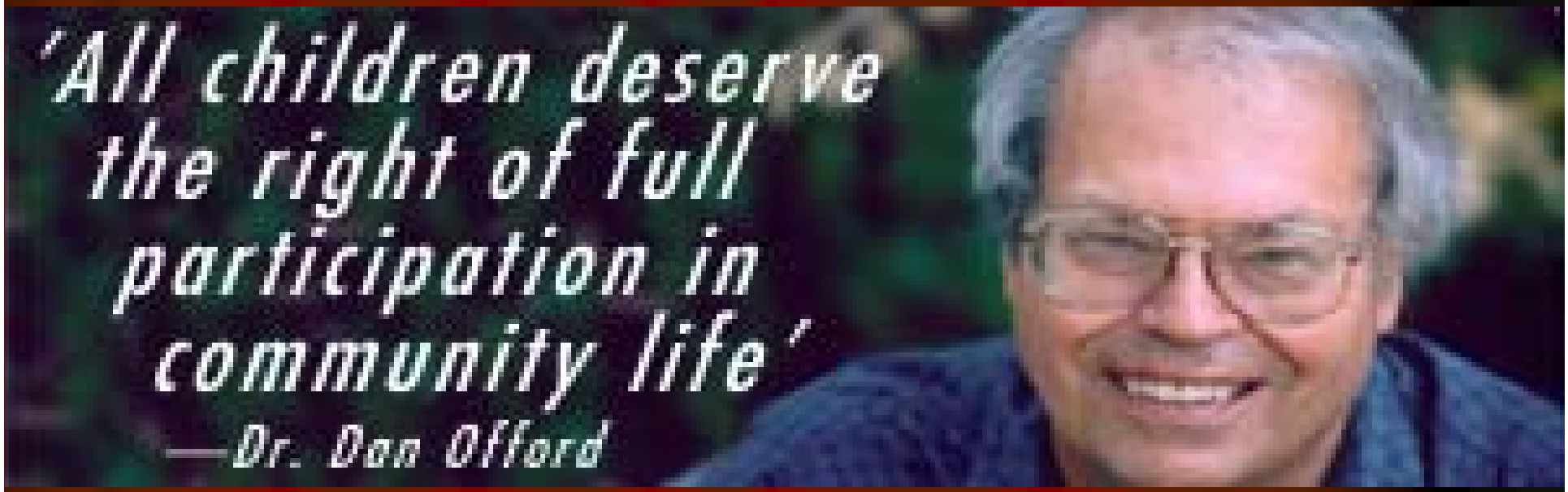

'All children deserve
the right of full
participation in
community life'
—Dr. Don Offord

The First ‘R” Relationships.

Relationships with our Children are the Key to health and Resilience

Special Link Inclusion Conference Aug 2008

Jean Clinton BMus MD FRCP(C)
McMaster Children's Hospital and University
Council for Early Child Development
Offord Centre for Child Studies

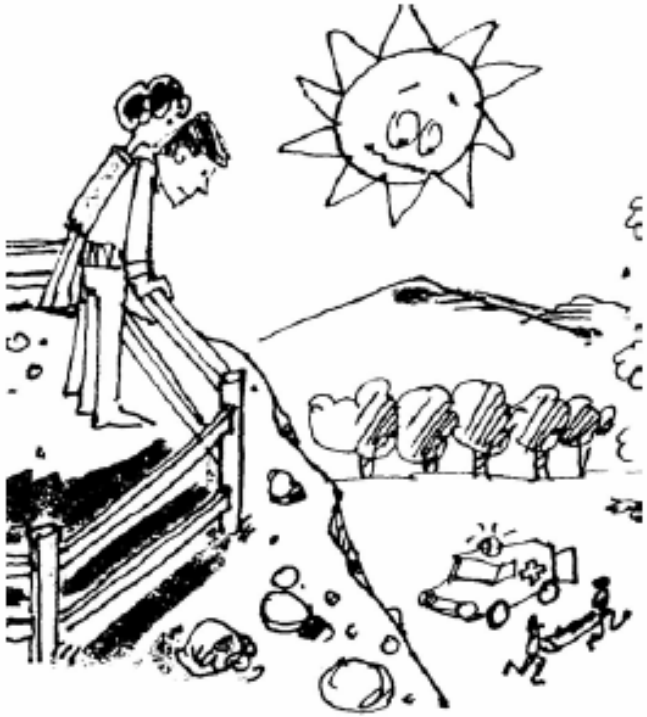
"t'was a dangerous cliff, as they freely confessed, though to walk near its crest was so pleasant.

But over its terrible edge there had slipped, a Duke and full many a peasant.

The people said something would have to be done, but their projects did not at all tally.

Some said 'put a fence around the edge of the cliff', some 'an ambulance down in the valley'.....

From the Parable of the Dangerous Cliff, Joseph Malins (1895)



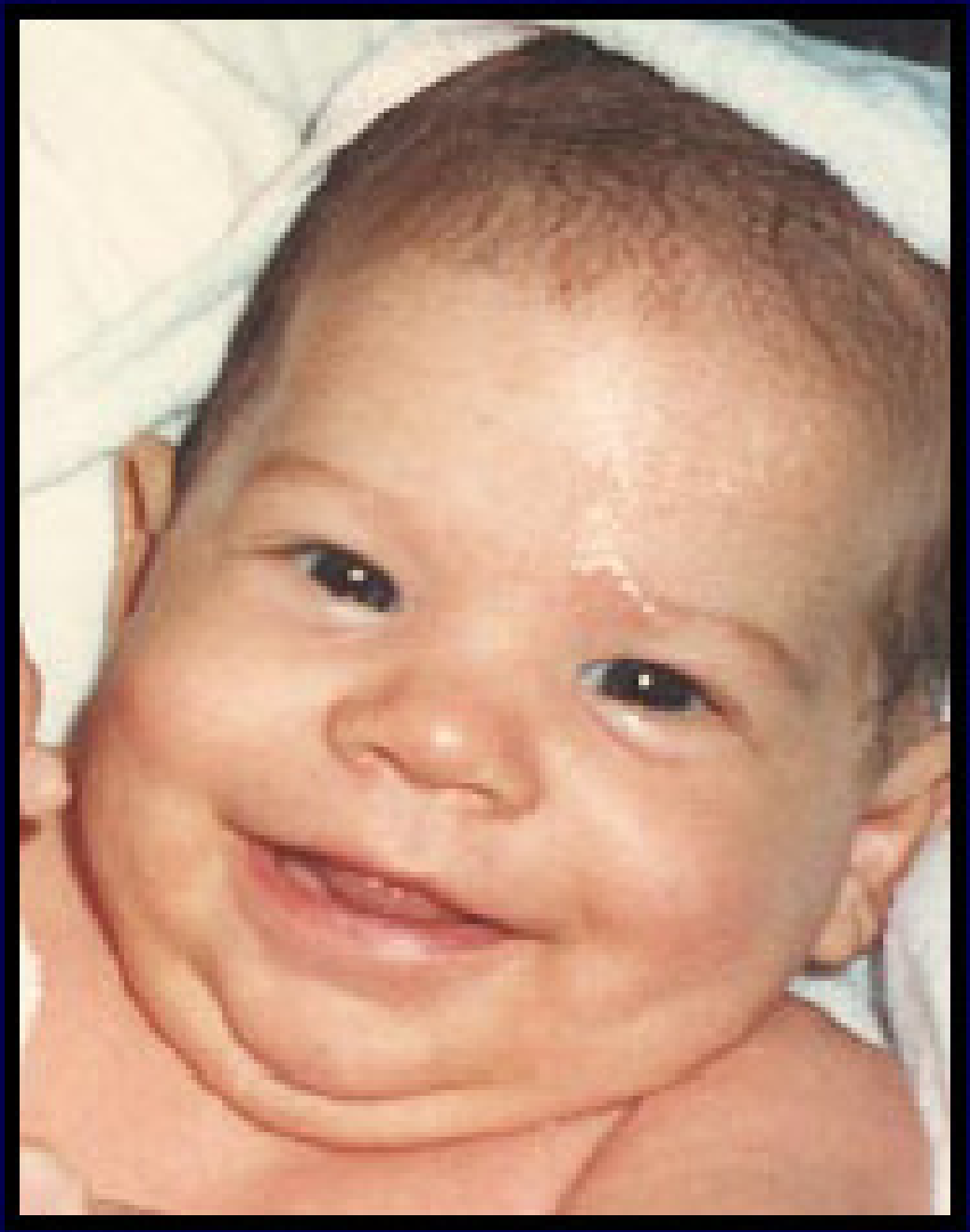
Said just one to his plea, 'it's a marvel to me that you'd give so much greater attention, to repairing results than to curing the cause, you had much better aim at prevention.....

The health and creativity of a community is renewed each generation through its children.

The family, community, or society that understands and values its children thrives -- the society that does not is destined to fail.

The best time to influence the character of a child is 100 years before they are born.

W.R. Inge



The Wisdom of the Elders

- Consider the interest of the next 7 generations when decisions are being made

Guiding Principles

- Development of the *whole child.*
- The importance of *belonging.*
- *Relationships* as central.

UNICEF REPORT CARD 2007

- "The true measure of a nation's standing is how well it attends to its children-their health and safety, their material security, their education and socialization, and their sense of being loved, valued and included in the families and societies into which they are born."

Unicef Innocenti Report 2007

Canada

Material Well Being	6	SWEDEN	1
Health and Safety	13	SWEDEN	1
Educational Well being	2	BELGIUM	1
Family and Peer Relationships	18	ITALY	1
Behaviours and Risks	17	SWEDEN	1
Subjective well being	15	NETHERLANDS	1
Overall	12/21		

Unicef Innocenti Report 2007

EARLY YEARS STUDY 2

Putting Science into Action

The Brain Matters

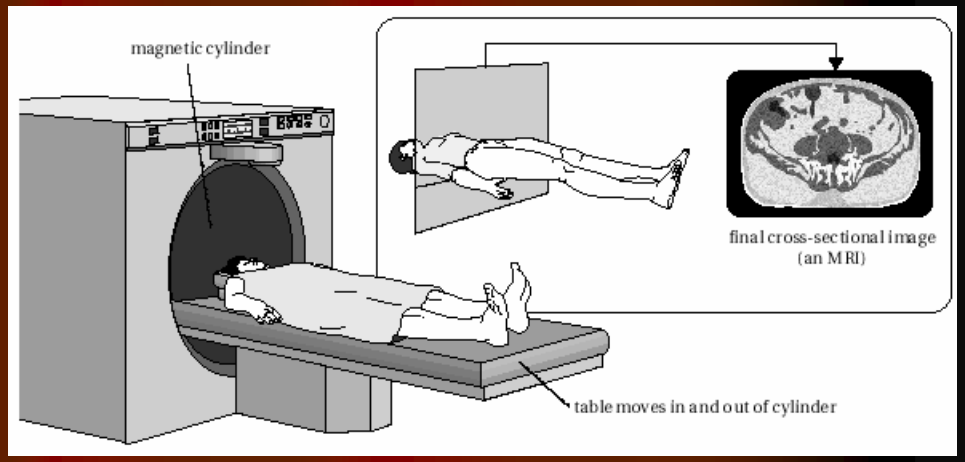
- The human brain is the organ responsible for everything we do. It allows us to laugh, walk, love, talk.
- For each of us, our brain is a reflection of our experiences.
- The brain is an environmental organ. It reflects our environment.

