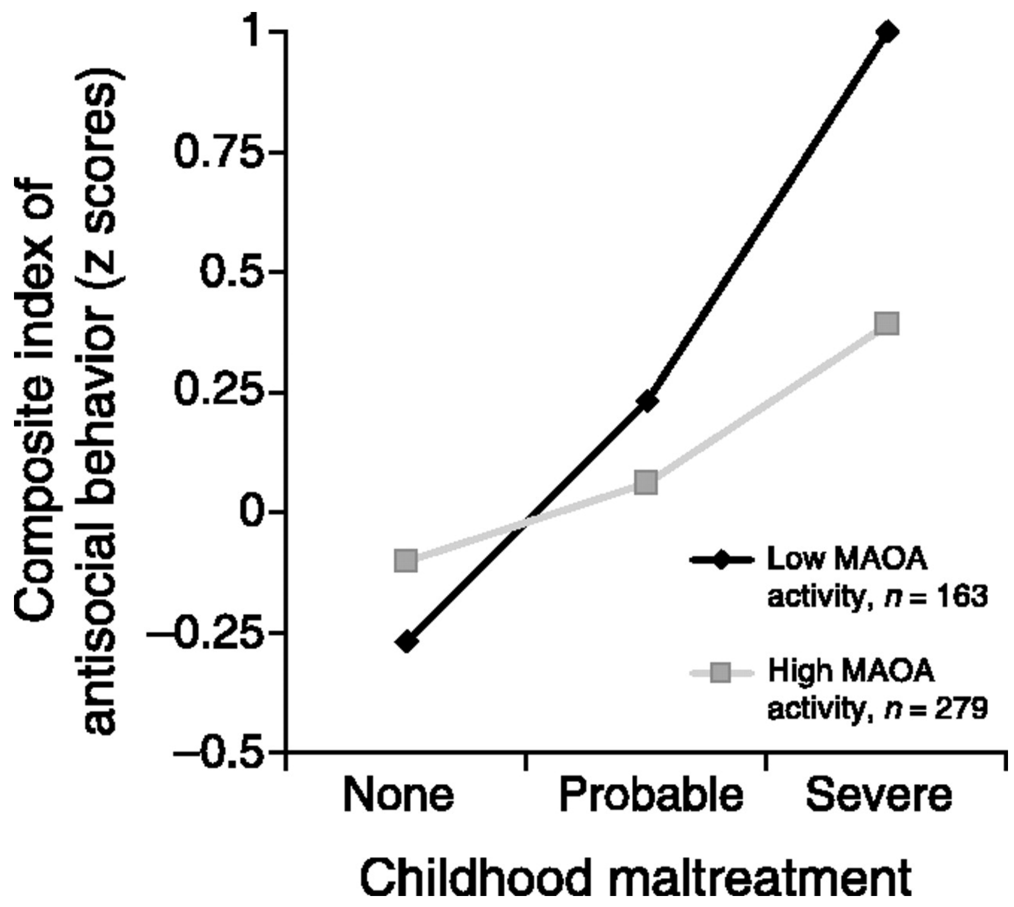
# Childhood maltreatment triggers gene expression

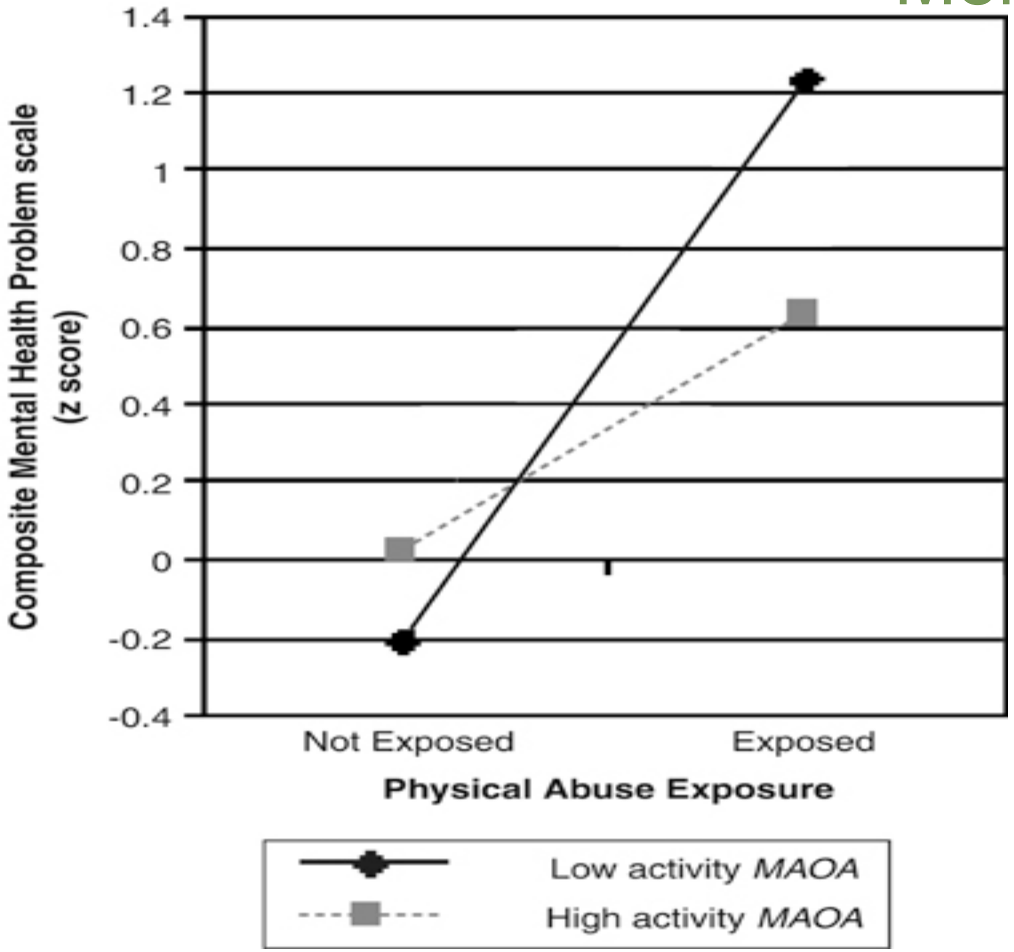



Antisocial behaviour as a function of monoamine oxidase A and childhood history of maltreatment

Caspi et al., 2002

# Physical abuse triggers monoamine-oxidase A
# The antisocial gene

## Mental health problems




Cohen et al., 2006

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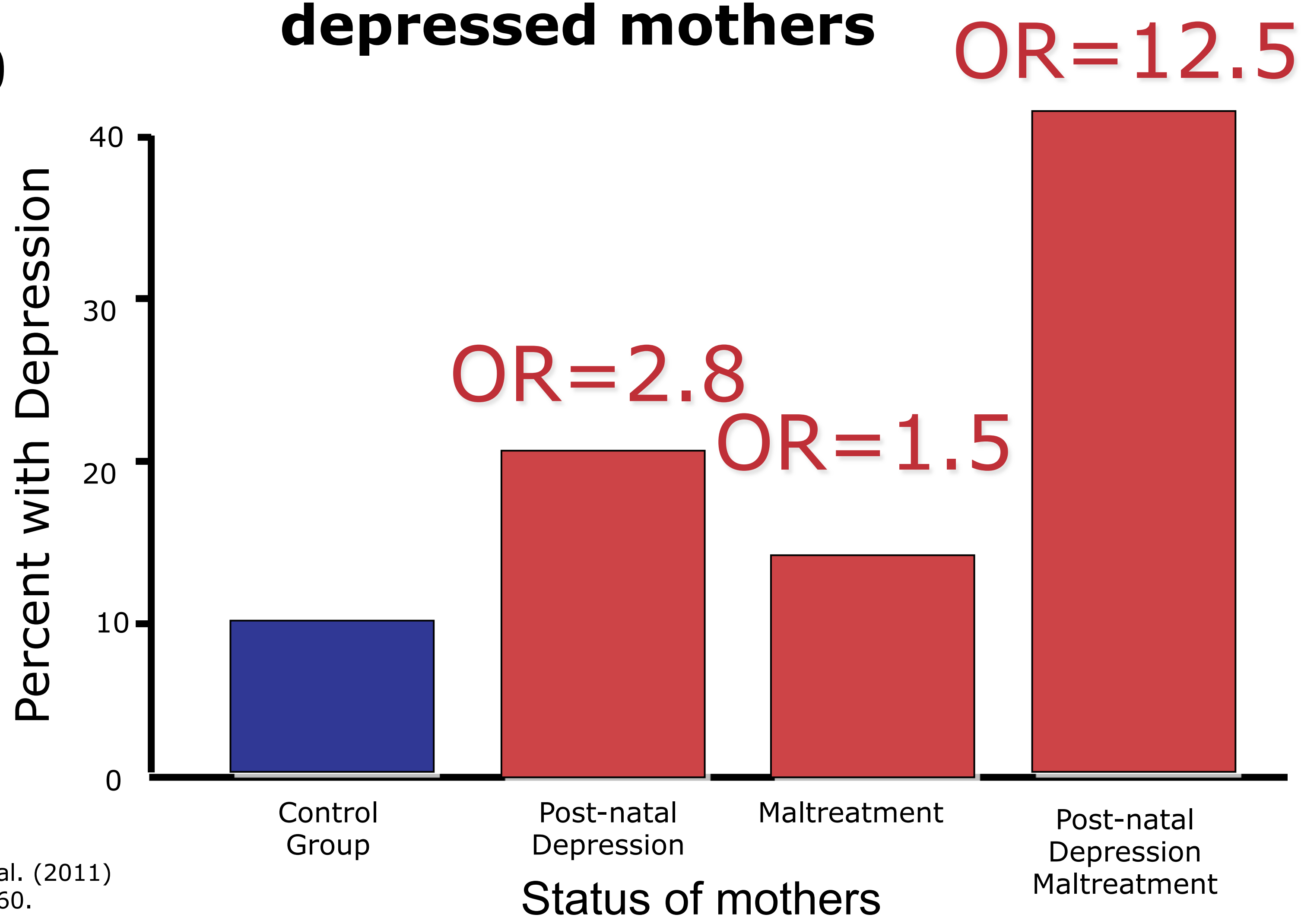
# Prevalence of depression and/or conduct problems at age 11/16 in maltreated children of post-natally depressed mothers

N=120




Source Pawlby et al. (2011) BJ,Psychiat, 50, 460.

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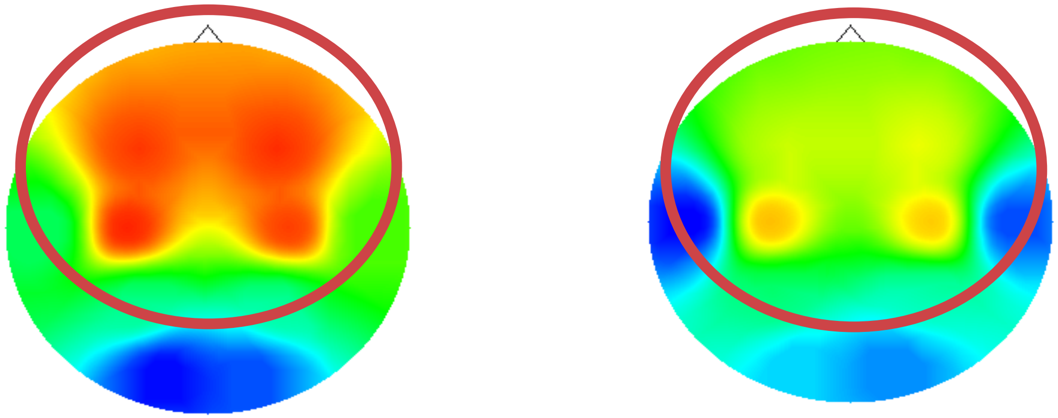
# Extreme Neglect Reduces Brain Power



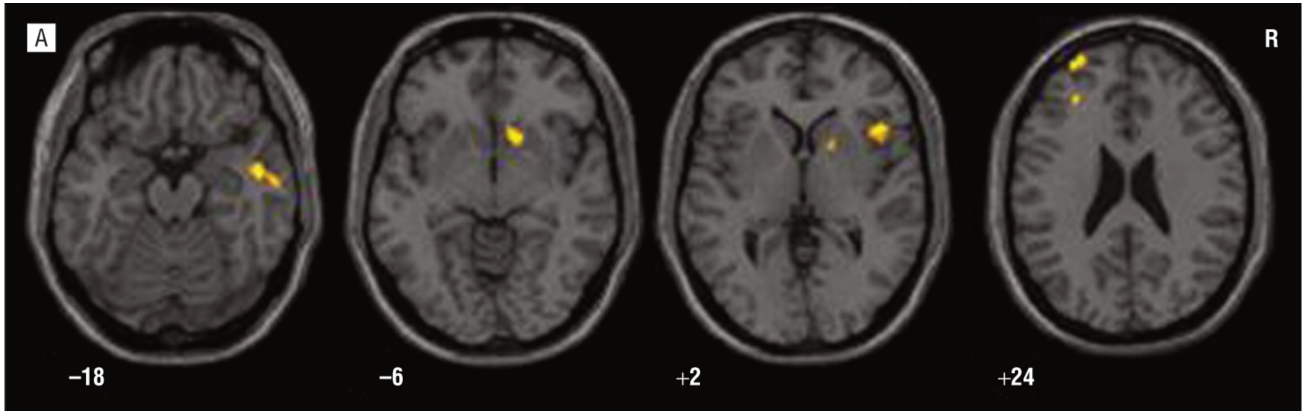
Positive Relationships | Extreme Neglect

Source: Nelson (2008) Journal of the American Academy of Child & Adolescent Psychiatry, 47, 1252; Marshall, Fox & BEIP (2004) Journal of Cognitive Neuroscience, 16, 1327

# Anatomical anomalies

## Adolescents (12-17) who suffered childhood trauma

Physical Abuse




Left dorsolateral prefrontal cortex | Left lateral rostral prefrontal cortex | Right orbitofrontal cortex | Right ventral striatum, right insula and right temporal association cortex

These regions are associated to:

- •Interoceptive body and emotional monitoring
- •Face perception
- •Empathic perception of others' emotions
- •Body ownership

Risk for:

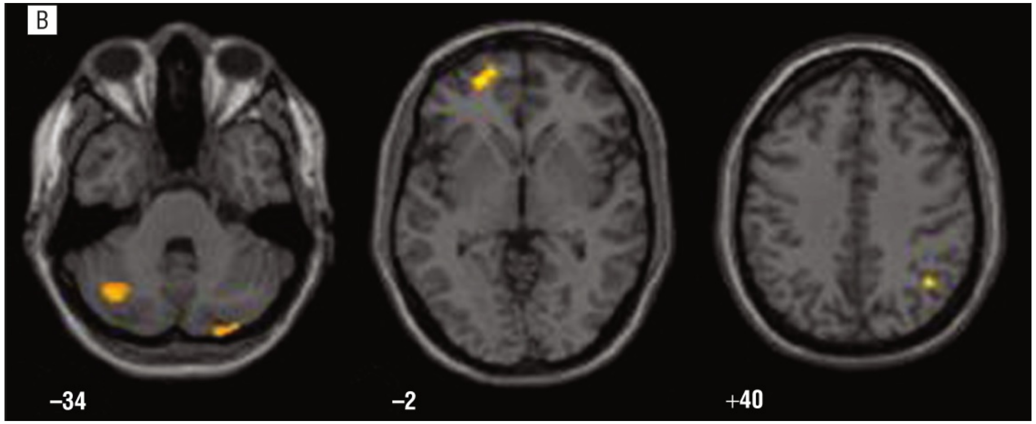
- •Dissociative symptoms
- •BPD
- •PTSD

Edmiston et al., 2011

# Anatomical anomalies

## Adolescents (12-17) who suffered childhood trauma

**Physical Neglect**




Left lateral rostral prefrontal cortex

Right parietal association cortex

Bilateral cerebellum

<u>These regions are associated to:</u>

- •Traumatic PTSD-like reminders
- •Emotional autobiographic memory
- •Fear conditioning

<u>Risk for:</u>

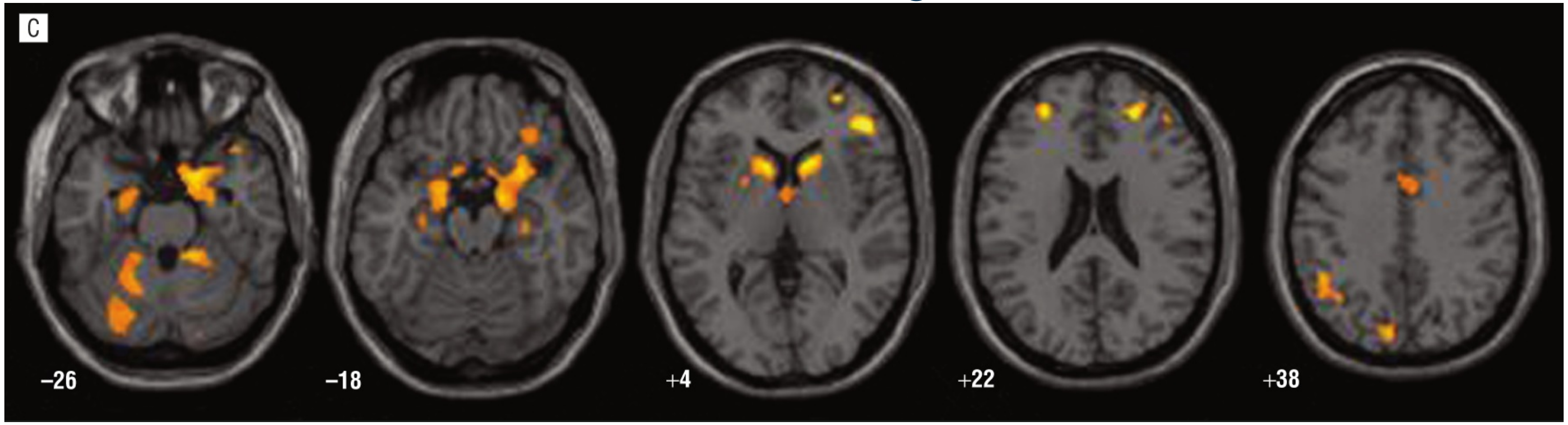
- •Affective and anxious symptoms
- •PTSD

Edmiston et al., 2011

# Anatomical anomalies

## Adolescents (12-17) who suffered childhood trauma

Emotional Neglect




Bilateral dorsolateral prefrontal cortex, bilateral rostral prefrontal cortex, right superior frontal gyrus, right orbitofrontal cortex, bilateral sub-genual prefrontal cortex, bilateral striatum, bilateral amygdala and hippocampus, left parietal association cortex, left occipital association cortex, bilateral cerebellum, and regions of hypothalamus and midbrain

These regions are also associated to emotional regulation

Risk for:

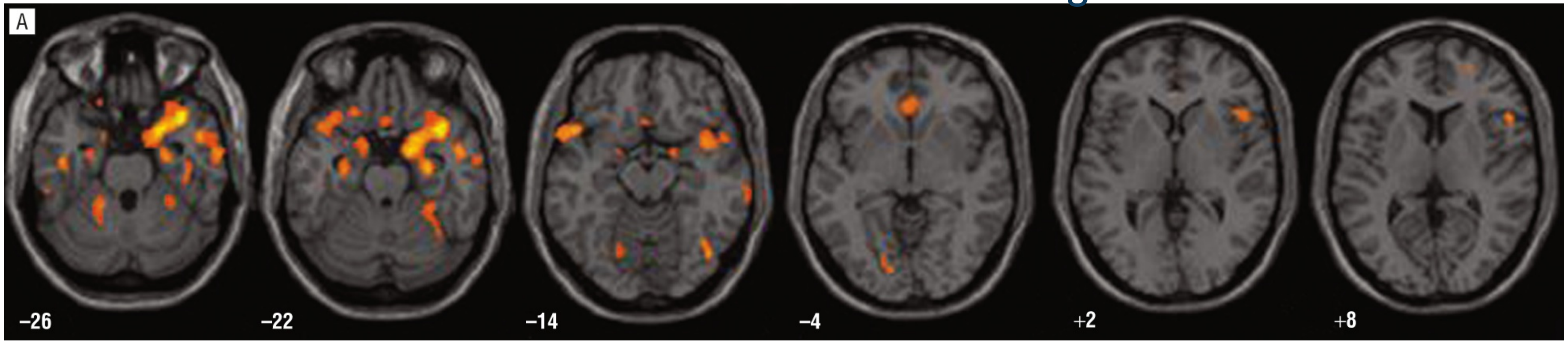
- Mood disorders

Edmiston et al., 2011

# Anatomical anomalies

## Adolescents (12-17) who suffered childhood trauma

Childhood trauma in girls




Right rostral prefrontal cortex, Bilateral orbital prefrontal cortex, Bilateral sub-genual PFC, Bilateral amygdala and hippocampus, right insula, bilateral fusiform gyrus, right temporo-occipital association cortex, left occipital association cortex and bilateral cerebellum.

Besides the mentioned risks, and considering the gender-differentiated development of the brain, childhood trauma puts girls in higher risk for **mood disorders**

Edmiston et al., 2011

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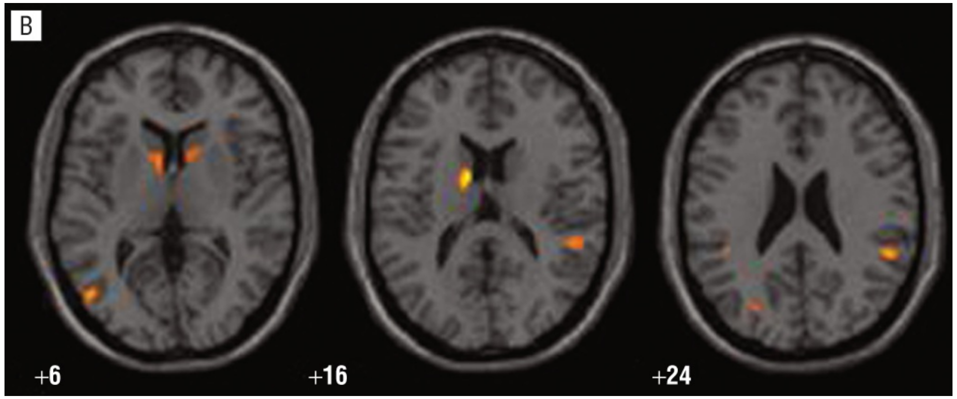
# Anatomical anomalies

## Adolescents (12-17) who suffered childhood trauma

Childhood trauma in boys

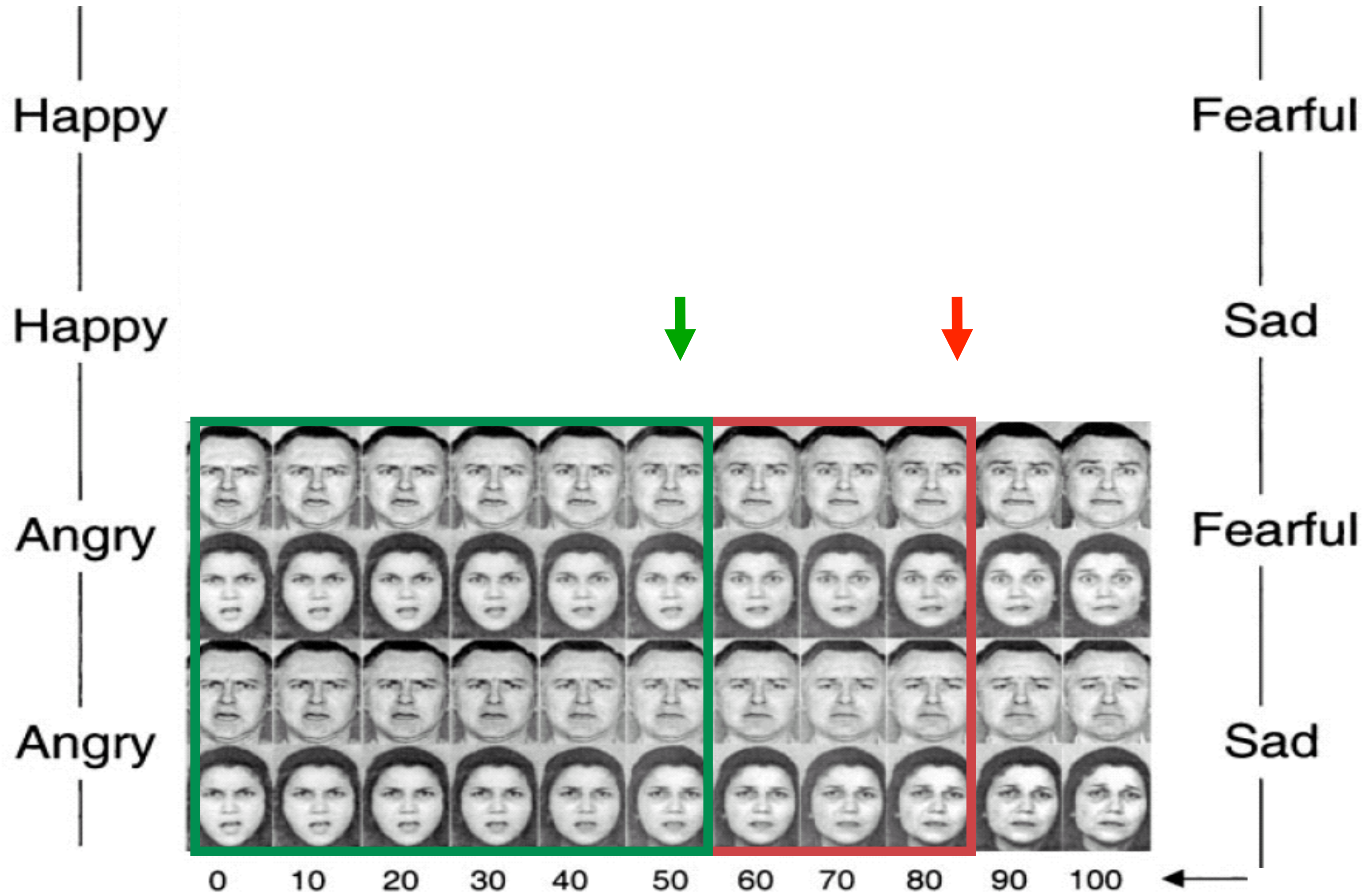



Bilateral caudate, bilateral temporoparietal cortex and left temporo-occipital association cortex.

…while boys who suffered childhood trauma are more at risk for
impulse control disorders