Adapted from Bruce Perry

BRAIN FACTS

- Contains an estimated 100 billion nerve cells -more cells than there are stars in the milky way galaxy (Encyclopedia Britannica. Astronomy
- Has the consistency of room temperature butter ….within a hard rigid casing!!
- About 95% of maximum size by age 6.
- Massive changes continue to occur for next 15-20 years
- Peak volume at 14.5 in boys and 11.5 in girls.

Time Magazine from the MEHRI Neuroscience lab


magnetic cylinder
final cross-sectional image
(an MRI)
table moves in and out of cylinder

Why do we care about brain?

You are your brain.

BUT
Your brain is not just produced by your genes.

Your brain is sculpted by a lifetime of experiences . The most important time in brain development is the first few years of life.

What is experience?

Everything that you encounter both pre- and postnatally as well as in adulthood…

Examples: sounds, touch, light, food, thoughts, drugs, injury, disease…

Brain Plasticity

- Ability of the brain to change in response to learning, aging, injury, drugs, disease, thoughts, sensory or motor experiences
- Brain Changes include alterations in connections (changes or additions), loss or addition of neurons, changes in vasculature, changes in support cells

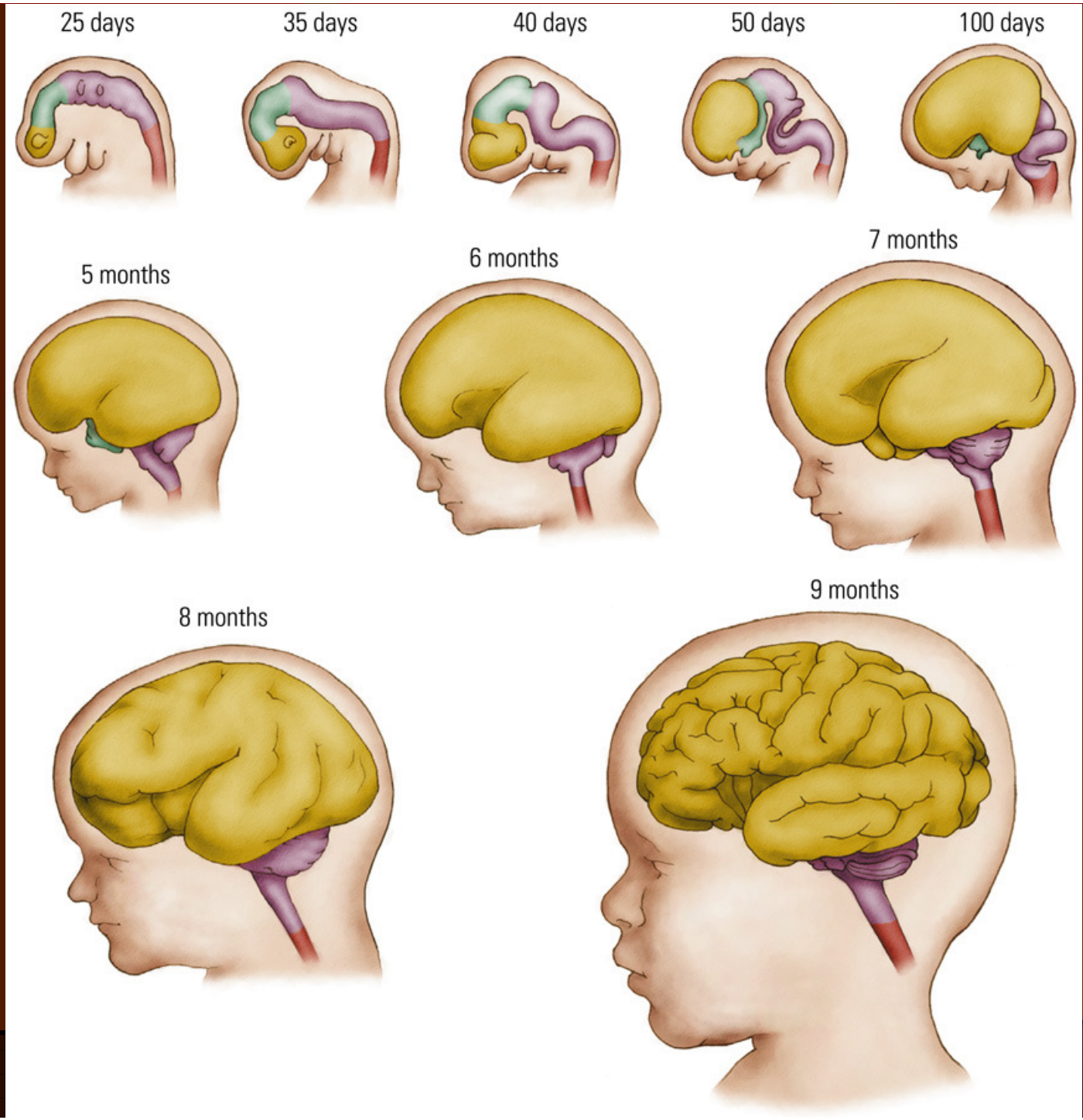
What does the brain do?

The function of the brain is to produce behaviour.

To do this, it must first "create" reality. This reality reflects the interaction of experience and a genetic blueprint of the brain.

Experience-Based Brain Development in the early years of life sets neurological and biological pathways that affect:

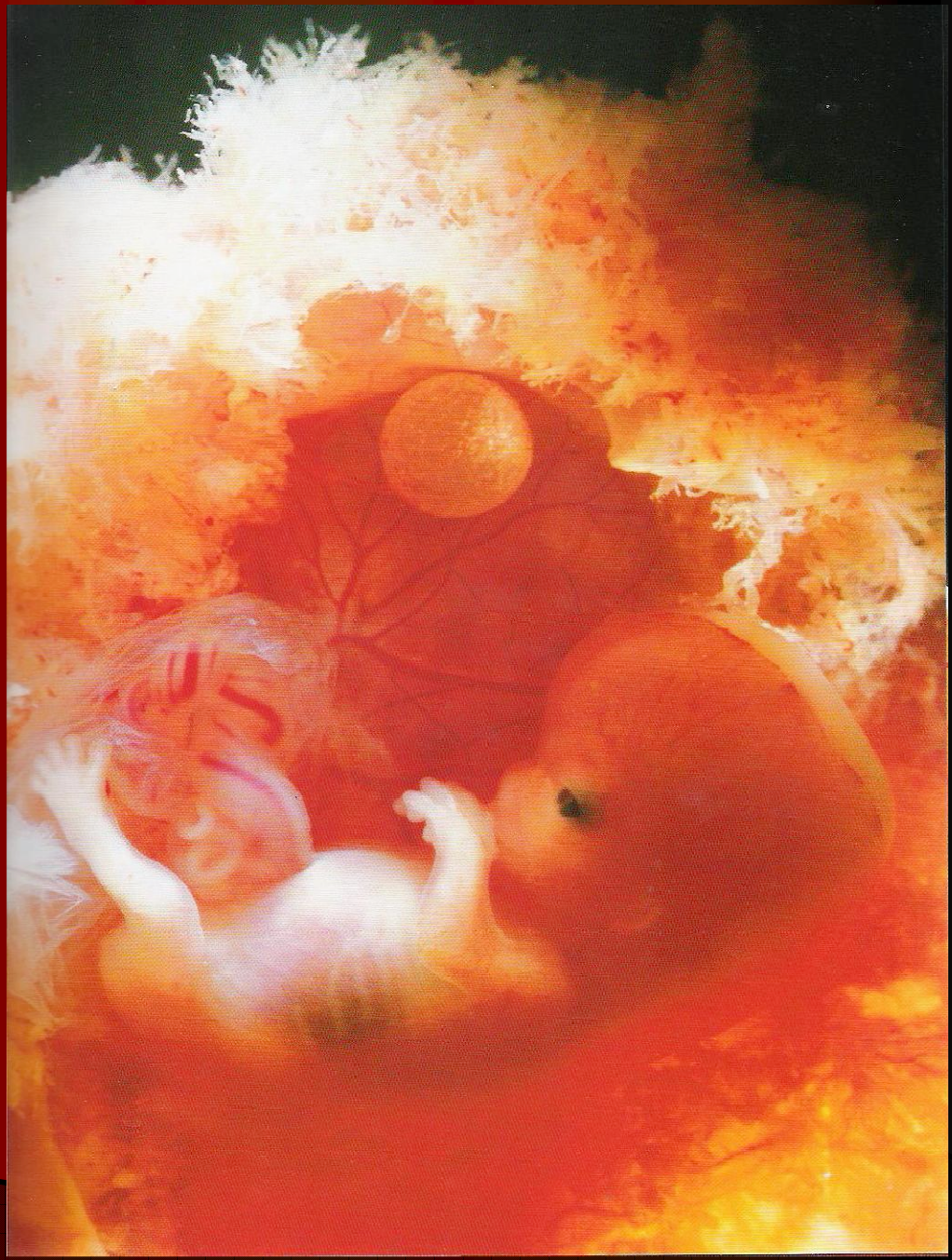
- Health
- Learning
- Behaviour



But, not done until at least age 20 years…

In Utero and during lactation maternal experience has a major influence on baby

13 weeks

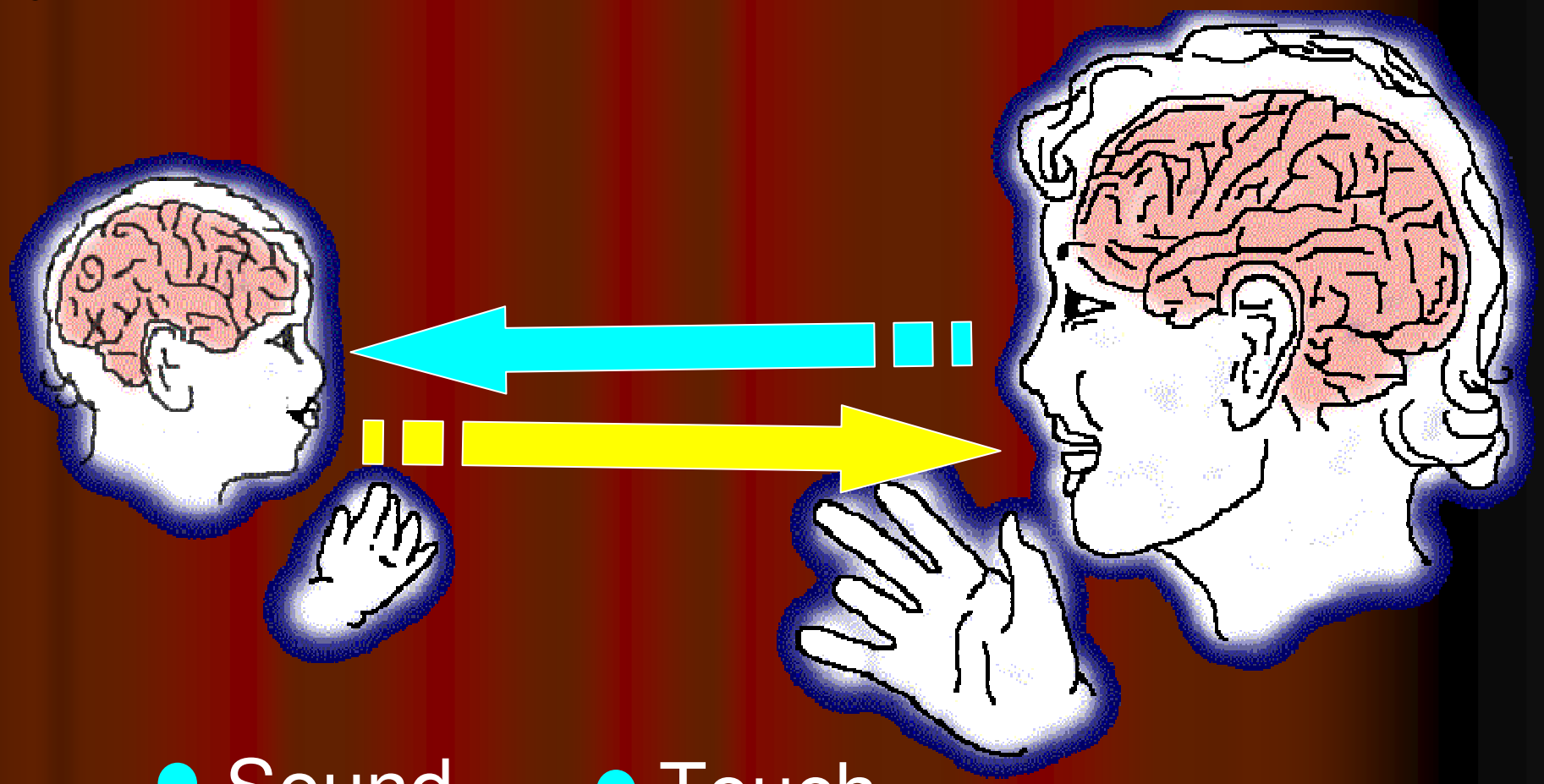


The Role of the Primary Caregiver in Early Brain Growth

- The primary caregiver serves as an 'external brain', regulating and stimulating the baby's brain
- Dyadic experiences are vital for:
  - Sensory regulation
  - Emotion-regulation
  - Self-Regulation
  - perceptual, cognitive, communicative and social development

The Critical Importance of Emotion

- Positive Emotion is the overarching mechanism that binds the dyad together
- The earliest emotions an infant experiences are pleasurable and aversive sensations
- She reflexively seeks out those experiences that are positive and avoids those that are aversive
  - i.e., an infant will only seek out dyadic interactions if she finds them pleasurable



- Sound
- Vision
- Smell
- Touch
- Proprioception
- Taste

PLASTICITY

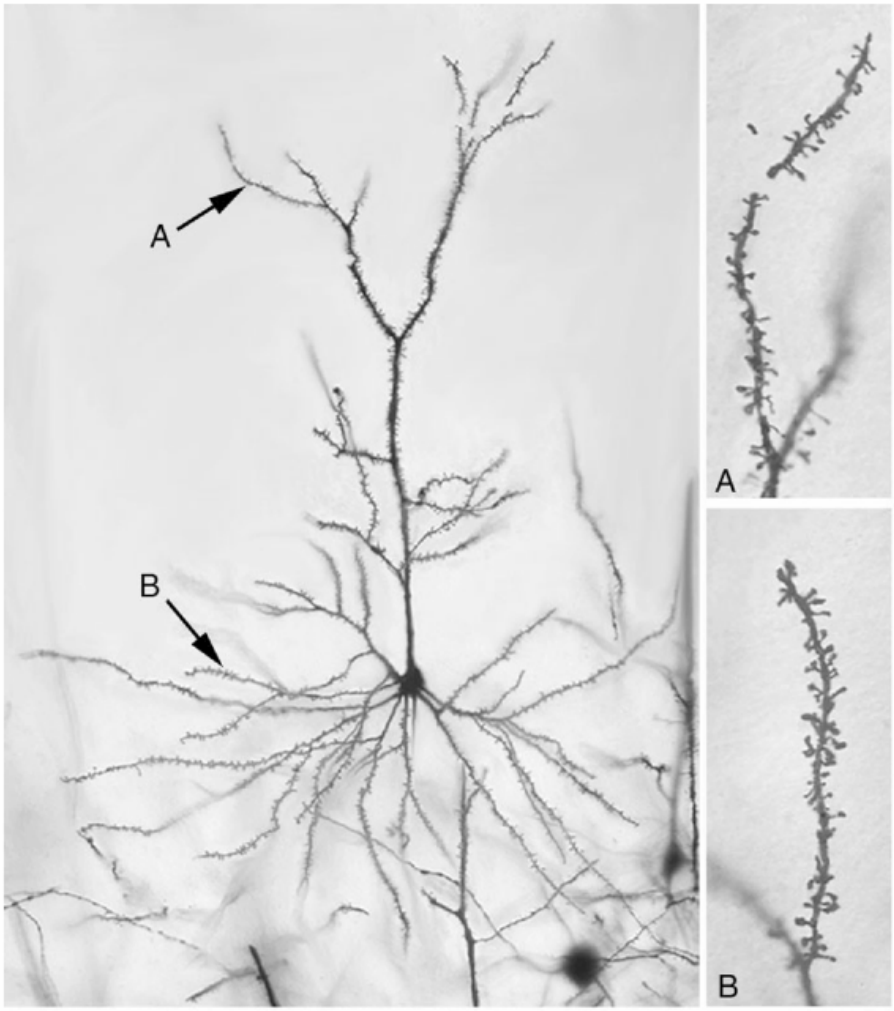
- Babies highly attuned to their environment
- Massive synaptic growth in first two years
- Pruning starts at 8months
- Pruning regulated by emotional interactions with caregivers

- From "The First Idea" Greenspan and Shanker

The Critical Importance of Affect

- Babies reflexively seeks out those experiences that are positive and avoids those that are aversive
  - i.e., an infant will only seek out dyadic interactions if she finds them pleasurable
- (Greenspan & Shanker, *The First Idea, chapters 1 and 2)*

Cortical Neuron

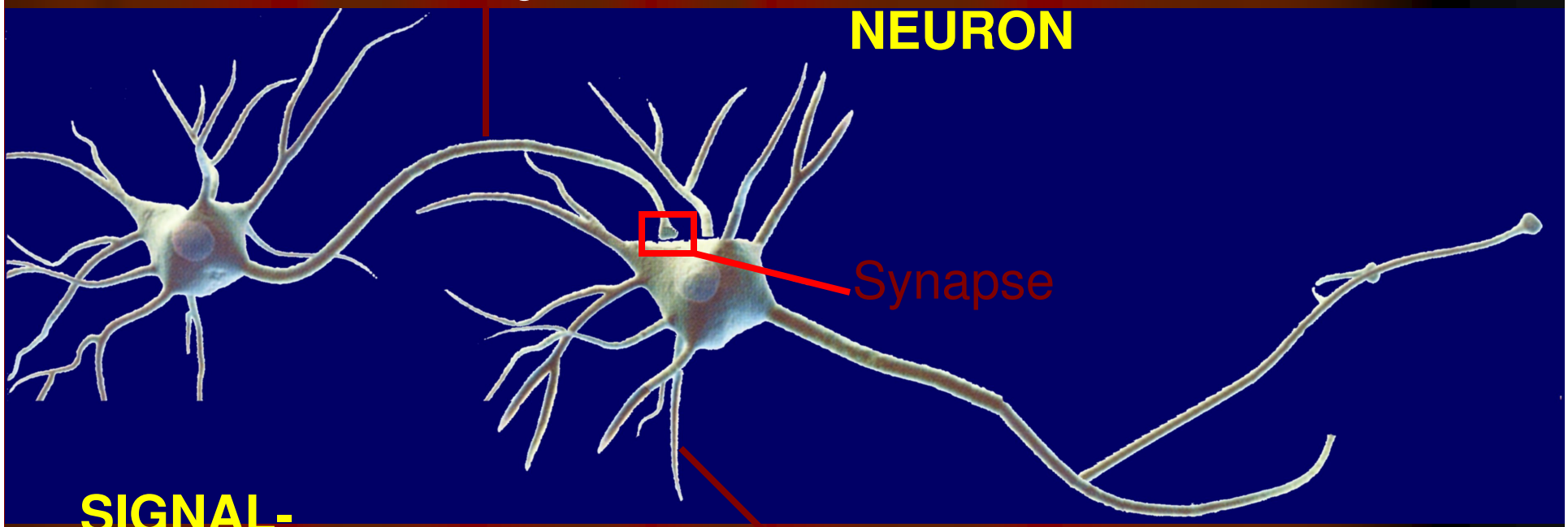


***Brain Plasticity*:**

Connections are formed and altered by experience

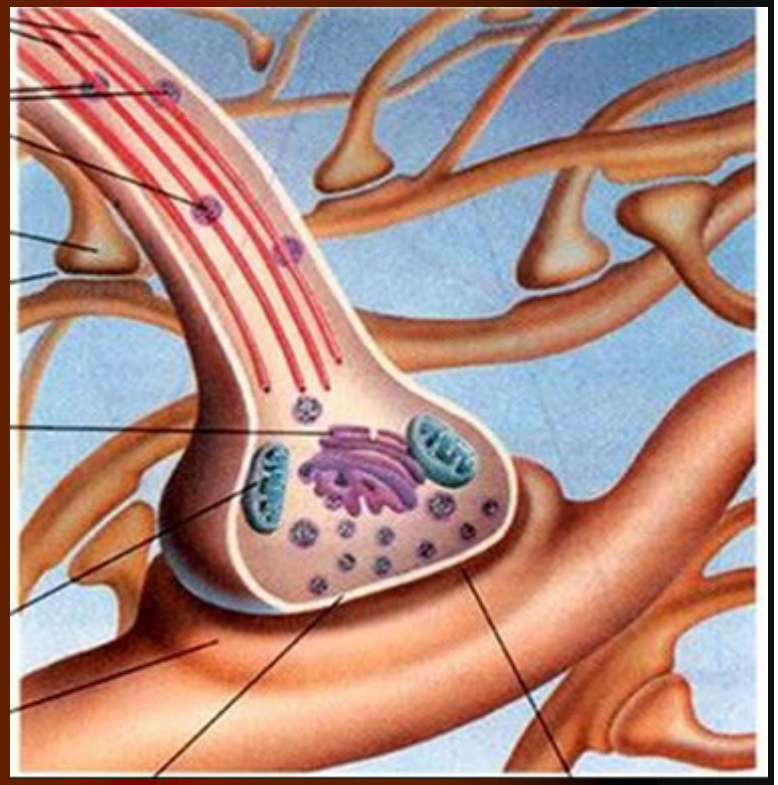
04-039

Two Neurons



Founders Network

SYNAPSE



Mirror Neurons

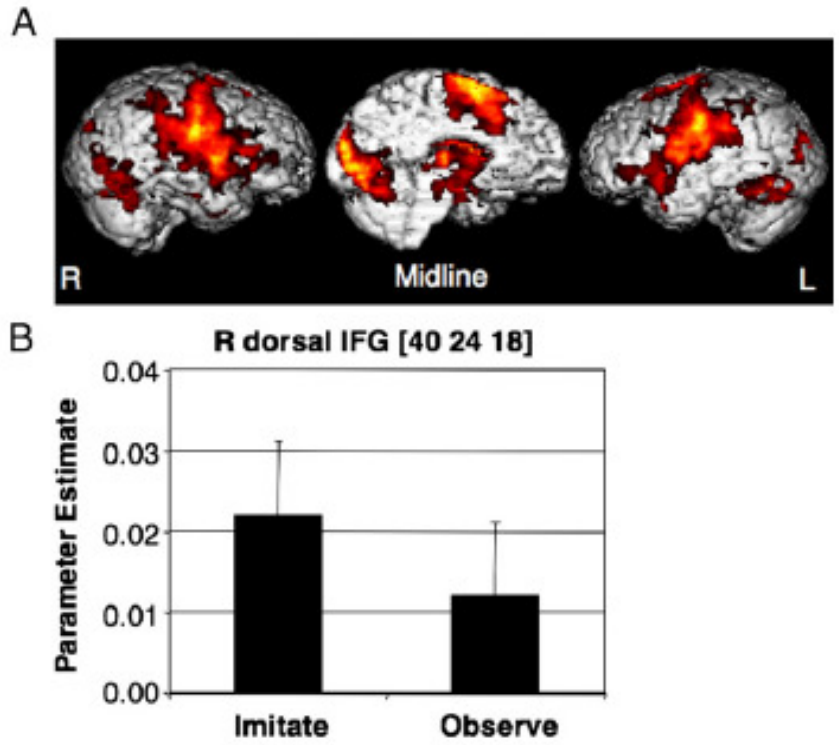


Fig. 1. Mirror neuron system activity in children. Panel A shows increased activity in mirror neuron areas, including pars opercularis, as well as rostral inferior parietal lobule, during imitation of facial expressions compared to null events (for display purposes, the imaging data were thresholded at $t>2.60$, $p<0.01$, corrected for multiple comparisons at the cluster level, $p<0.05$). Also shown are activations in ventral premotor, primary motor, and somatosensory cortex, supplementary motor area, visual cortices, as well as the limbic system including the amygdala. Panel B compares activity in right pars opercularis during imitation and observation of facial emotional expressions.

Vision - Hubel & Wiesel

Eye cataracts at birth prevent development of vision neurons in the occipital cortex

Professor April Benasich (upper right) gently covers a baby's head with sensors that reveal how babies process rapidly occurring sounds, a key factor in language development. (Credit: Image courtesy of Rutgers University)

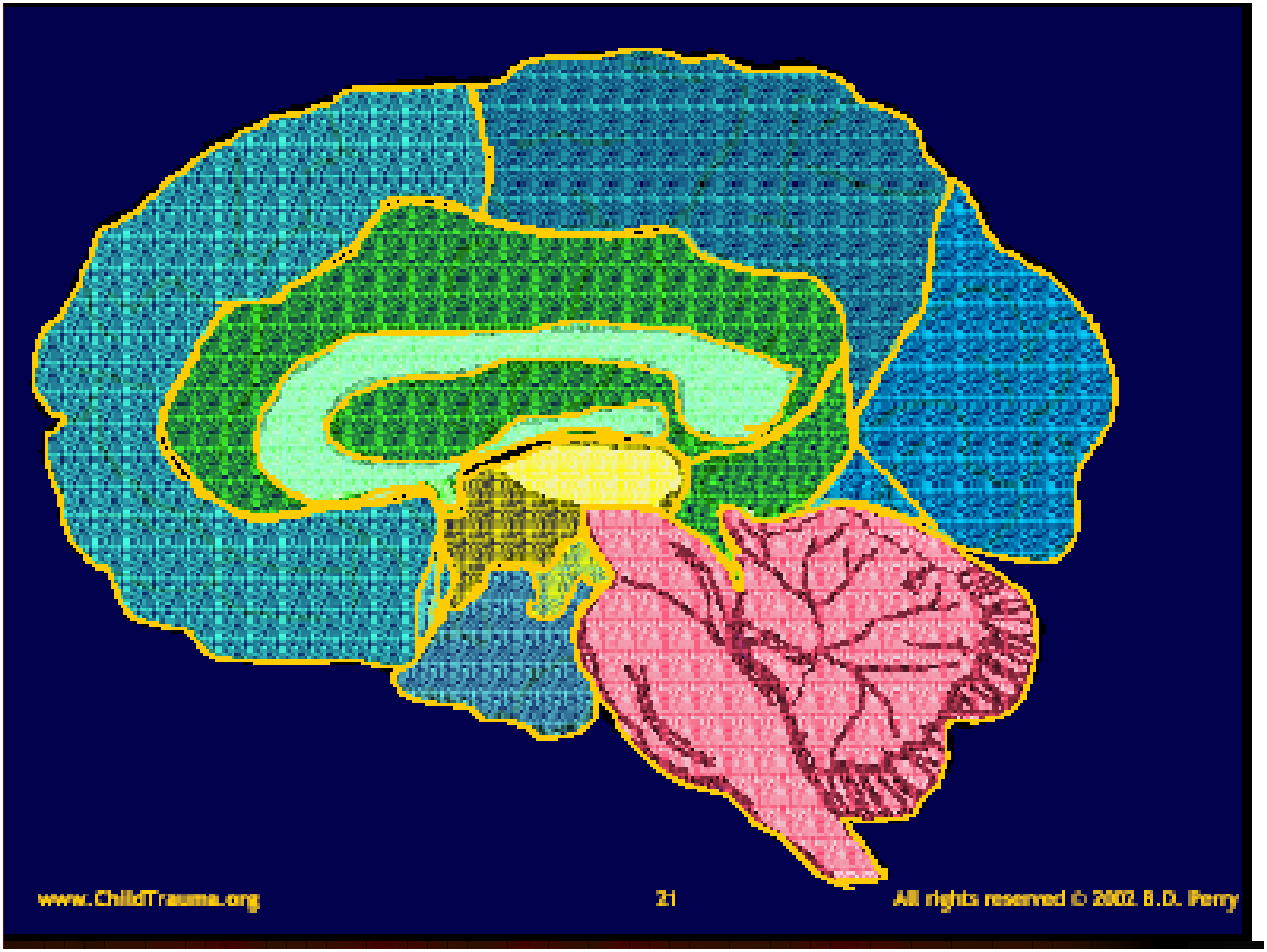
The Best Learners in The Universe

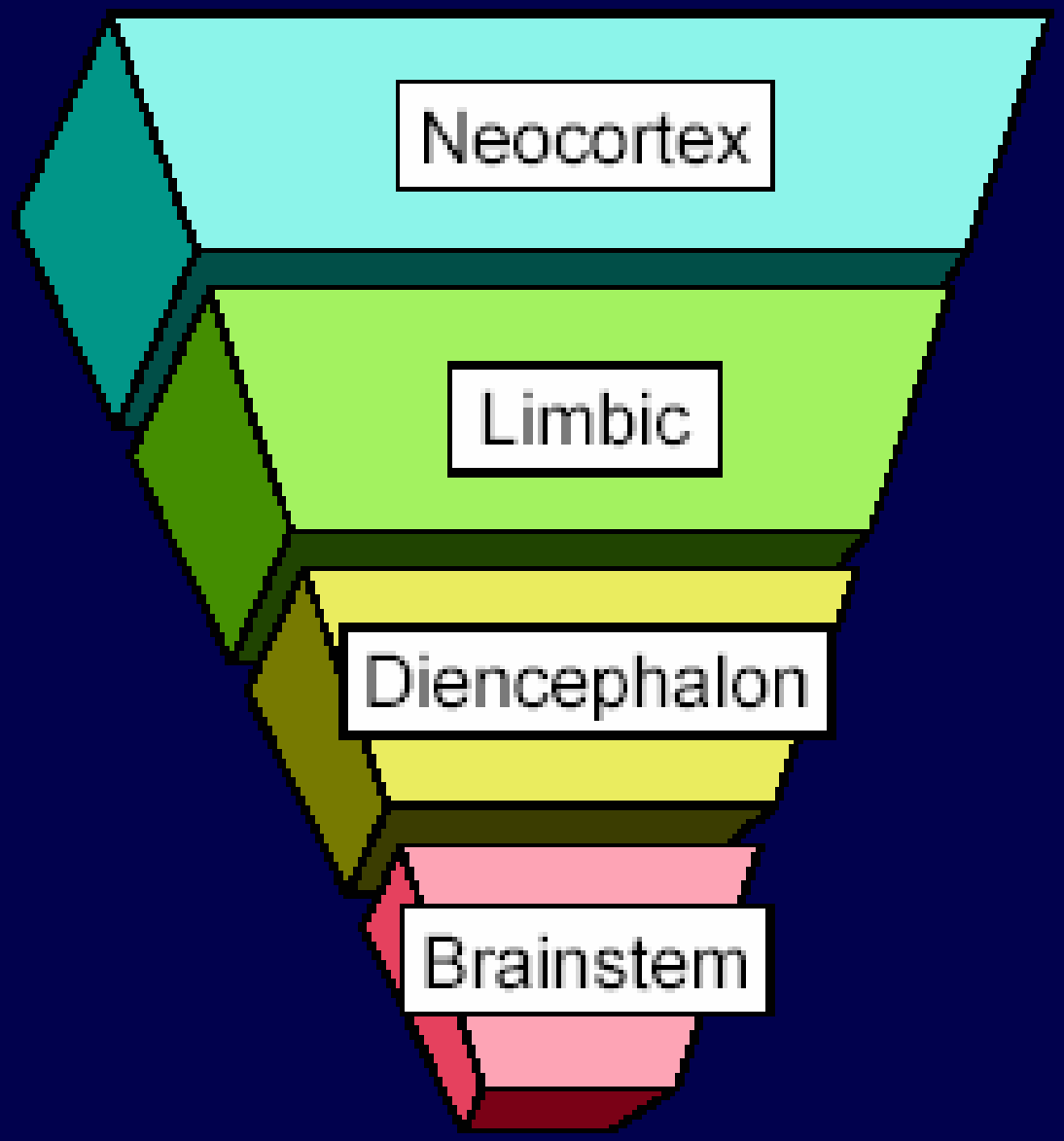
Babies begin learning in the first months of life. infants are "citizens of the world" at birth and early in life they can hear the differences between all the consonants and vowels used in any language.