Edmiston et al., 2011

# Early Maltreatment Affects Later Behavior

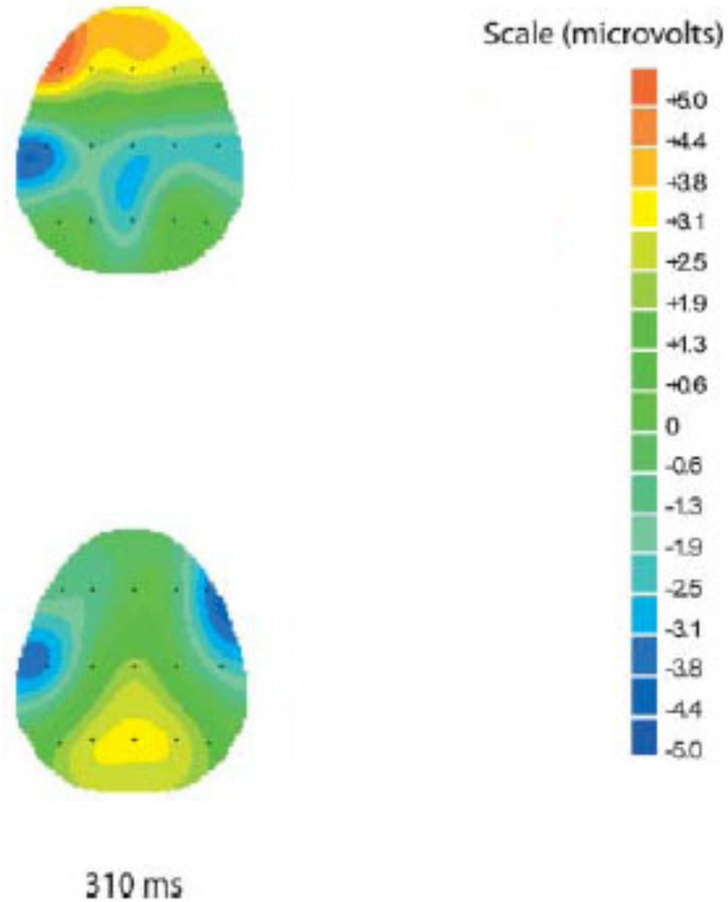



Source: Pollak & Kistler (2002) PNAS, 99, 9072

# EEG study of the responses of maltreated and non-maltreated children to viewing an angry face

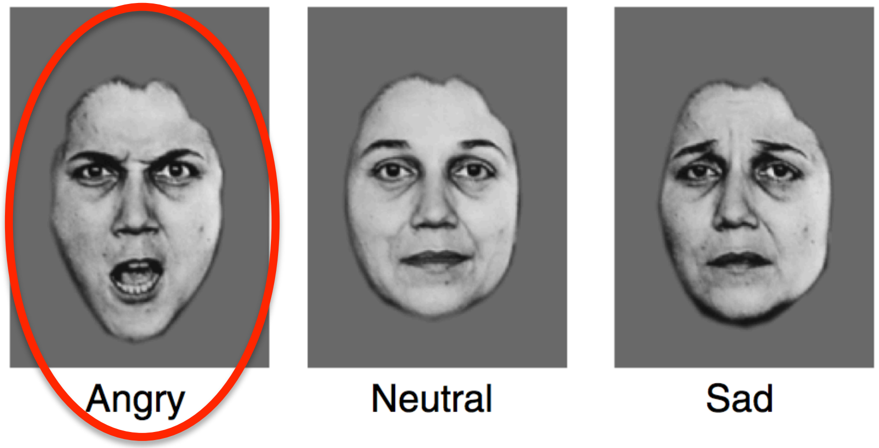
Maltreated group

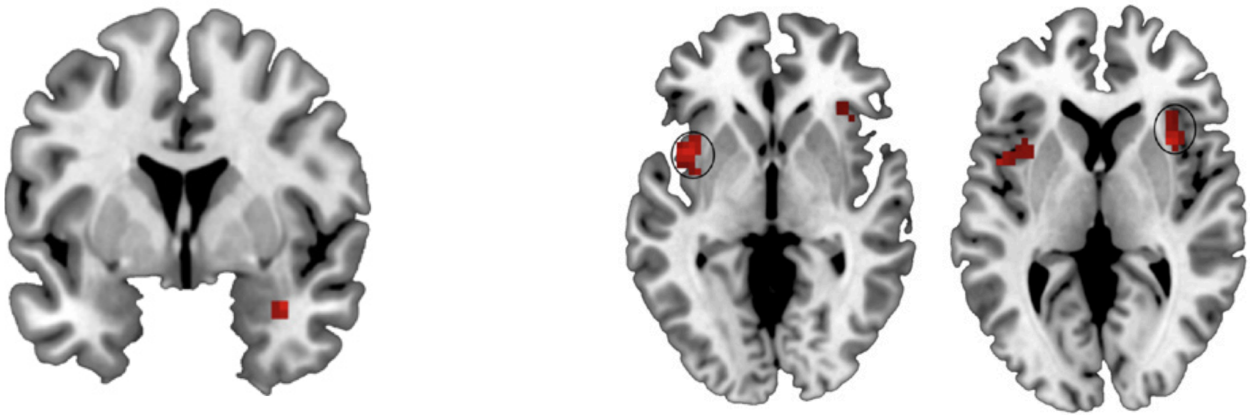
Comparison group




(Source: Cicchetti & Curtis, 2005, Dev. & Psychopath.)

# Functional anomalies of the traumatised brain



Amygdala hyperactivation

Bilateral anterior insula hyperactivation

McCrory et al., 2011

## Children exposed to family violence

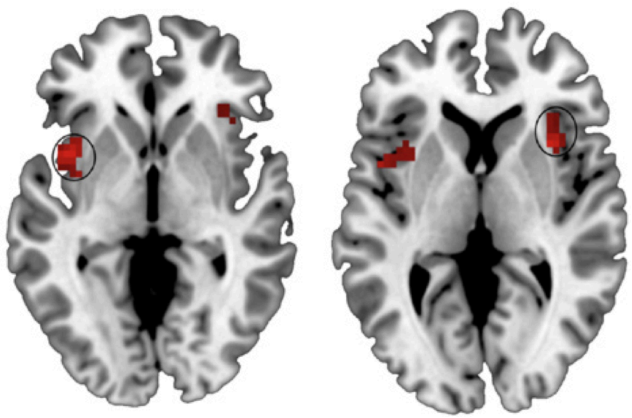
# Functional anomalies of the traumatised brain

- Face recognition independent of level of threat or emotionality

→ Detect threat
Anticipate pain ←

- Integrates emotional, sensory and bodily information
- Guides social processing and decision making

Amygdala
Hyperactivation



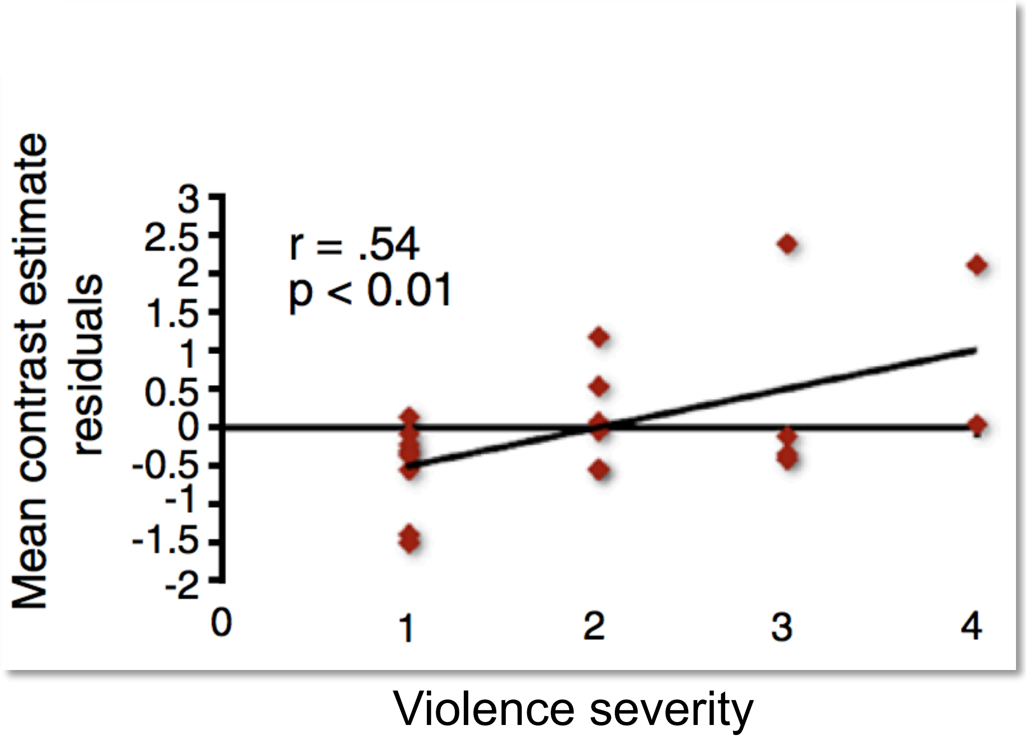
Bilateral anterior insula
hyperactivation

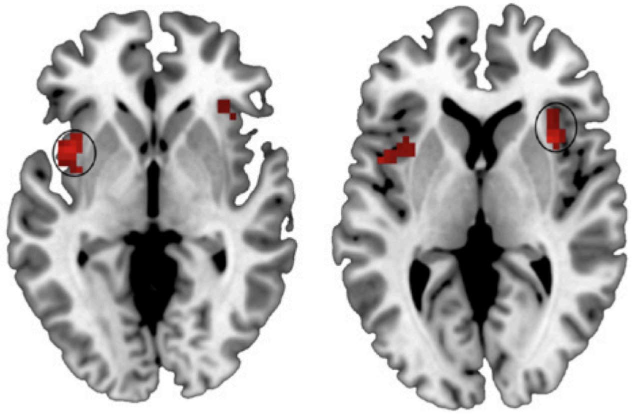
McCrory et al., 2011

## Children exposed to family violence

# Functional anomalies of the traumatised brain

The anterior insula activates more when violence has been more severe



McCrory et al., 2011

## Children exposed to family violence

# Functional anomalies of the traumatised brain

<ins>These anomalies could confer a short-term advantage:</ins>

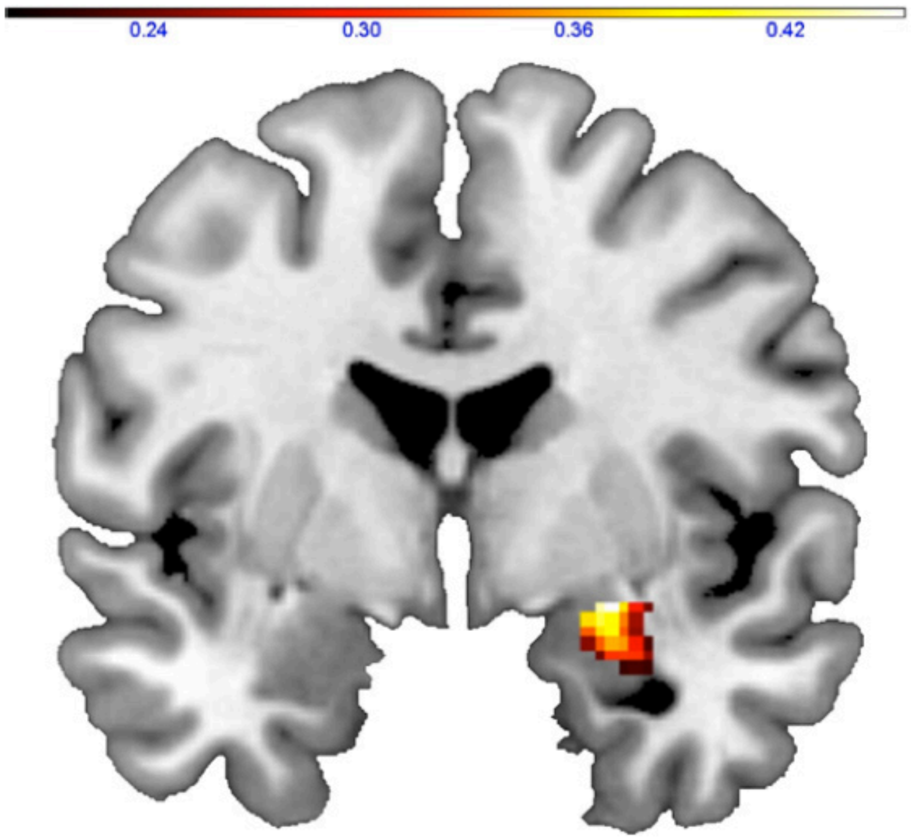
- Vigilance to threat
- It is found in healthy soldiers exposed to combat

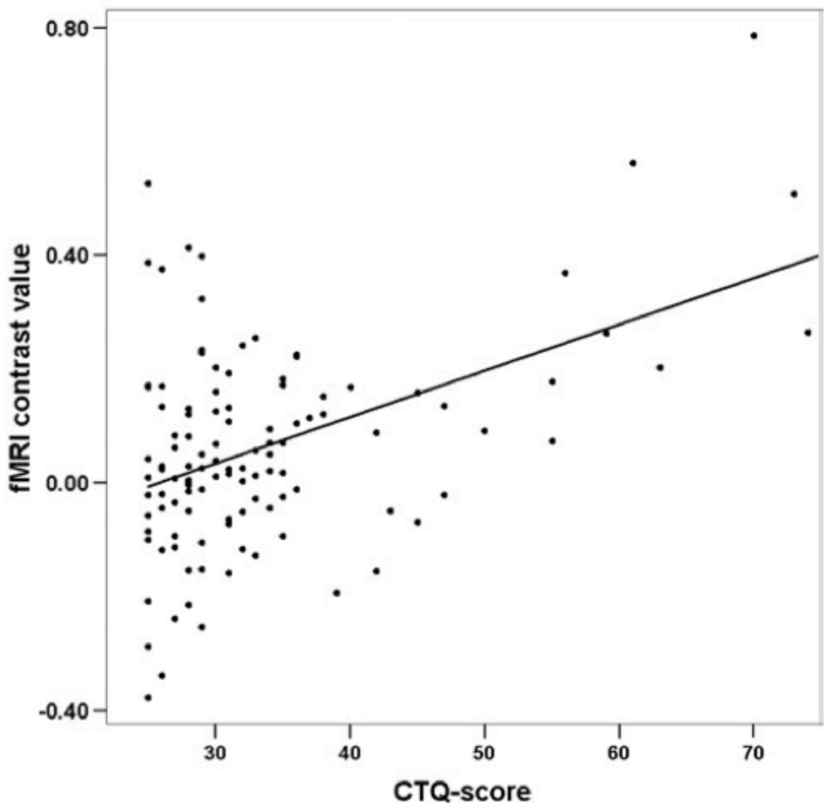
But they constitute a latent neural risk that predisposes to an increased likelihood of maladaptation in safe contexts (e.g. school) and of adult psychopathology