“But to learn a specific language, they have to learn which sound distinctions are meaningful in their language. English, for example, separates "R" from "L." Japanese does not. Already by 12 months, infants have the rules down,

Patricia Kuhl, co-director of the Center for Mind, Brain and Learning at the University of Washington

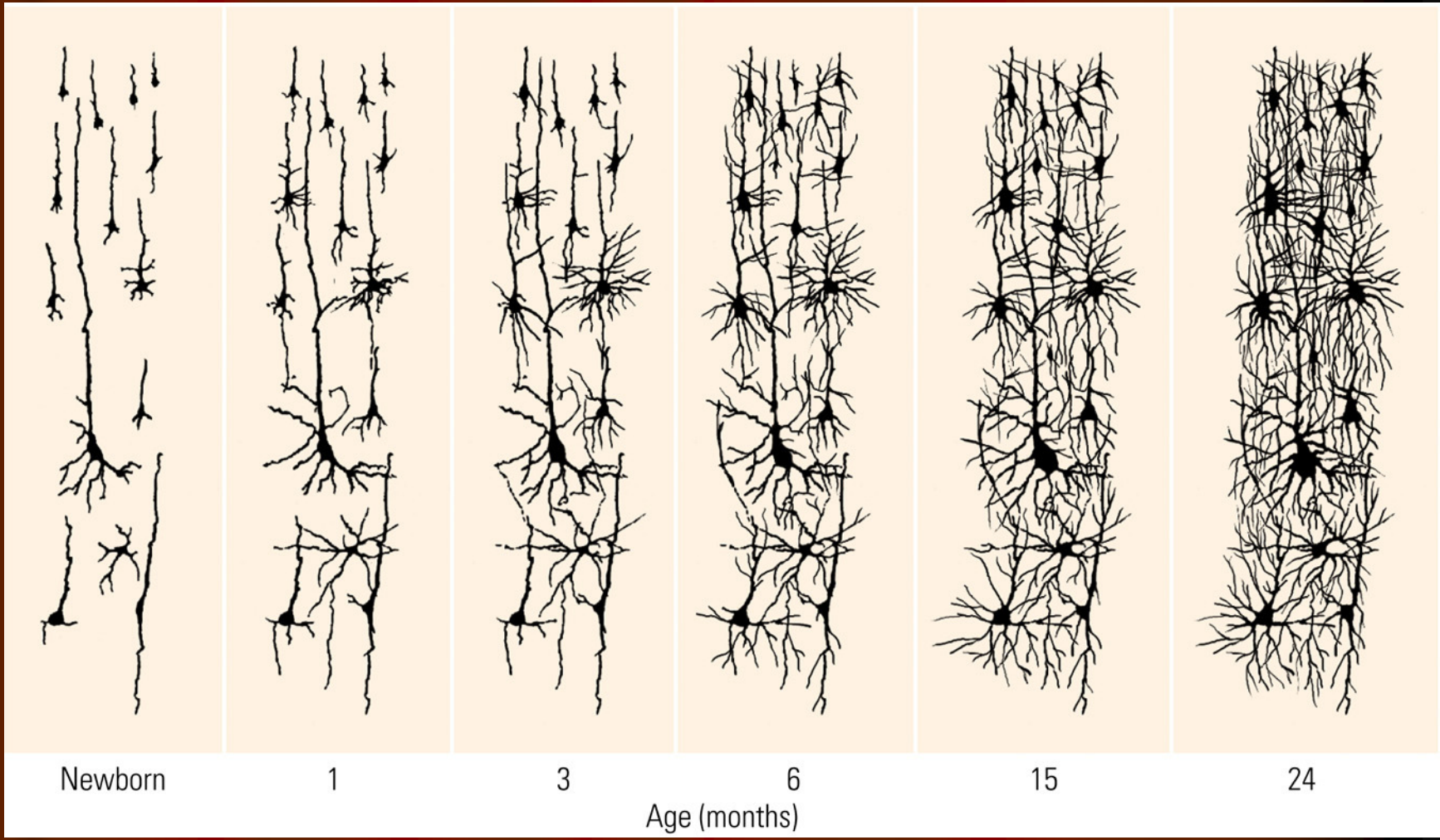

.641-22
© WWW.ANIMATE4.COM



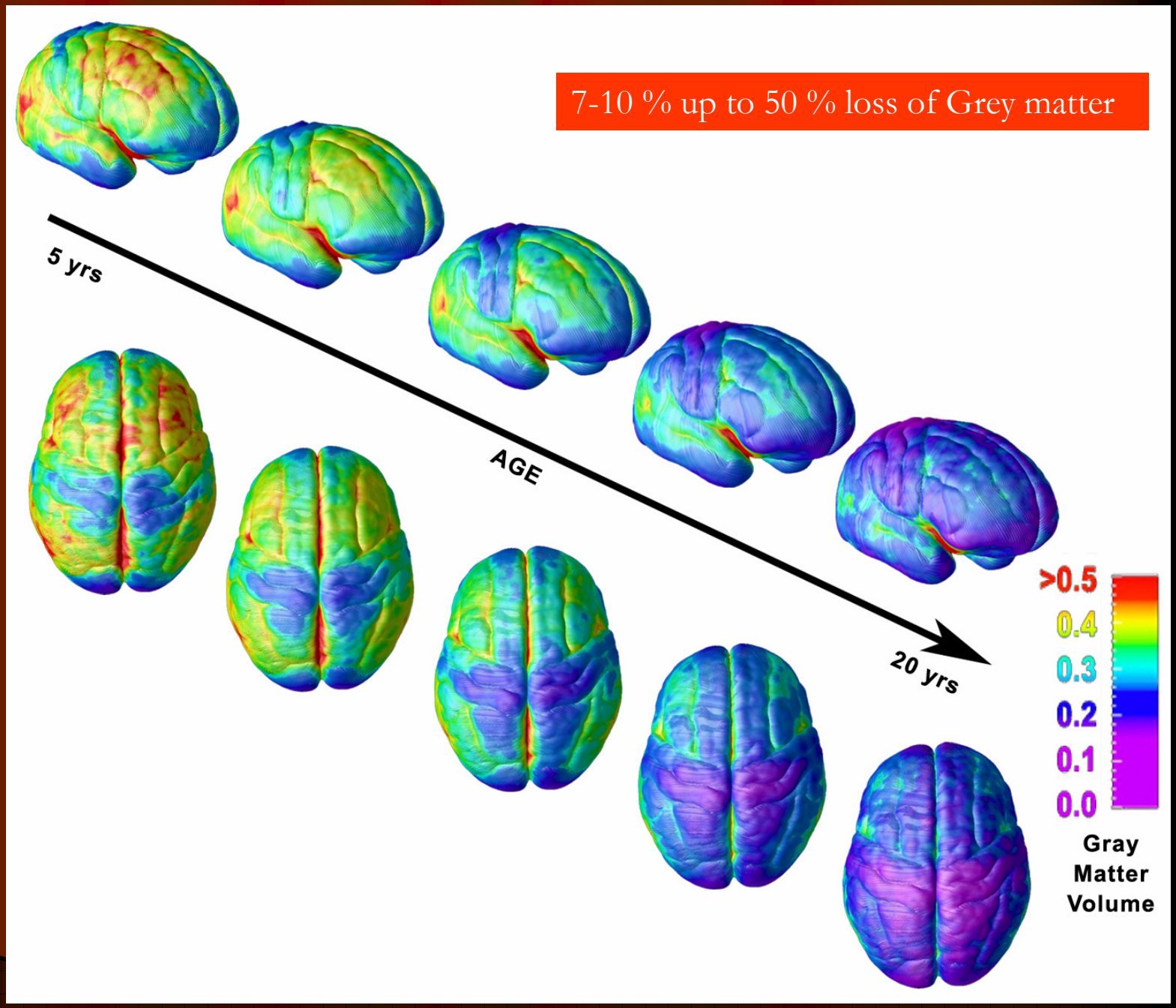


Abstract thought
Concrete Thought
Affiliation
"Attachment"
Sexual Behavior
Emotional Reactivity
Motor Regulation
"Arousal"
Appetite/Satiety
Sleep
Blood Pressure
Heart Rate
Body Temperature

Brain Cells develop connections over the first 2 years

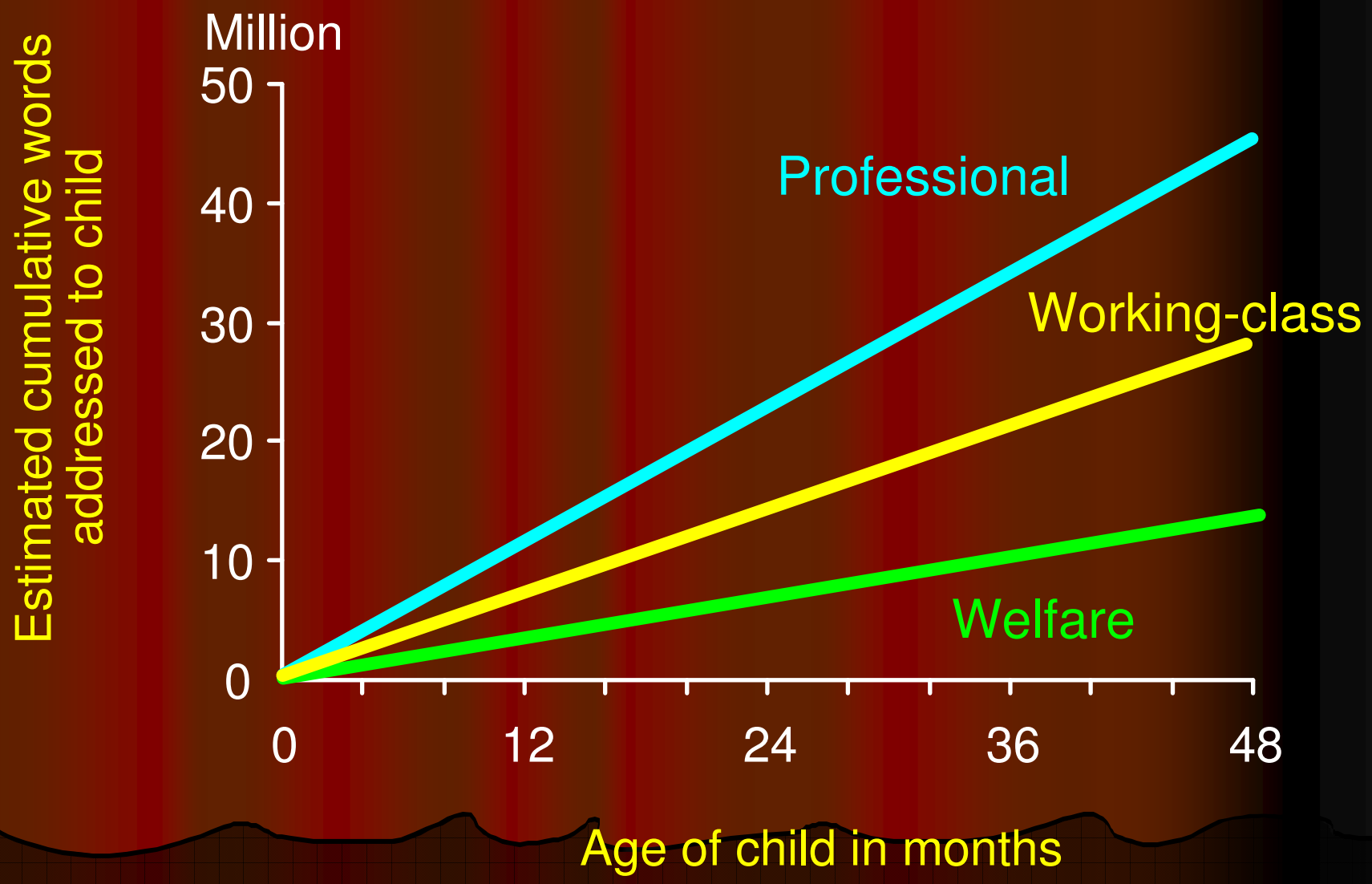


Then they are sculpted actively for the rest of your life!