McCrory et al., 2011

# Functional consequences of childhood trauma

## Increased amygdala response to negative stimuli in healthy adults



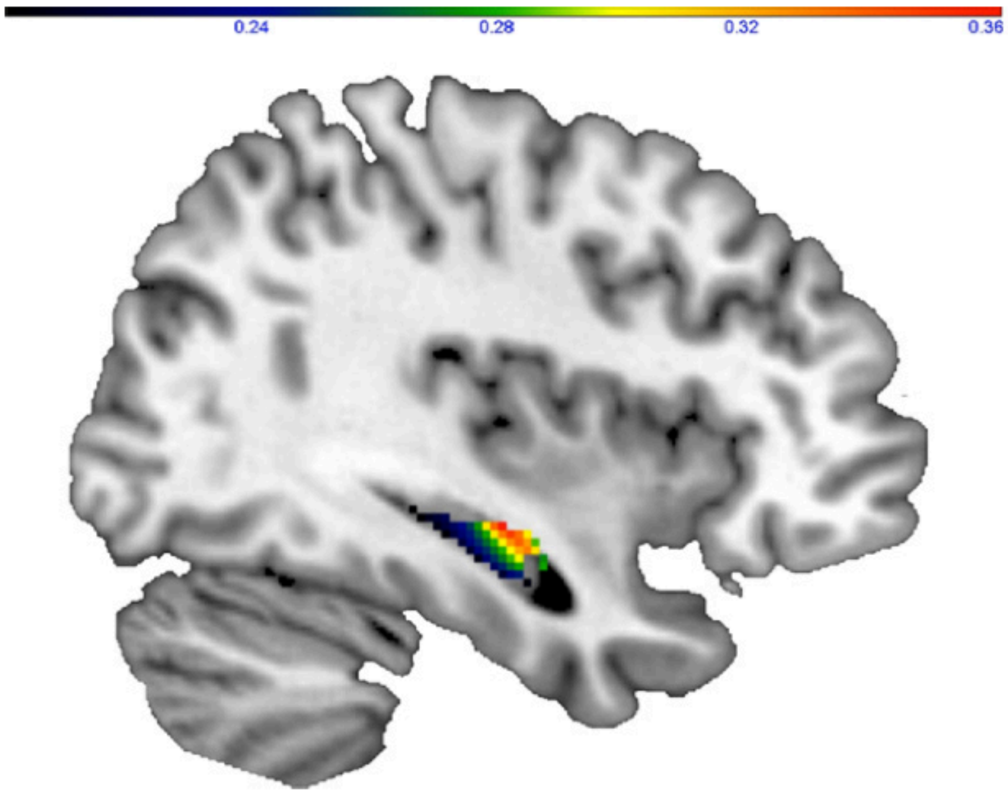

Usually, depressed patients present this anomaly

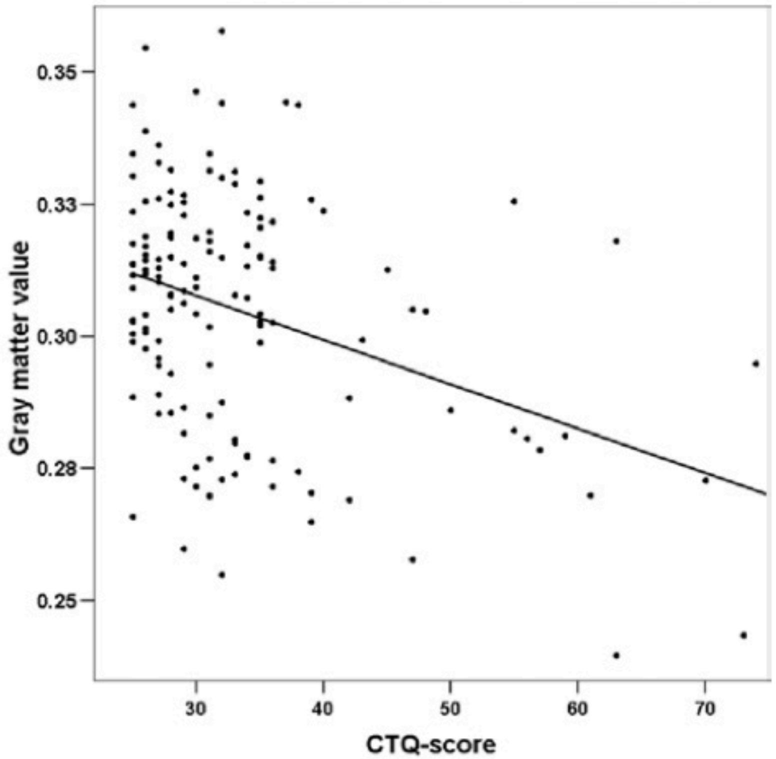
This study shows functional anomalies related to childhood trauma **in healthy adults**

Dannlowski et al., 2012

# Anatomical consequences of childhood trauma

## Underdevelopment of hippocampal gray matter in healthy adults

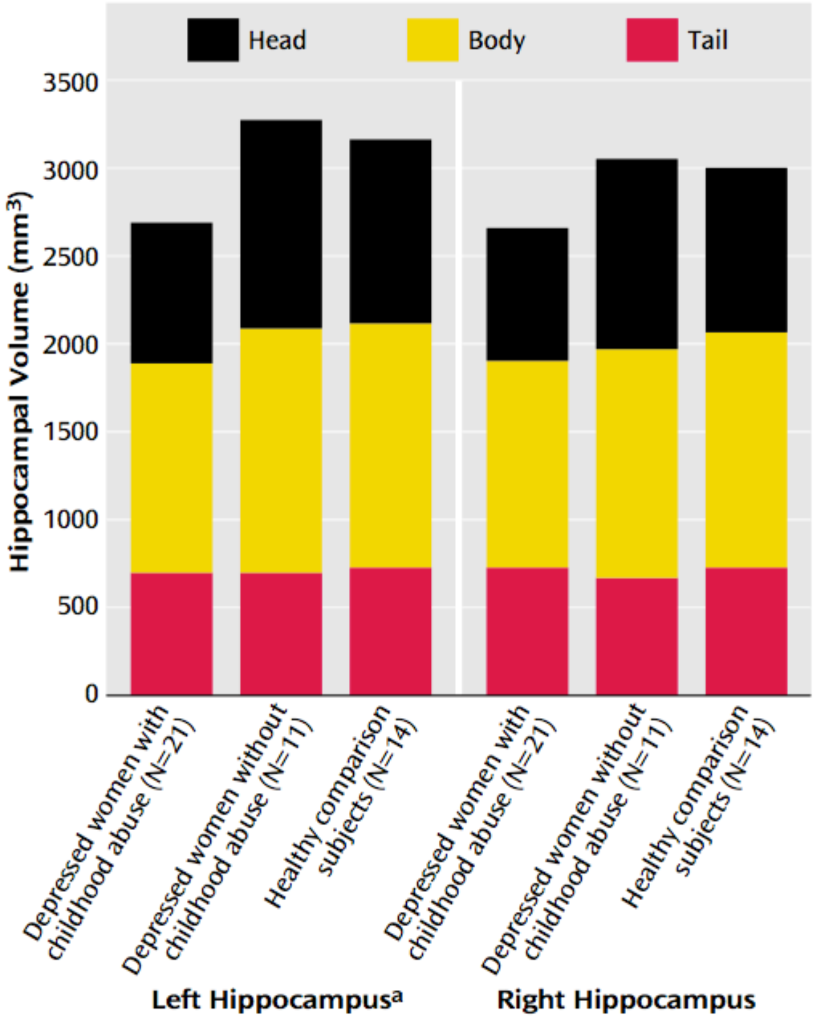



Usually, depressed and PTSD patients present this anomaly
This study shows structural anomalies related to childhood trauma **in healthy adults**

Dannlowski et al., 2012

# Reduced hippocampal volume as consequence of childhood abuse




**Depressed** women with history of childhood physical and/or sexual **abuse** present **reduced hippocampal** volumes

These structural abnormalities are present in patients with **treatment-resistant** depression

It is suggested that a history of childhood abuse could predict **poor response to antidepressants** in adult depression

Vythilingam et al.,, 2002

## In sum, the areas of the brain most vulnerable to early stress:

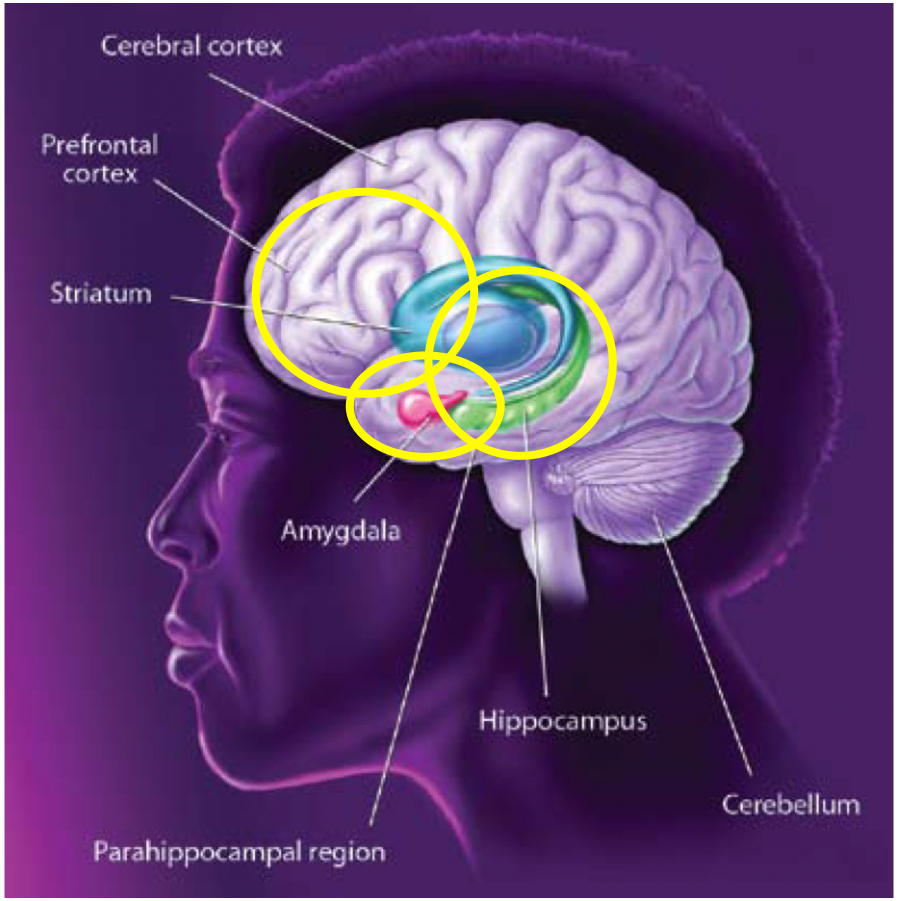
- Hippocampus
- Amygdala
- Neocortex
- Cerebellum
- Corpus callosum

**These areas have in common:**

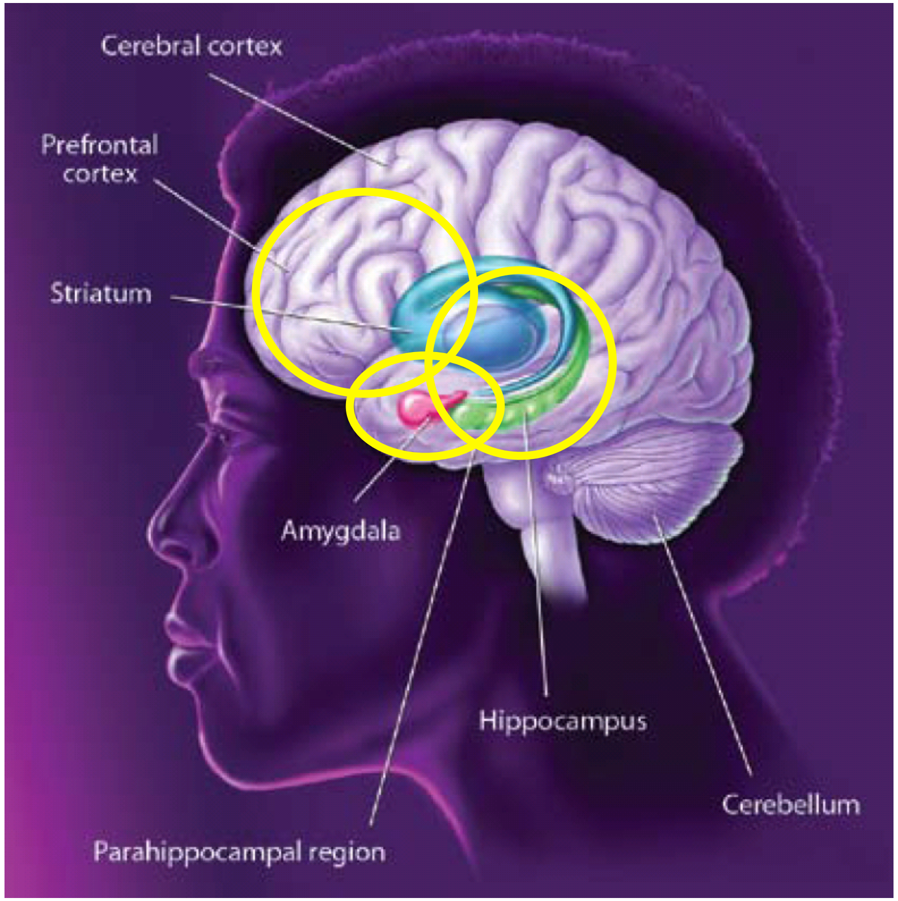
- Important later postnatal development (**experience expectant**)
- High density of **glucocorticoid receptors**
- And even, some degree of postnatal **neurogenesis**

Grassi-Oliveira, Ashy & Stein, 2008

# The Brain Architecture of Anxiety and Fear



# The Brain Architecture of Memory and Learning



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# Early Life Experiences Have Combined Life-Long Cumulative Impact on Physical Health

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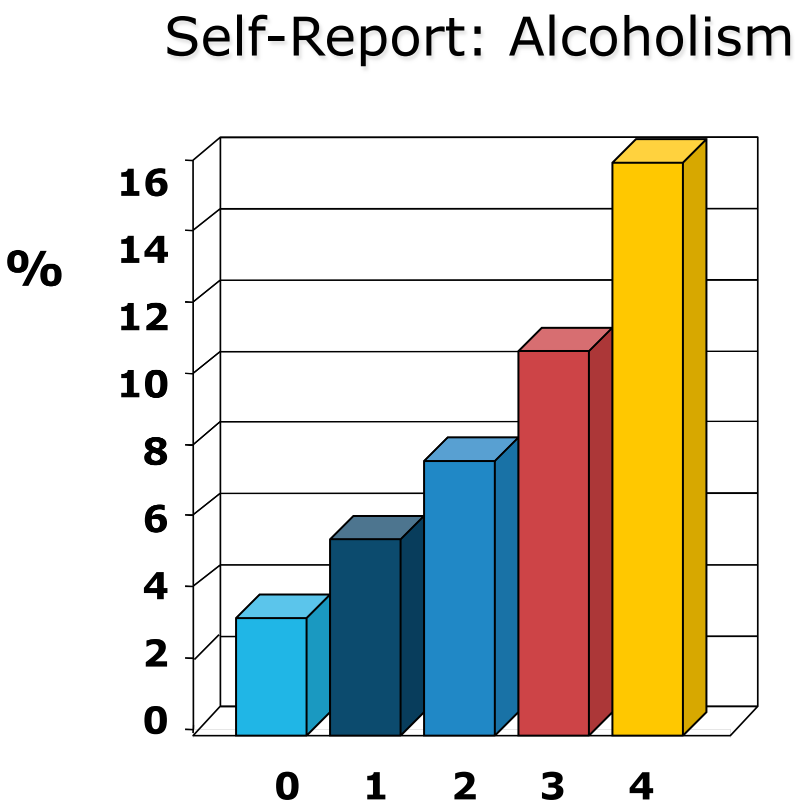
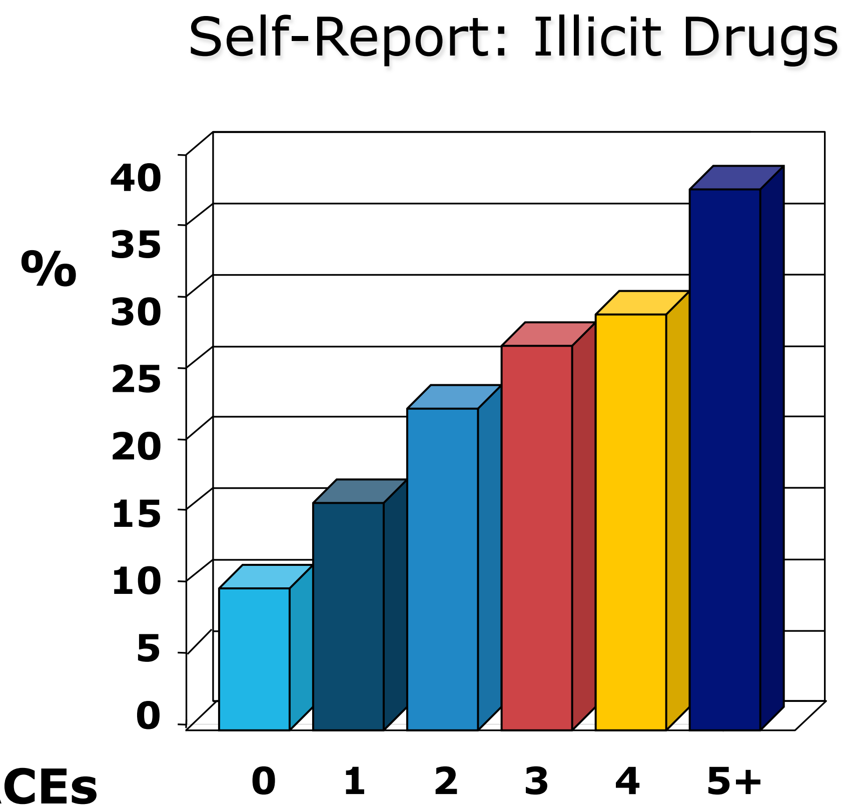
# Risk Factors for Adult Substance Abuse are Embedded in Adverse Childhood Experiences