7-10 % up to 50 % loss of Grey matter
5 yrs
AGE
20 yrs
>0.5
0.4
0.3
0.2
0.1
0.0
Gray
Matter
Volume

02-002

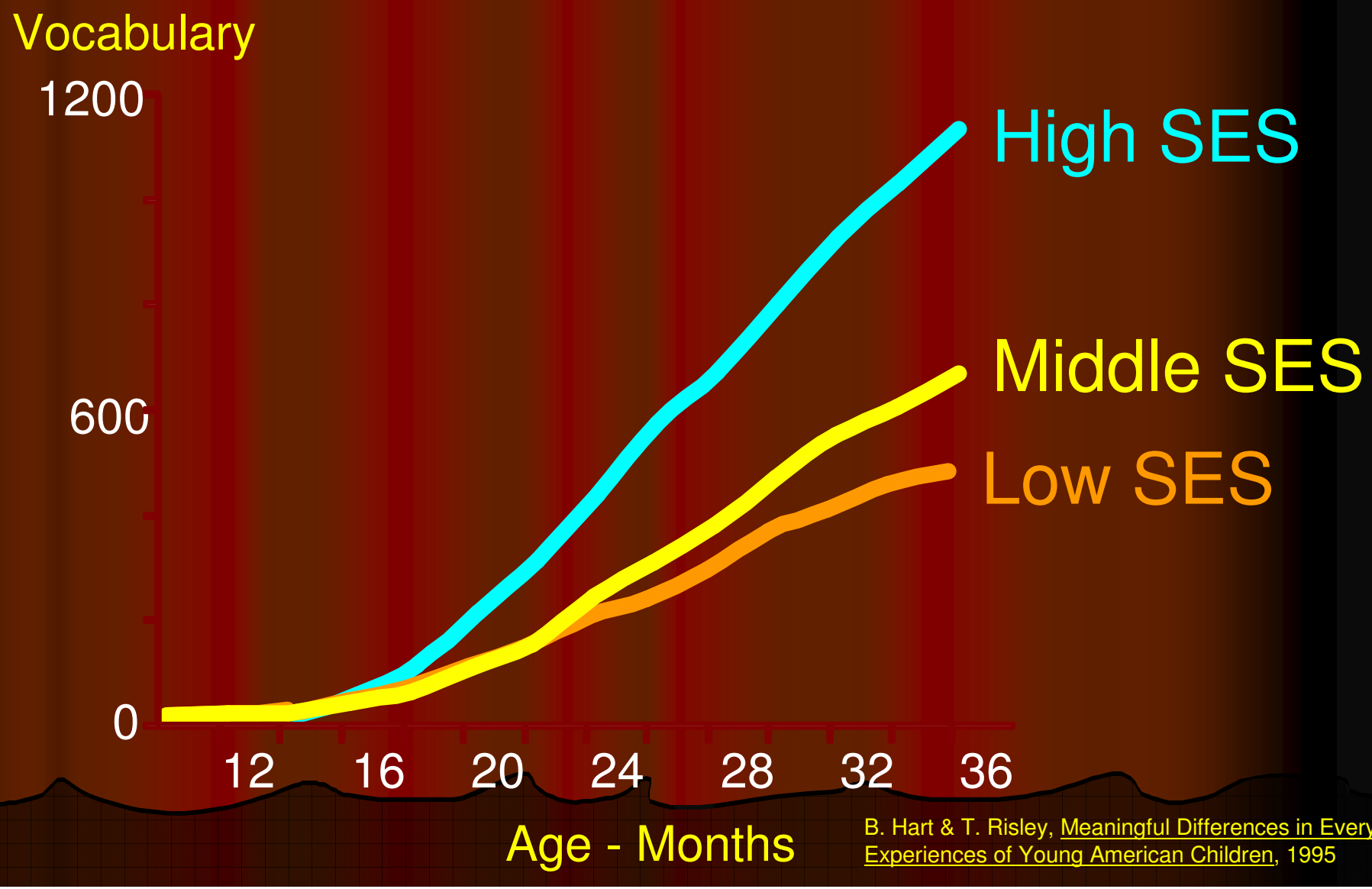
Estimated Culmulative Difference in Language Experiences by 4 Years of Age



From Hart and Risley

02-001

Vocabulary Growth – First 3 Years



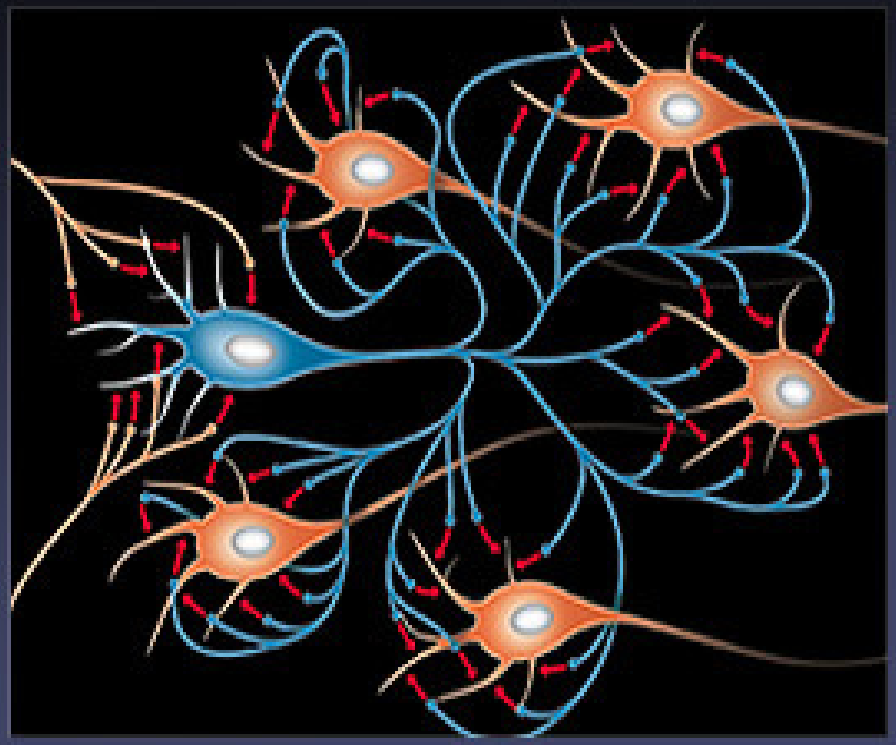
B. Hart & T. Risley, Meaningful Differences in Everyday Experiences of Young American Children, 1995

Disorders are Downstream Result of Biological Challenges

- **Basic biological challenges include:**
  - **Sensory regulation and integration**
  - **Information processing and motor control**
  - **Hypo- and hyper-functioning neurohormonal systems**
  - **Cortisolemia**
- **A child with such deficits may avoid the interactive experiences essential for healthy development or become entrenched in behaviors that lead to developmental, psychological & behavioral problems**
- **Extreme social challenges (e.g., deprivation, abuse) can lead to similar results**

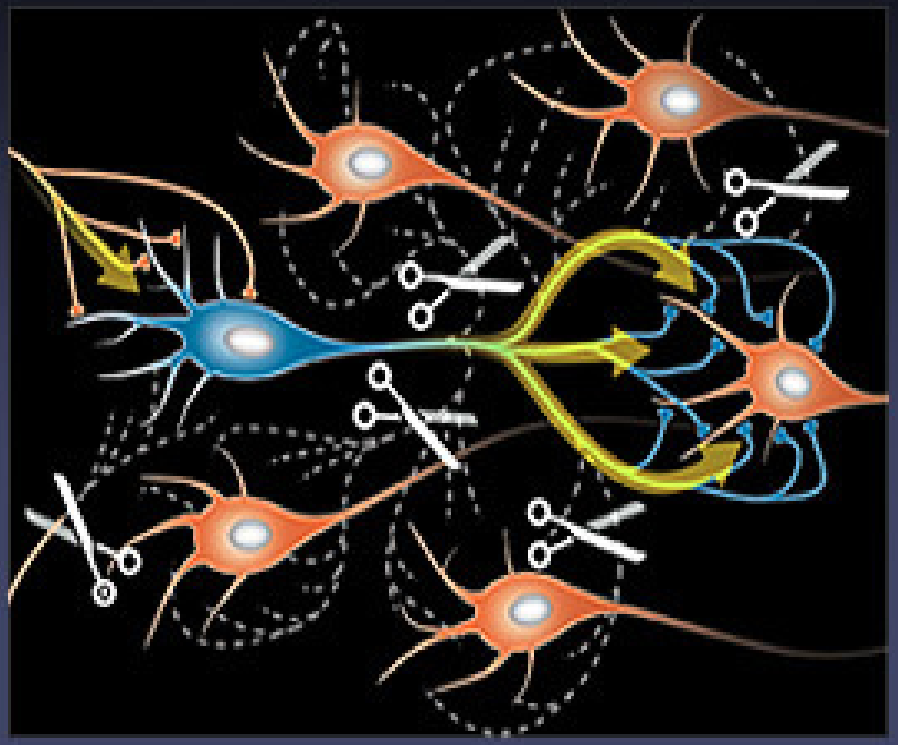
Nerve Proliferation...

- By age 11 for girls and 12 for boys, the neurons in the front of the brain have formed thousands of new connections. Over the next few years most of these links will be pruned.



...and Pruning

- Those that are used and reinforced — the pathways involved in language, for example — will be strengthened, while the ones that aren't used will die out



« PREVIOUS

NEXT: Gray Matter »

USE IT OR LOSE IT !

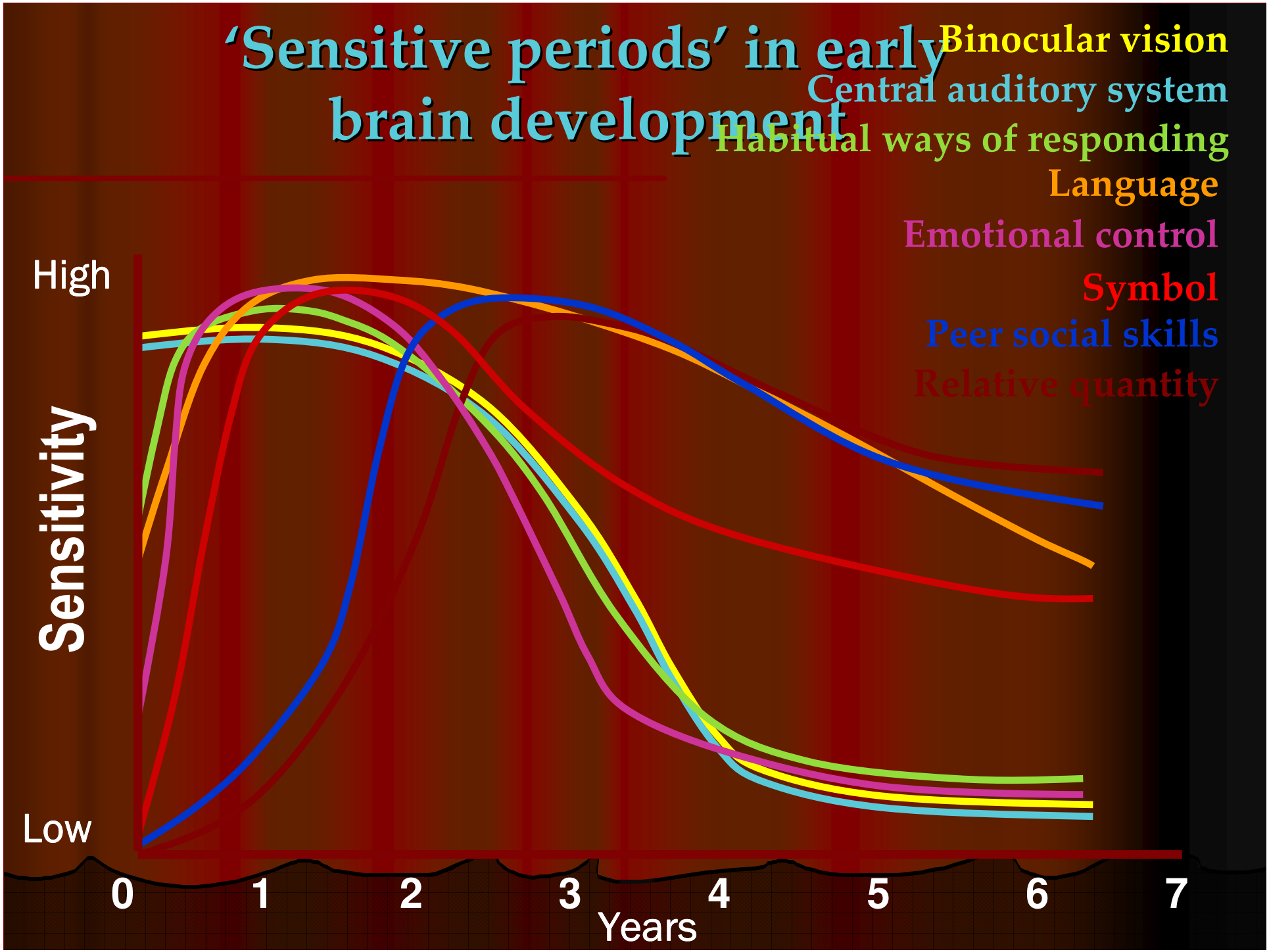
- The more a system, or set of brain cells is activated, the more that system changes in response. The stronger the repetitions the stronger the memory.

3 Year Old Children

Normal

Extreme Neglect

‘Sensitive periods’ in early brain development



03-063

HEALTH

04-006

Swedish Longitudinal Study – ECD and Adult Health

Adult Health	Number of Adverse ECD Circumstances*				
	0	1	2	3	4
	Odds - Ratios				
General Physical	1	1.39	1.54	2.08	2.66
Circulatory	1	1.56	1.53	2.91	7.76
Mental	1	1.78	2.05	3.76	10.27

* Economic, family size, broken family and family dissention

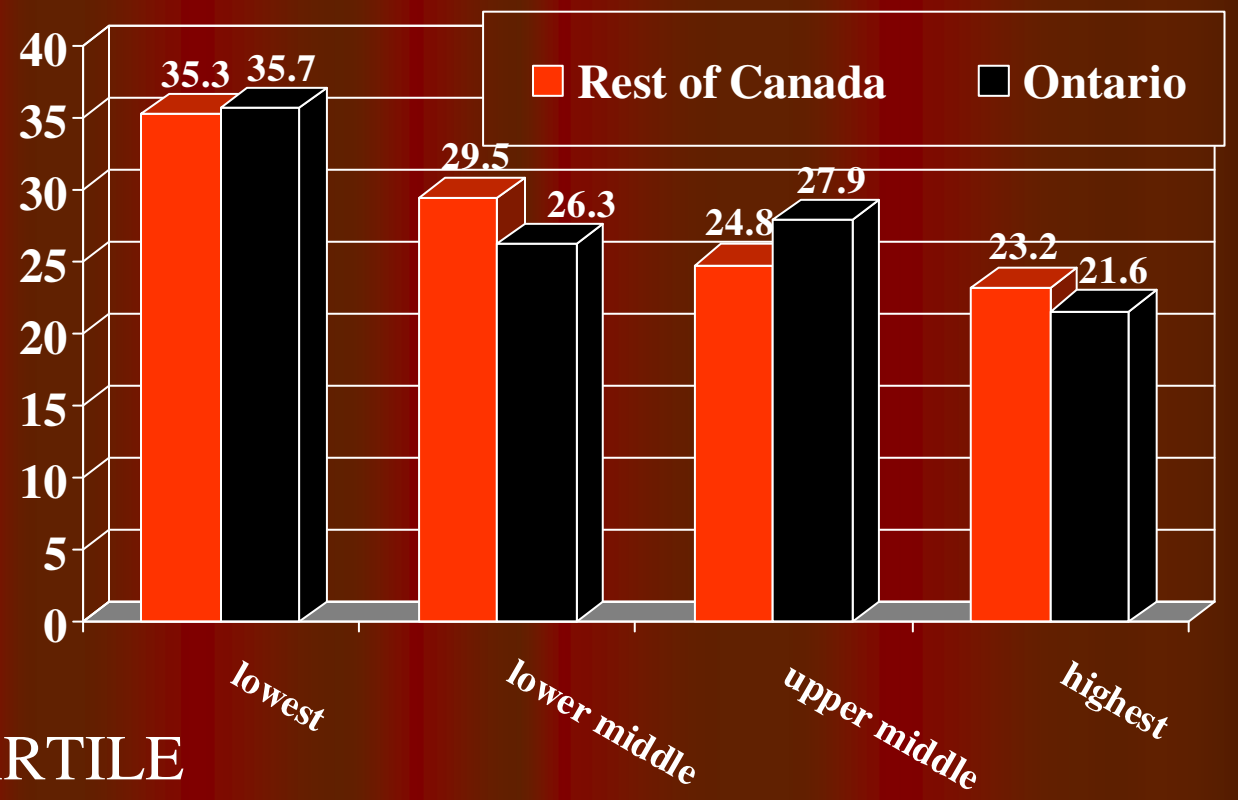
Lundberg, Soc. Sci. Med, Vol. 36, No. 8, 1993