Source: Dube et al, 2002 Addictive Behaviors, 27, 713

Source: Dube et al, 2005 American J Preven Med, 28, 430

**Schilling et al, BMC Public Health 7 (2007)**

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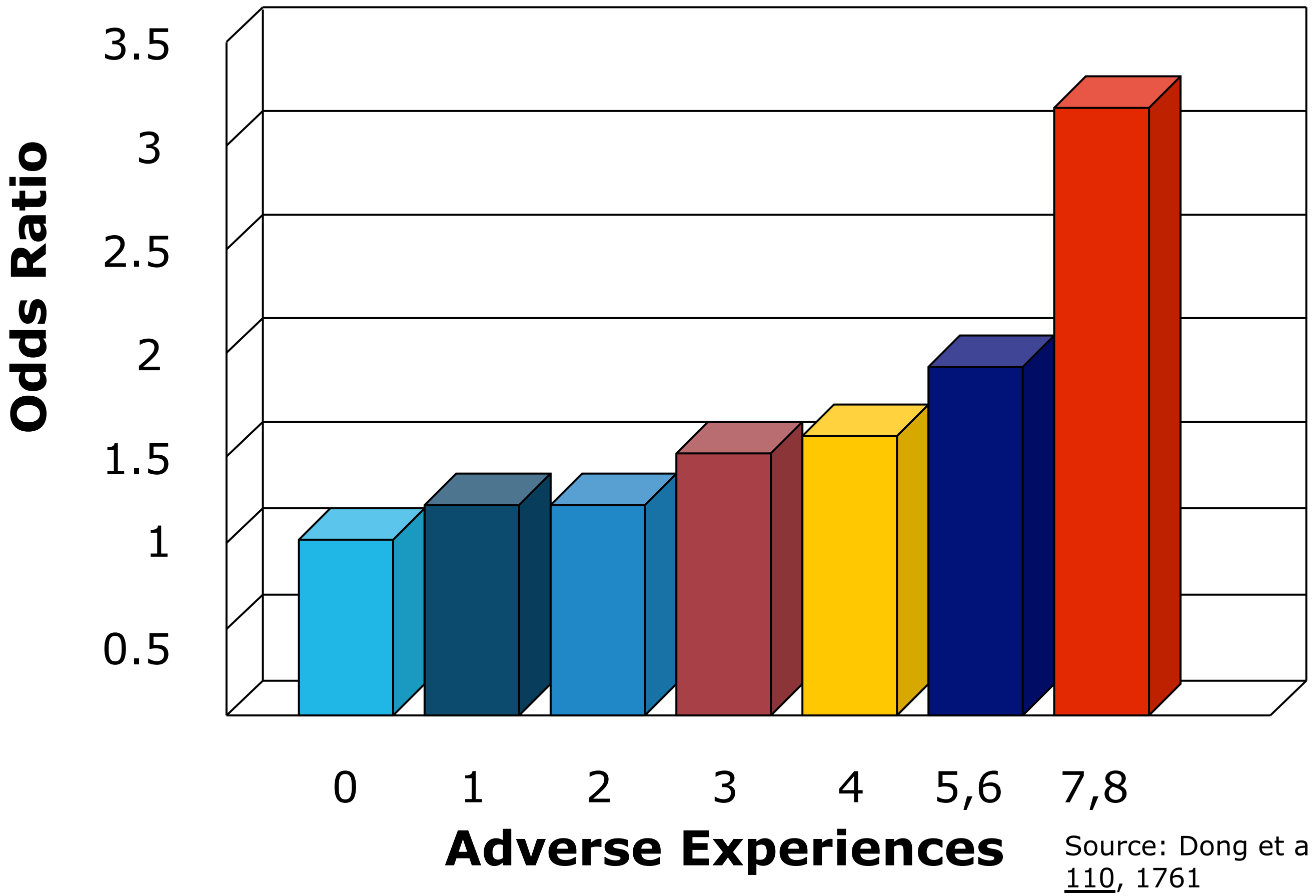
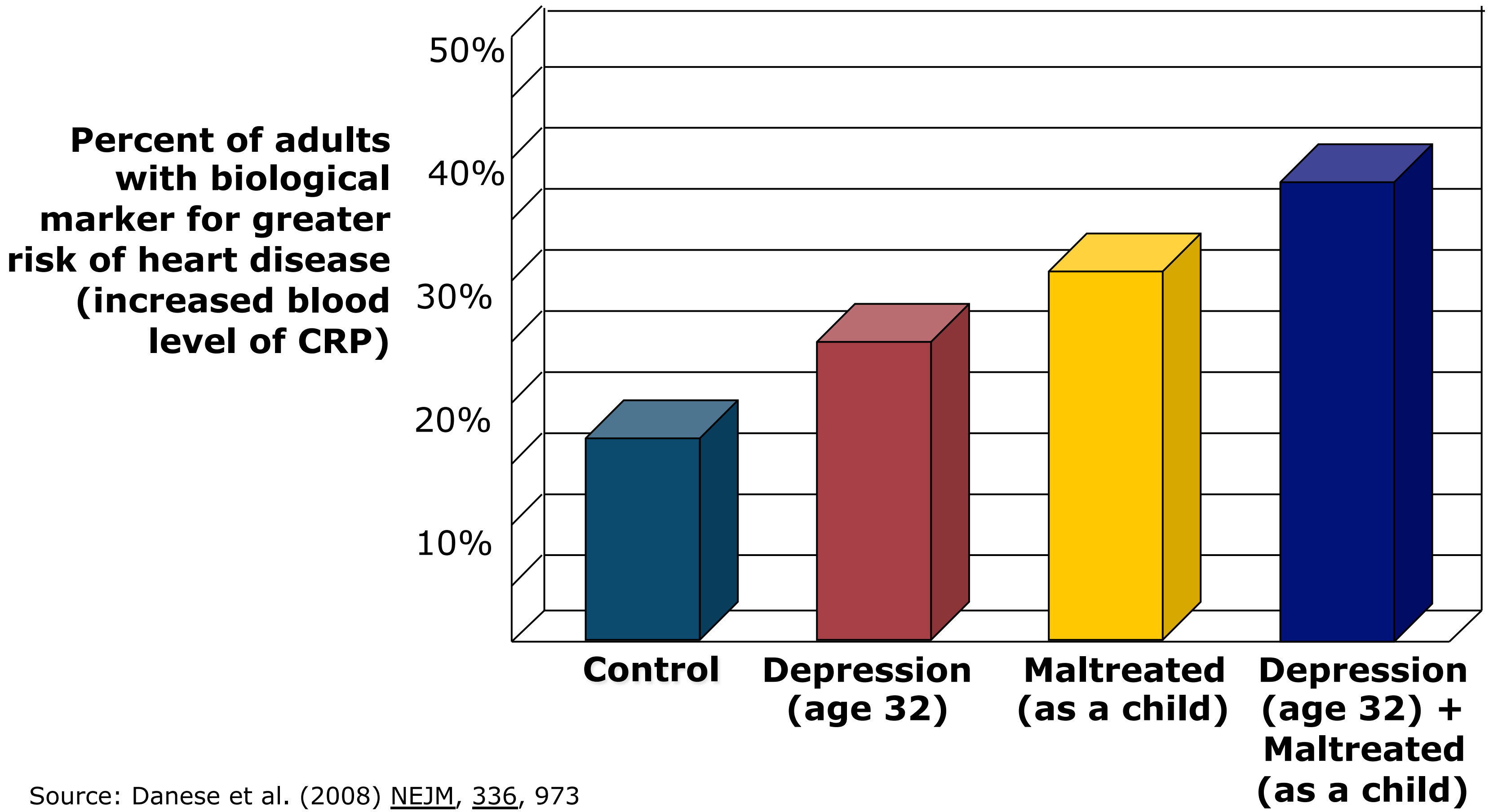
# Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences



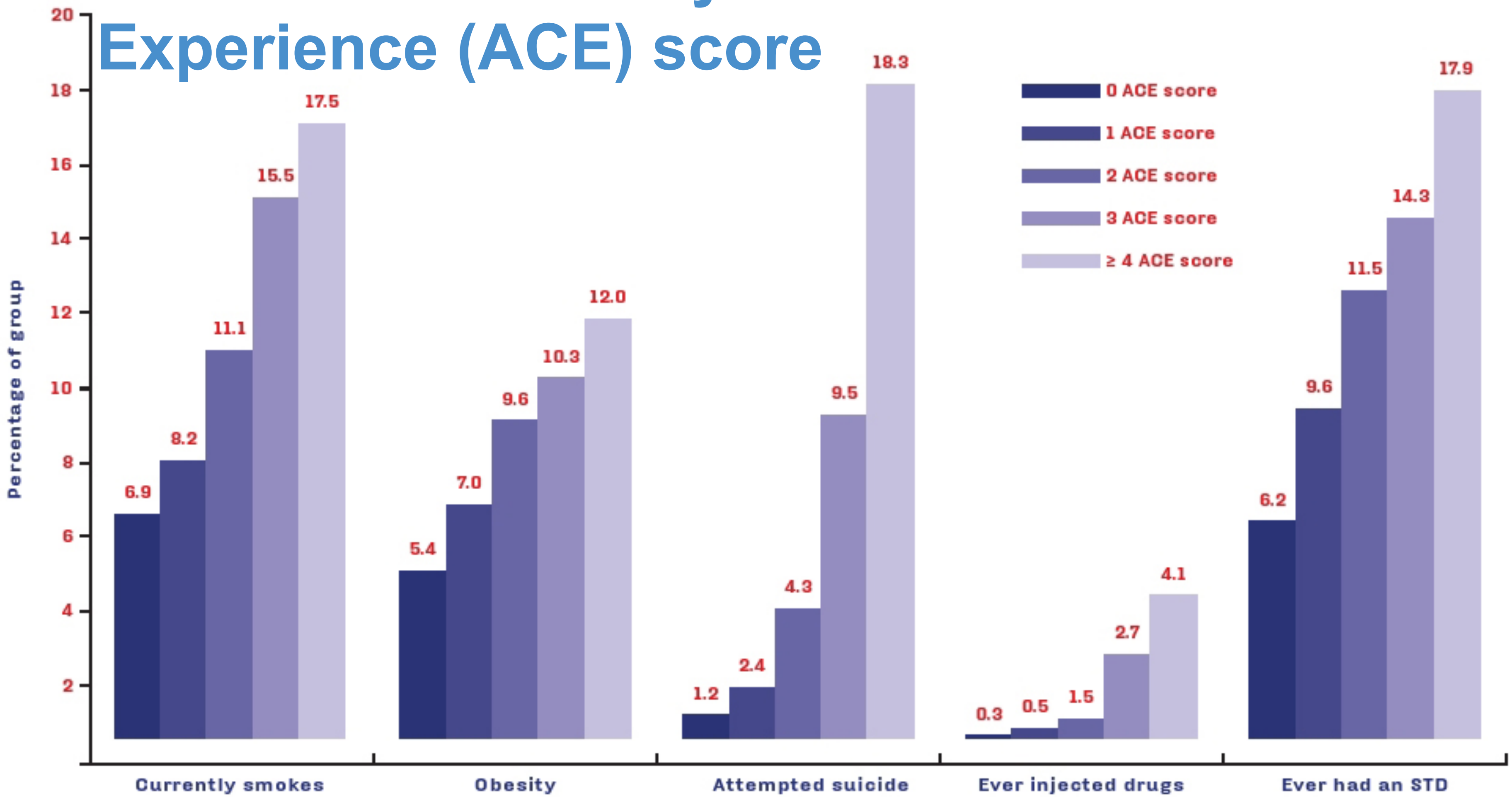

Source: Dong et al. (2004) Circulation, 110, 1761

# Biological Evidence Links Maltreatment in Childhood to Greater Risk of Adult Heart Disease



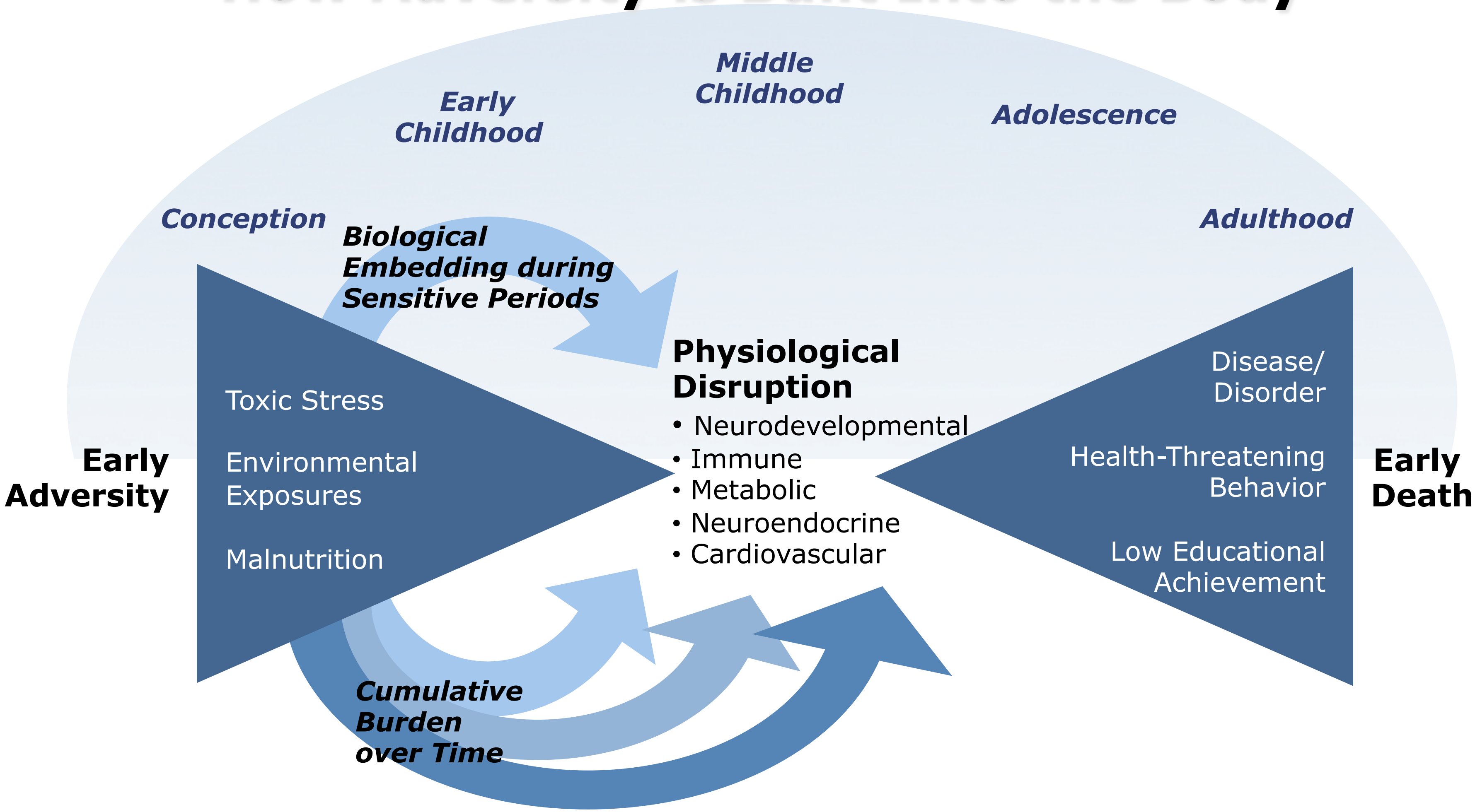

Source: Danese et al. (2008) NEJM, 336, 973

# Adult health risks by Adverse Childhood Experience (ACE) score

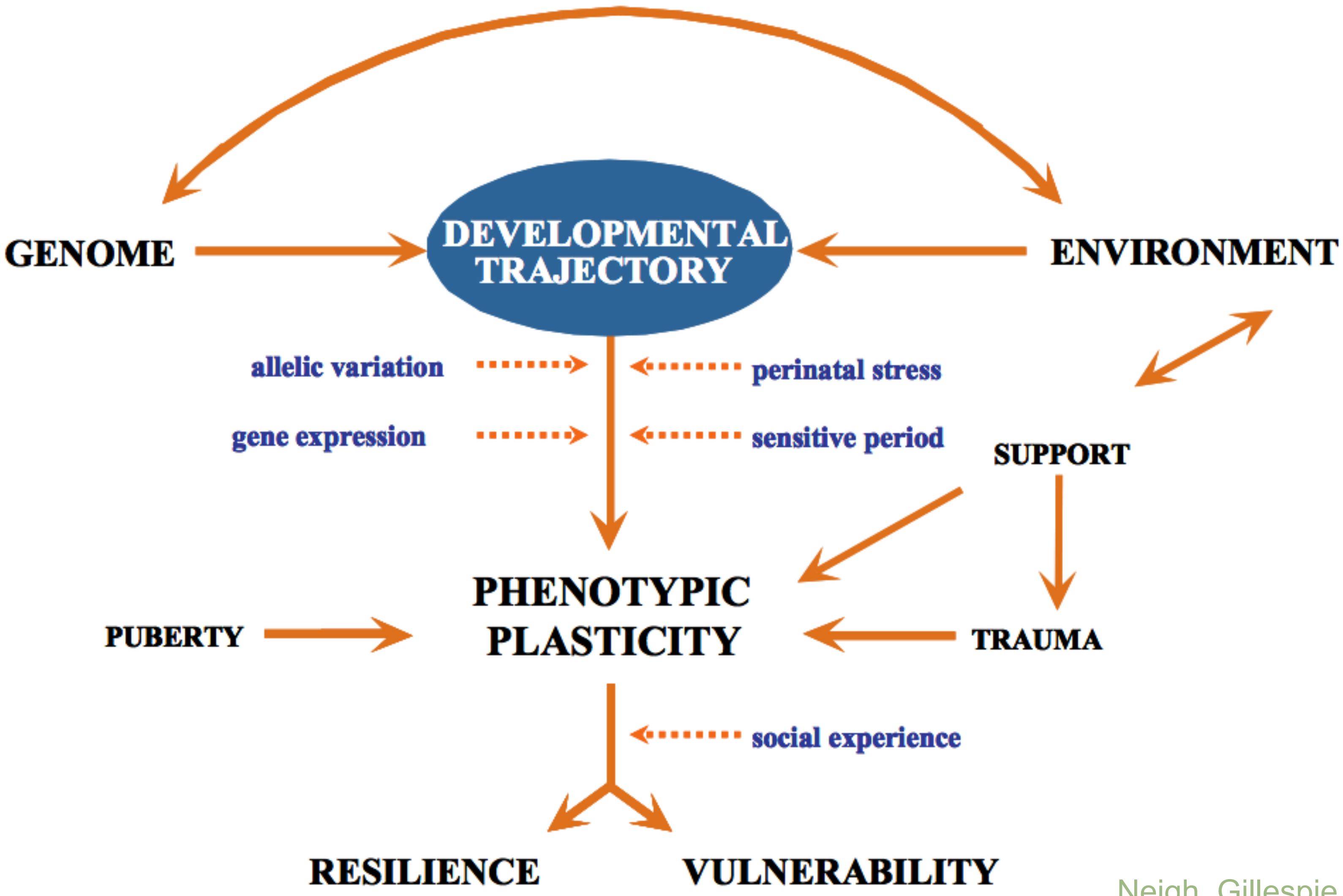



Anda, 2006

# The Childhood Roots of Health Disparities: How Adversity is Built Into the Body



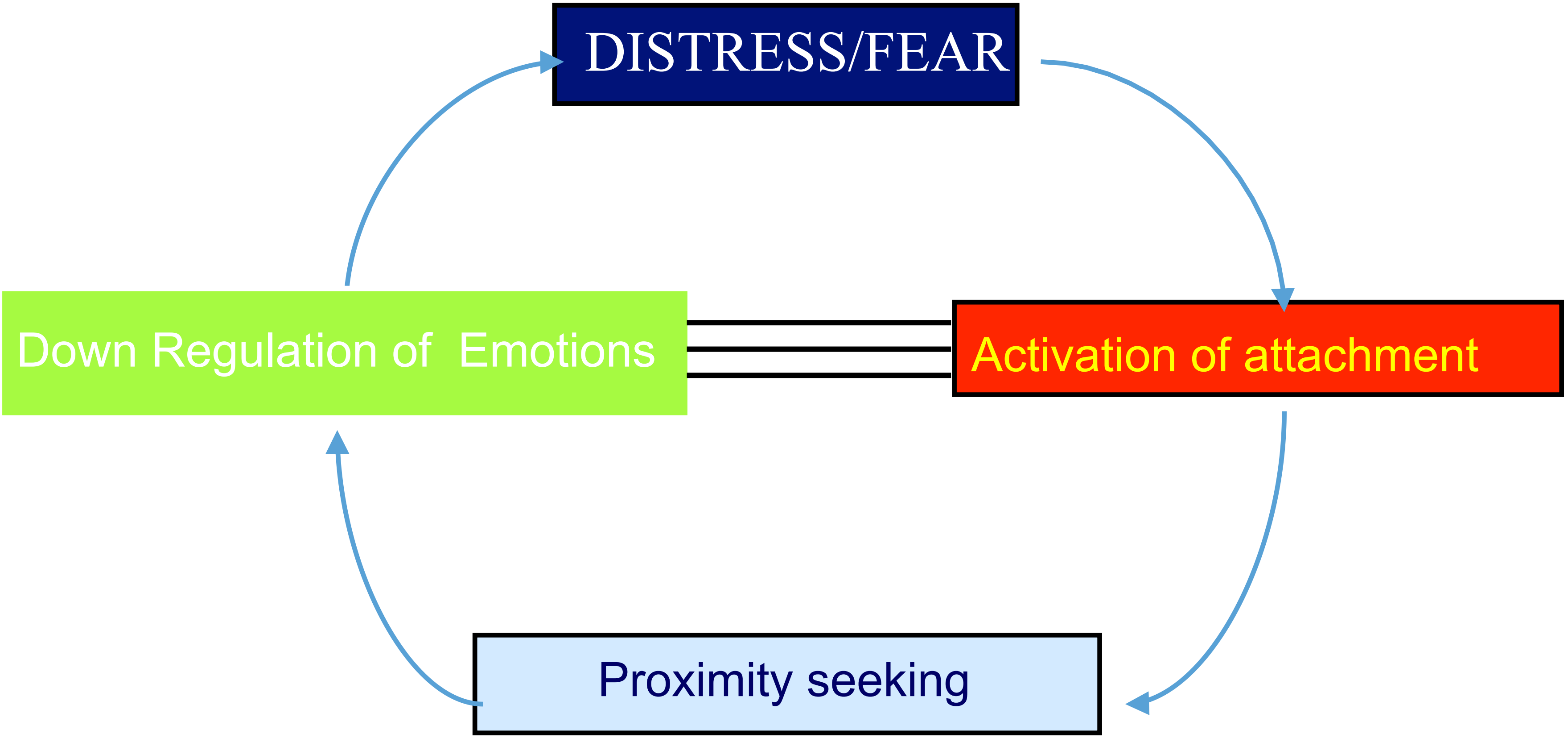
# A model for brain development




Neigh, Gillespie & Nemeroff, 2009

# Attachment Research Says that Remediation and Prevention ARE Possible

# How Does Attachment Work?




The forming of an attachment bond

# Functions of attachment

- Physical survival
  - Protection of life, then of brain development
- Emotional survival
  - Feeling loveable, interesting → turn to world
  - Stress regulation, being able to tolerate self and others
- Cognitive survival
  - Capacities – attention/focus, social skills and trust, curiosity: exploration and engagement with learning

# Disorganised Attachment Classification

Disorganised-disoriented infants
- freezing, hand clapping, wish to escape

Arousal of attachment system → attachment figure is both the haven of safety and the source of great stress

Associated with
- severe neglect
- physical abuse
- sexual abuse

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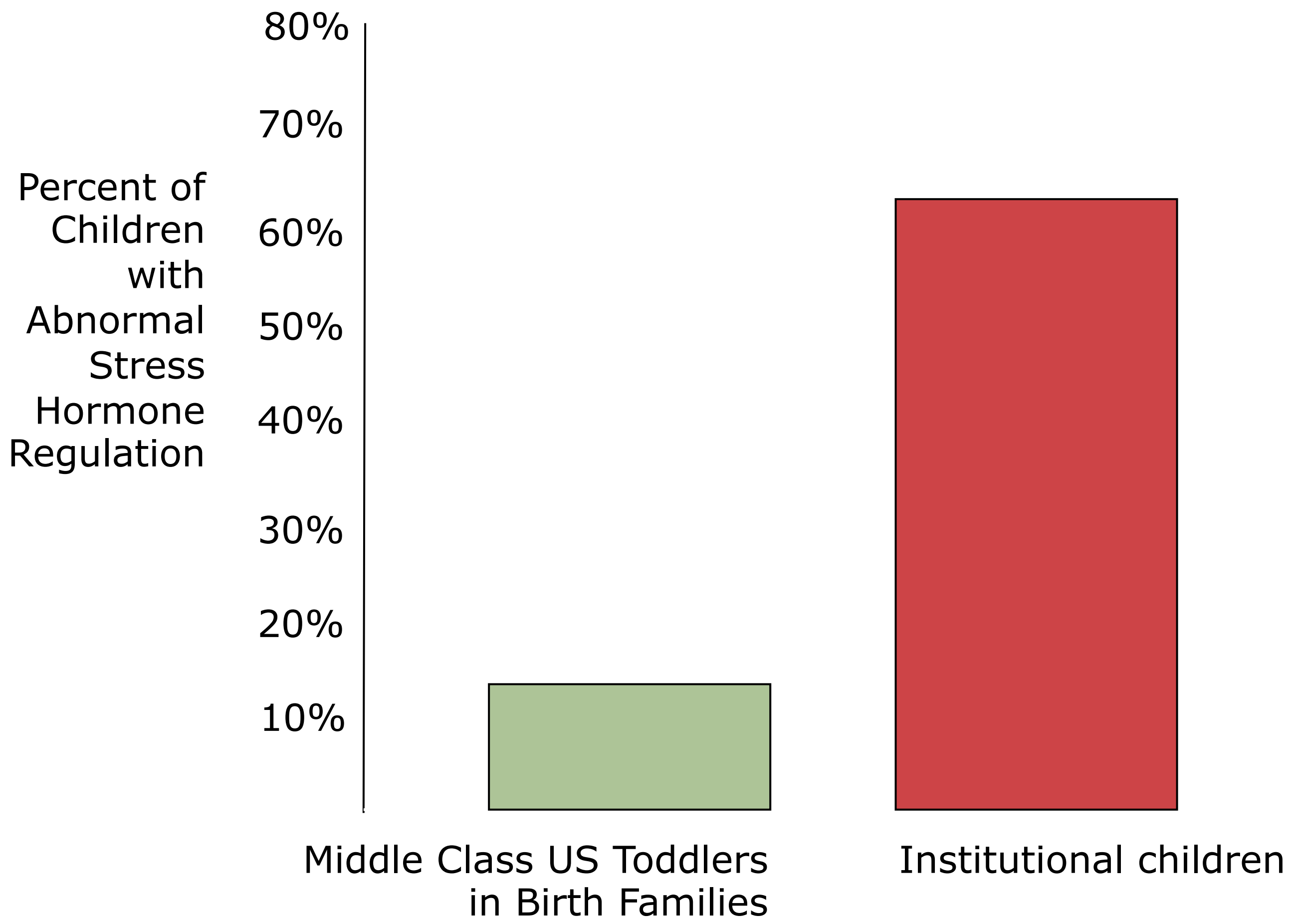
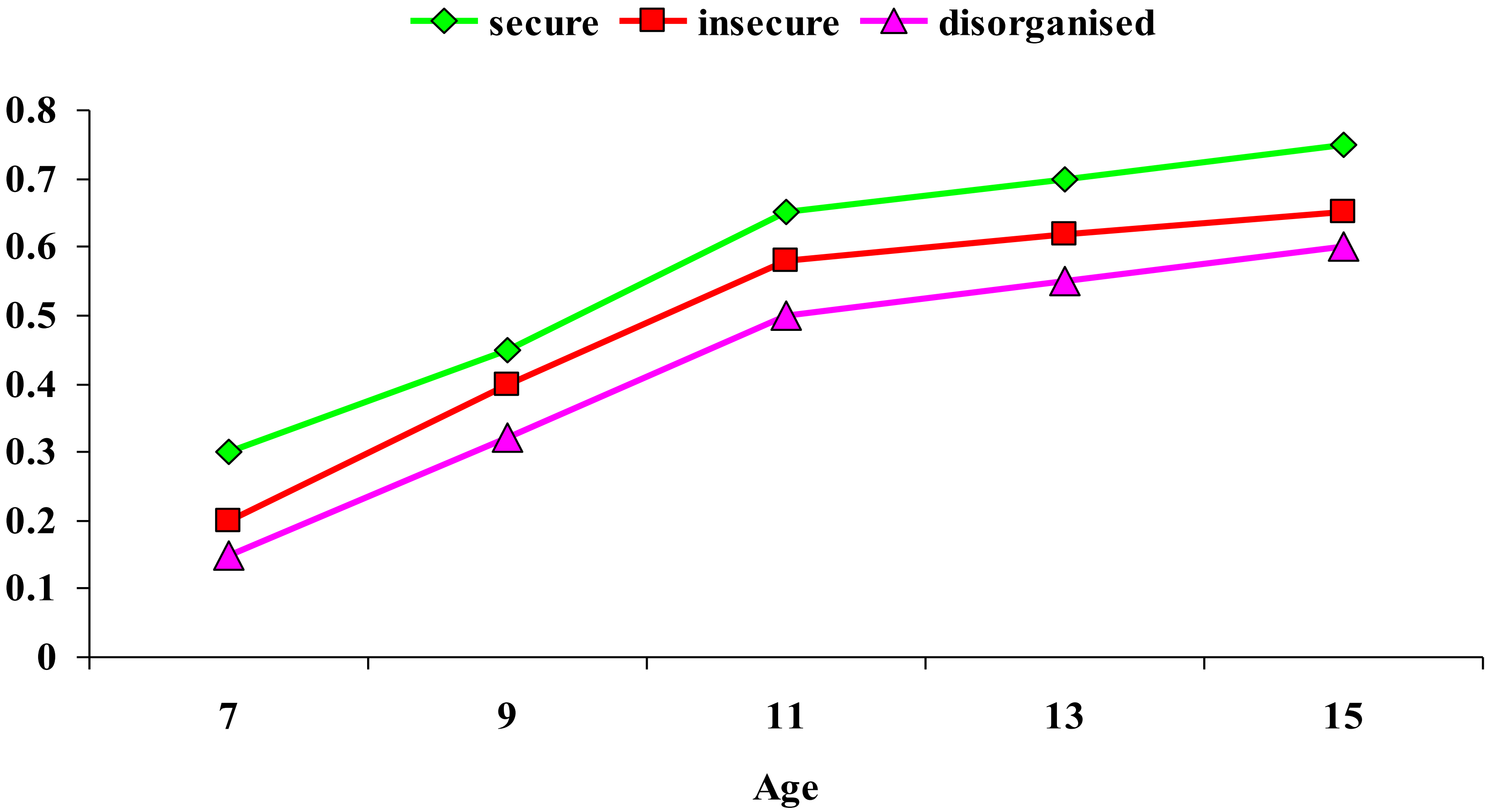
# Disorganized Attachment and Institutionalization




Source: Gunnar & Fisher (2006) Development & Psychopathology, 18, 651-677

# Attachment and cognitive functioning: the development of competence in logical reasoning




Source: Jacobson et al

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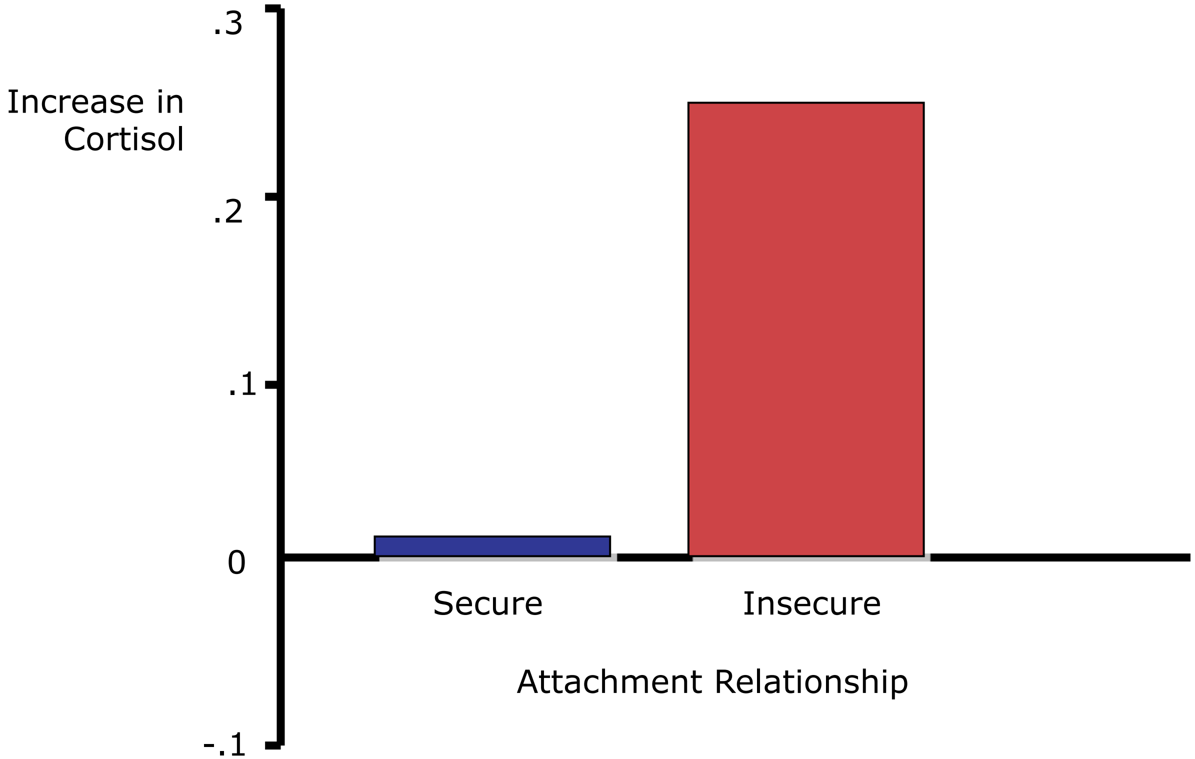
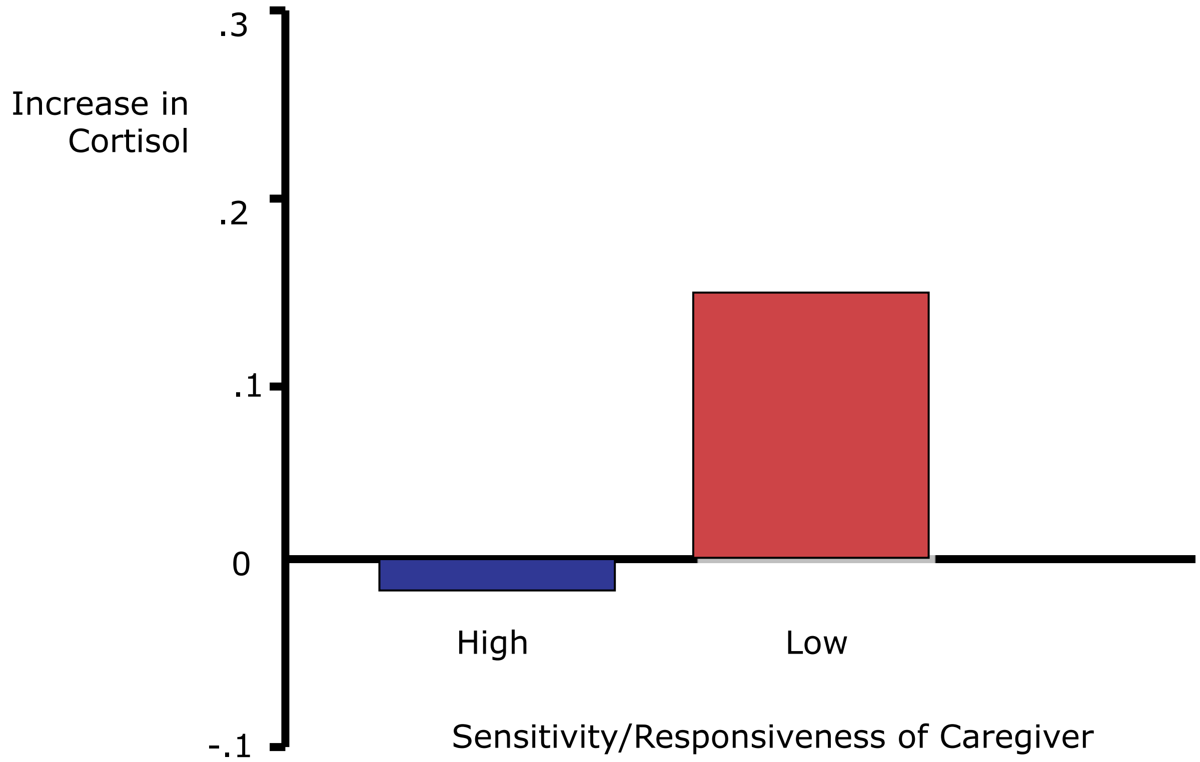
# Secure Relationships Calm Children's Stress Hormone Response




Source: Nachmias et al. (1996)
Child Development, 67, 508

# Sensitive Care Calms Children's Stress Hormone Response in Parent's Absence




Source: Nachmias et al. (1996)
Child Development, 67, 508

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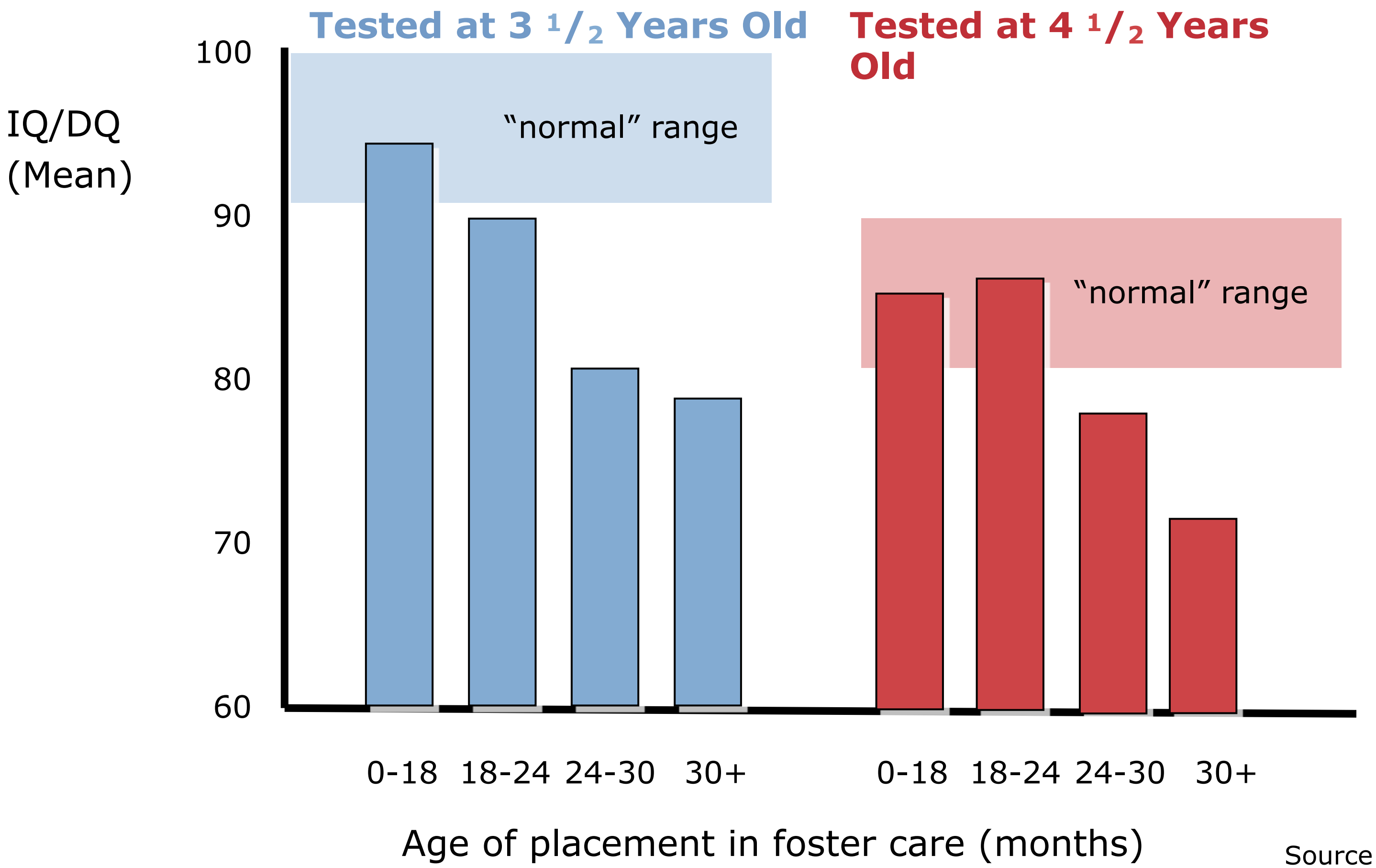
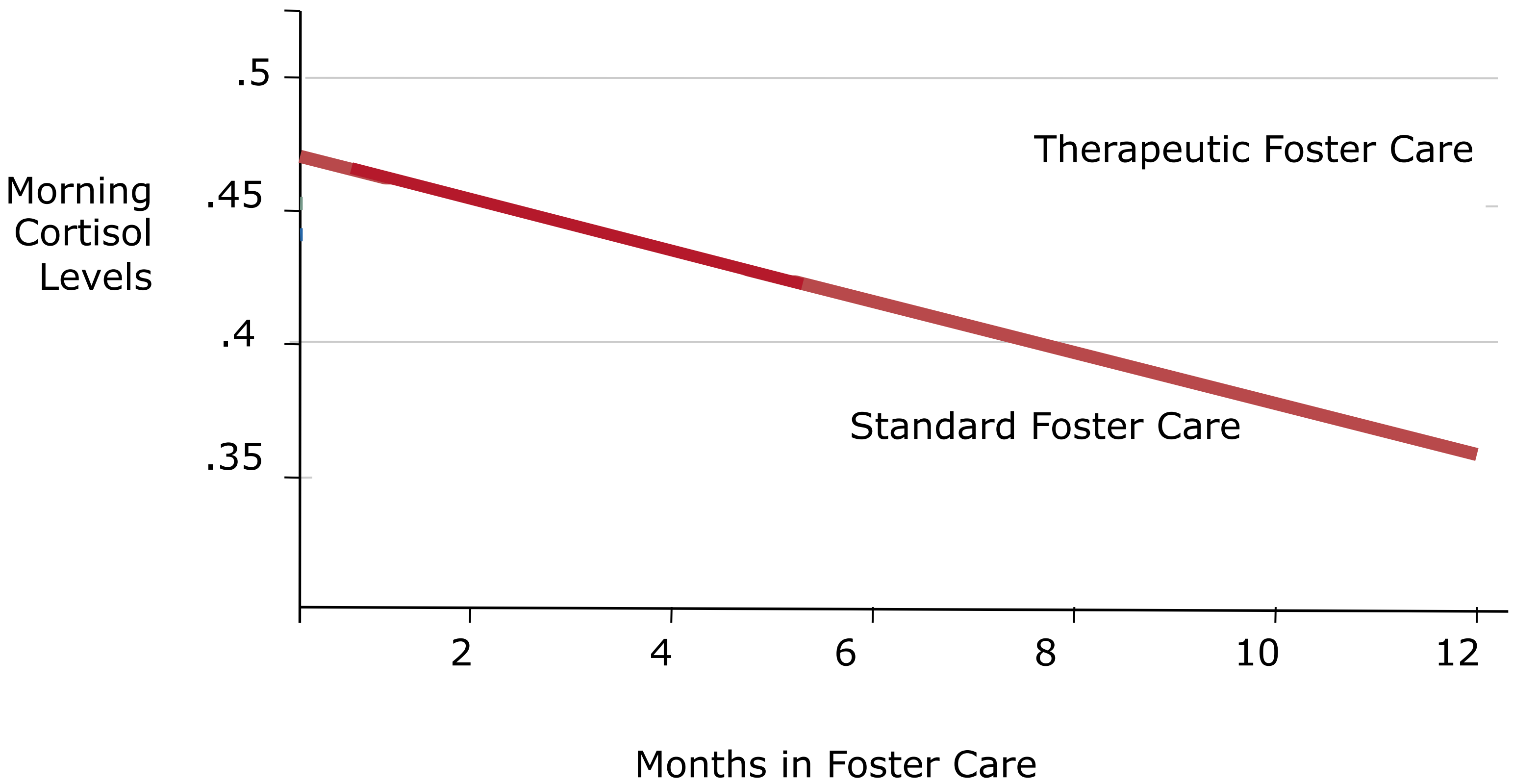
# Delayed Intervention Harms Development
## Bucharest Early Intervention Program



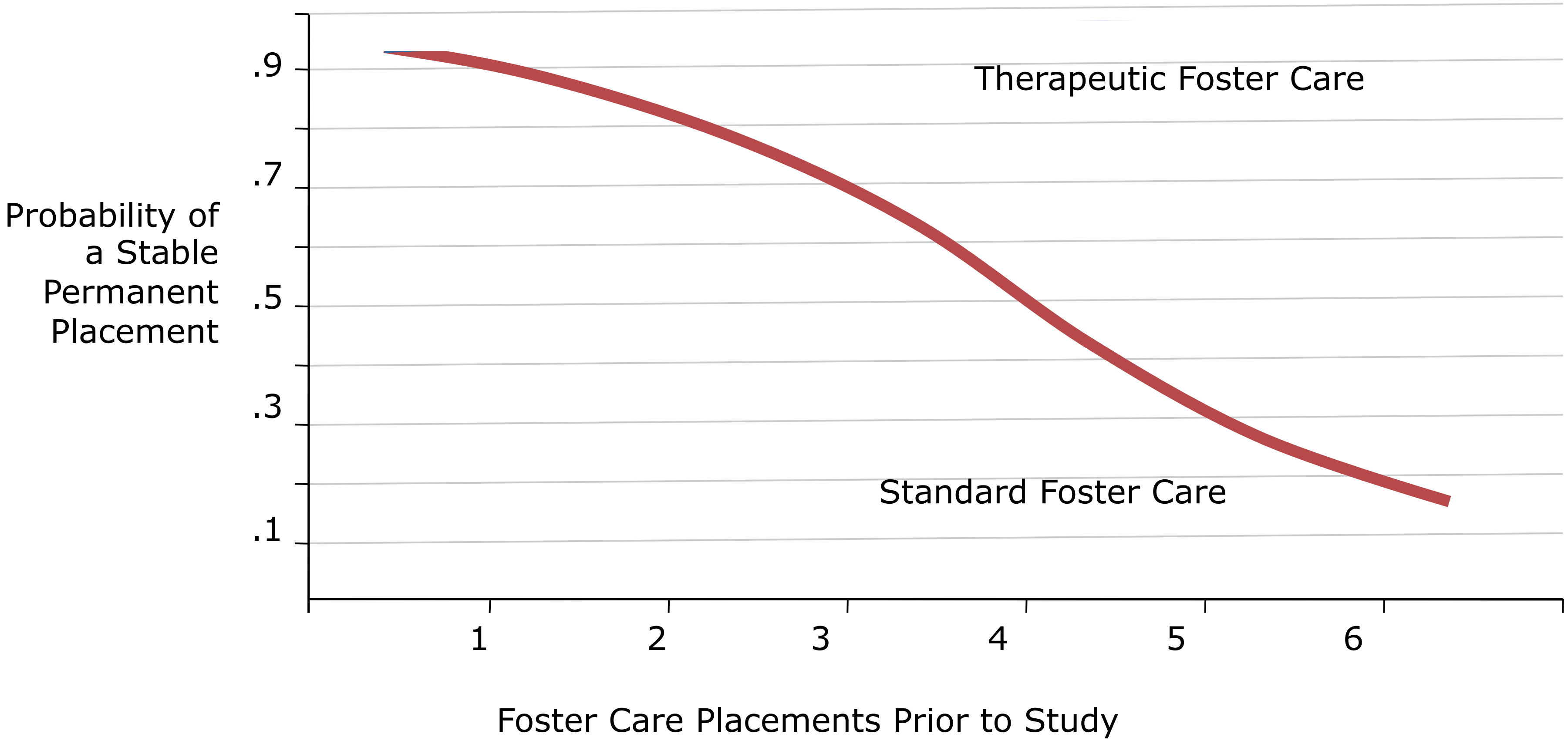

Source: Nelson et al. (2007) Science, 318, 1937

# Instability Disrupts the Stress Response System — But Relationships Reverse the Effect




Source: Fisher, Stoolmiller & Gunnar (2007) Psychoneuroendocrinology, 32, 892

# Placement Instability Breeds More Instability— But Brain Plasticity Means Interventions Can Help




Source: Fisher, Burraston & Pears (2005) Child Maltreatment, 10, 61

# How Should We Act On the Science?

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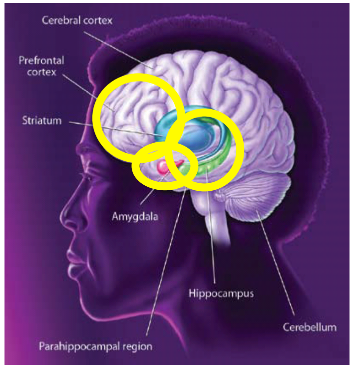
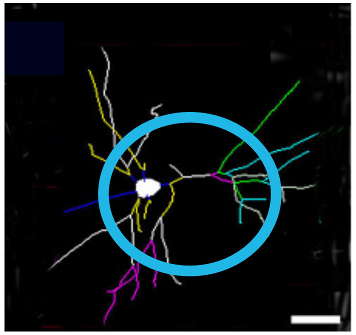
# Keys to Healthy Brain Development

Supportive relationships and positive learning experiences that begin in the home but can be strengthened by outside assistance when families need help.

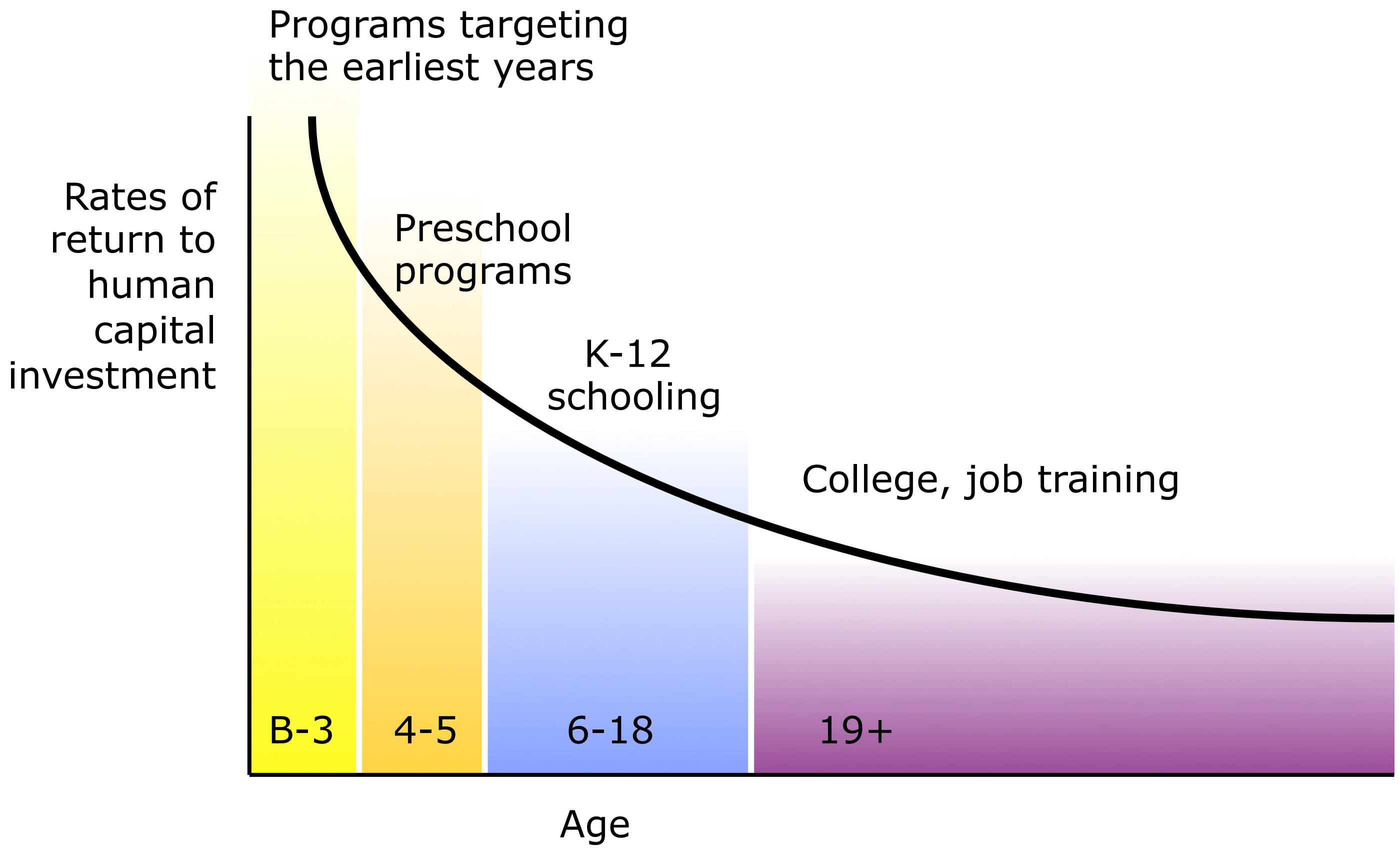



A balanced approach to emotional, social, cognitive, and language development.

Highly specialized interventions as early as possible for children and families experiencing significant adversity.



# Preventive Intervention is More Efficient and Produces More Favorable Outcomes Than Later Remediation




Heckman, J. (2007)

# Building a New Science-Based Approach to Promoting Health and Preventing Disease

A healthier population begins with **reducing toxic stress** in early childhood, not just trying to change adult behavior.

Early childhood intervention programs can be a vehicle for enhancing lifelong health, not just preparing children to succeed in school.

A redesigned child **welfare system** could improve health outcomes by promoting positive relationships and **adaptive development**, not simply focusing on physical safety and custody.

# Maximizing Return on Investment

The basic principles of neuroscience indicate that later remediation will be more costly than **preventive intervention** in the first years of life.

*Brains:* **more physiological energy** needed to compensate for poorly formed neural circuits.

*Society:* **higher cost of remedial education**, clinical treatment, crime.

# Think Broadly About Children's Environment of Relationships

Plan from pregnancy to kindergarten, and look **beyond education and health care**.

Invest in the development and retention of a skilled early childhood **workforce**.

Make sure vulnerable children have **access to stable, supportive relationships** with adults—as early and as consistently as possible.

# Parenting

- **Parenting behaviours** and the home environment are the **biggest influences** on early development (Waldfogel and Washbrook 2010, 2011; other refs)
- Rigorous RCTs have shown **parenting interventions can be effective** (NFP, PALS, PEEP, Incredible Years)
- A number of effective programmes have been shown to **increase** parents' **involvement** in, and **encouragement** for, children's **learning** and **development** (Cummings et al 2011)
  - Long-term benefits for parental support and attitudes?

# Parenting

BUT

- **Not all** programmes are effective

- The **RCT** approach has drawbacks
  - > Most have only been evaluated on a very **small scale**
  - > The **components** of the "optimal" programme are far from clear

- Effects are much **consistent** for **socio-emotional** and **physical** health outcomes but **not** for **cognitive/educational** ones

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