04-161

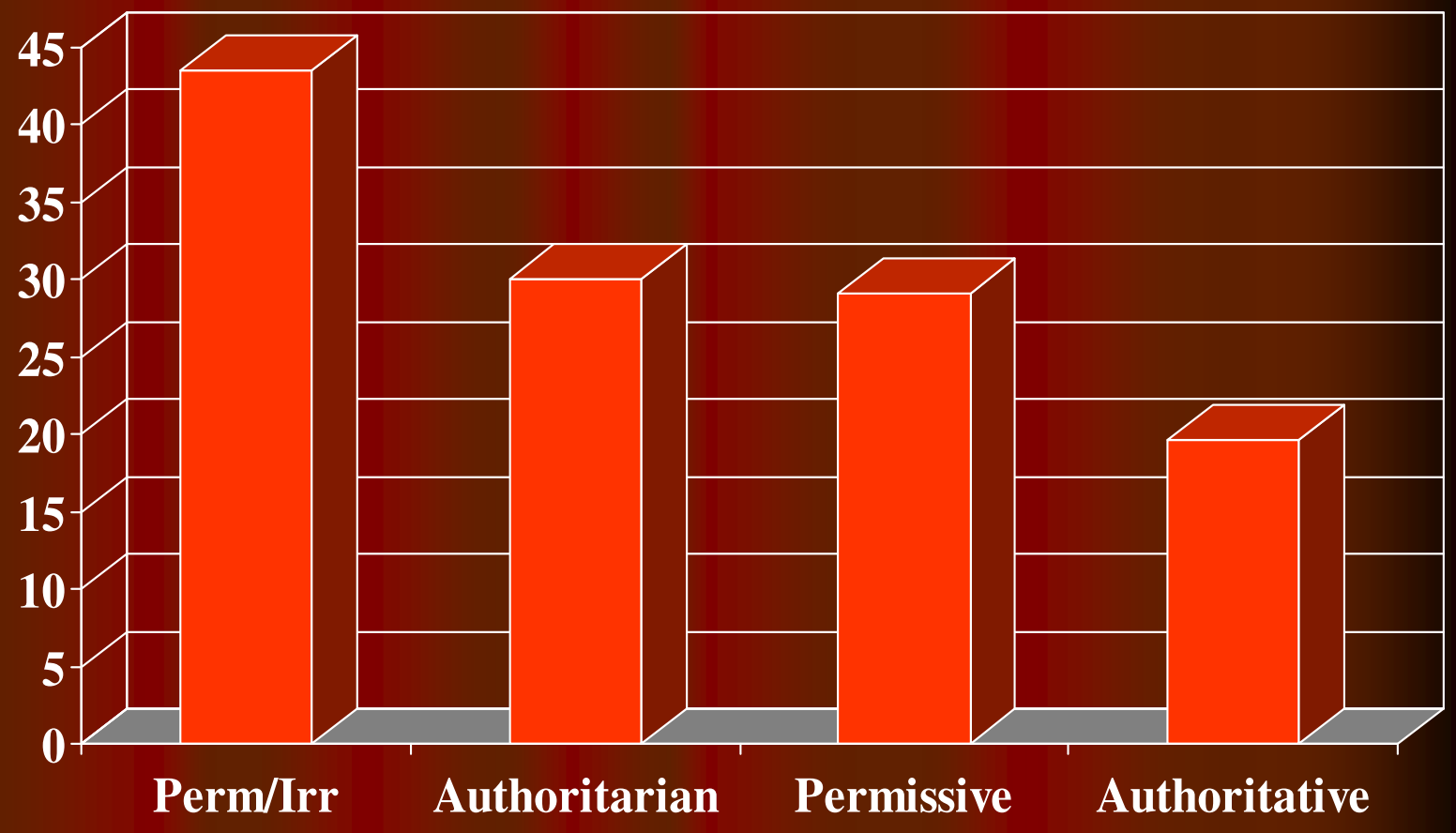
VULNERABLE CHILDREN

The Founders' Network

The Prevalence of Children with Difficulties by Family Income



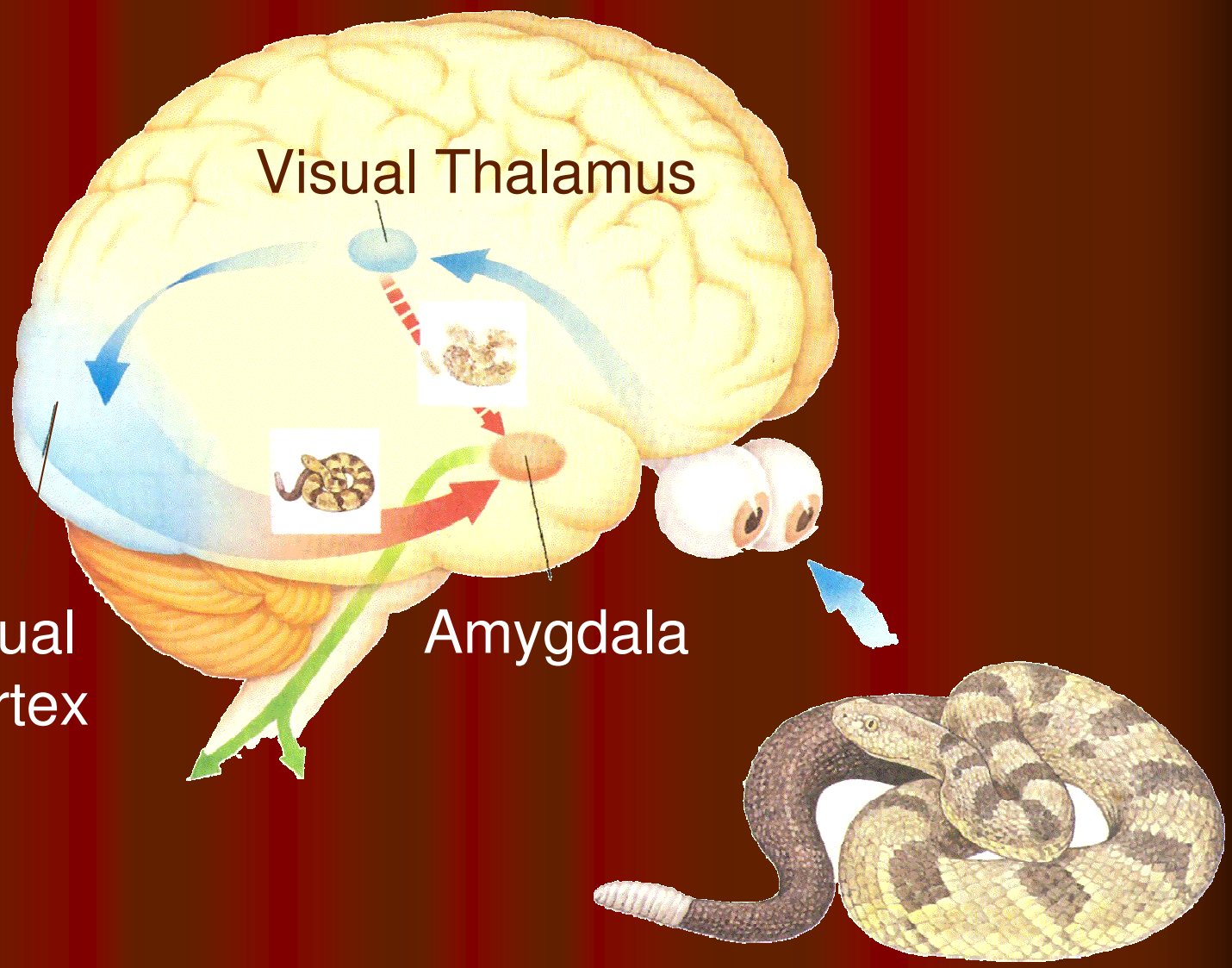
Prevalence of Children With Difficulties by Parenting Style



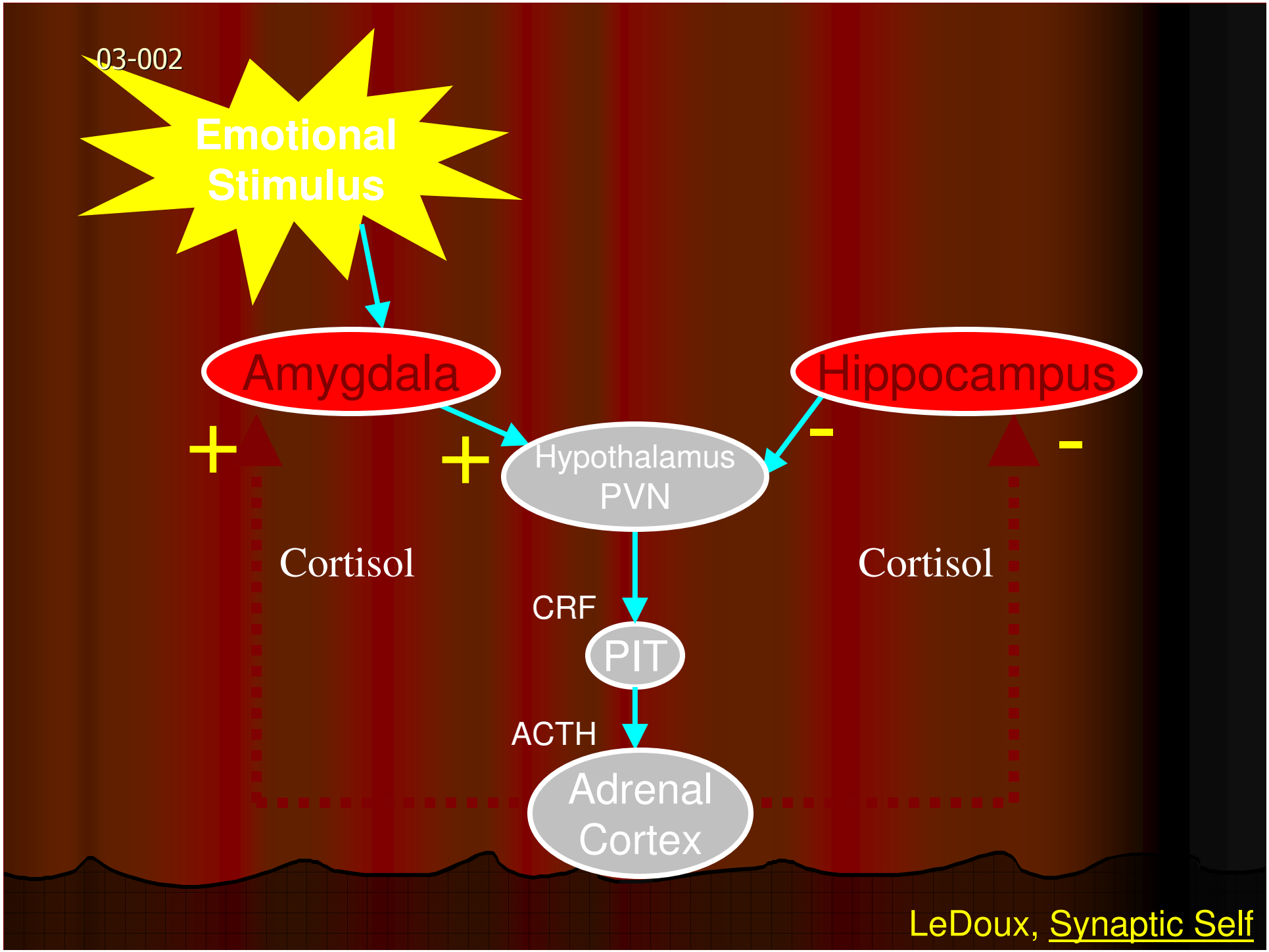
Wilms (1999)

02-066

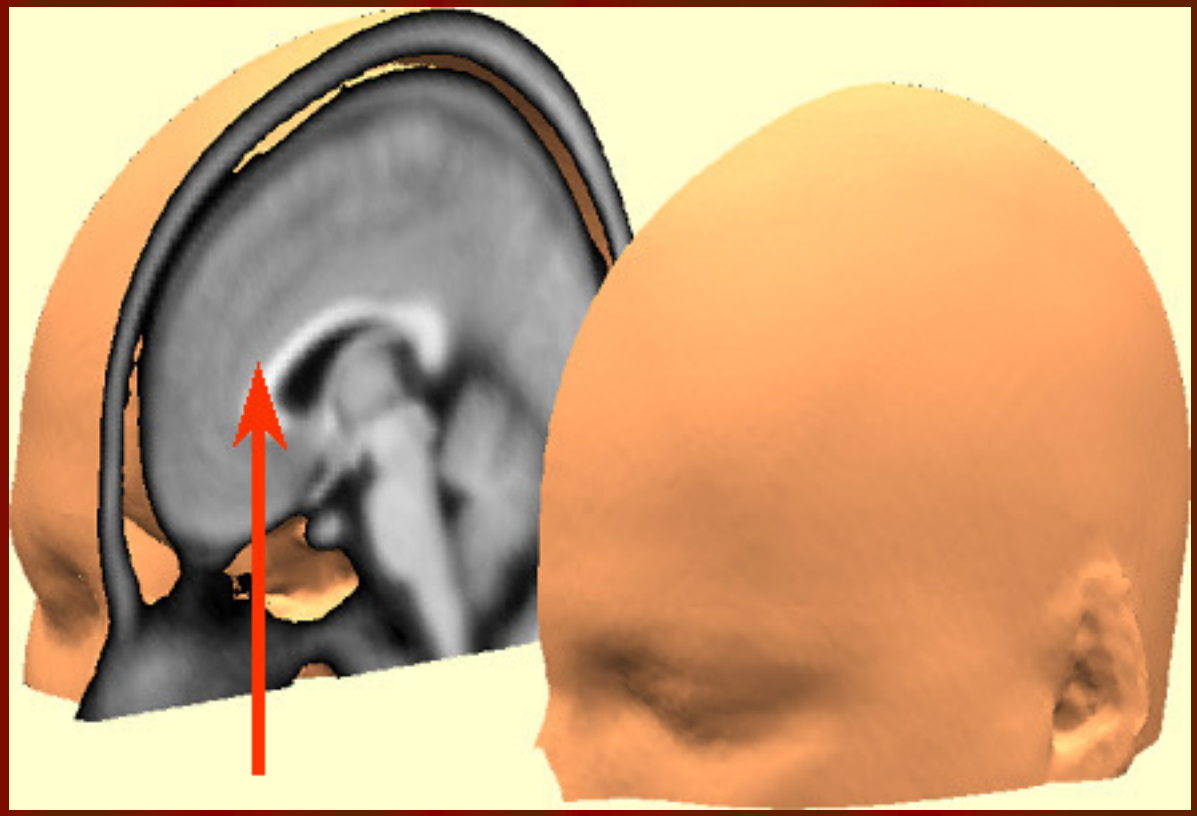
The Fear Response

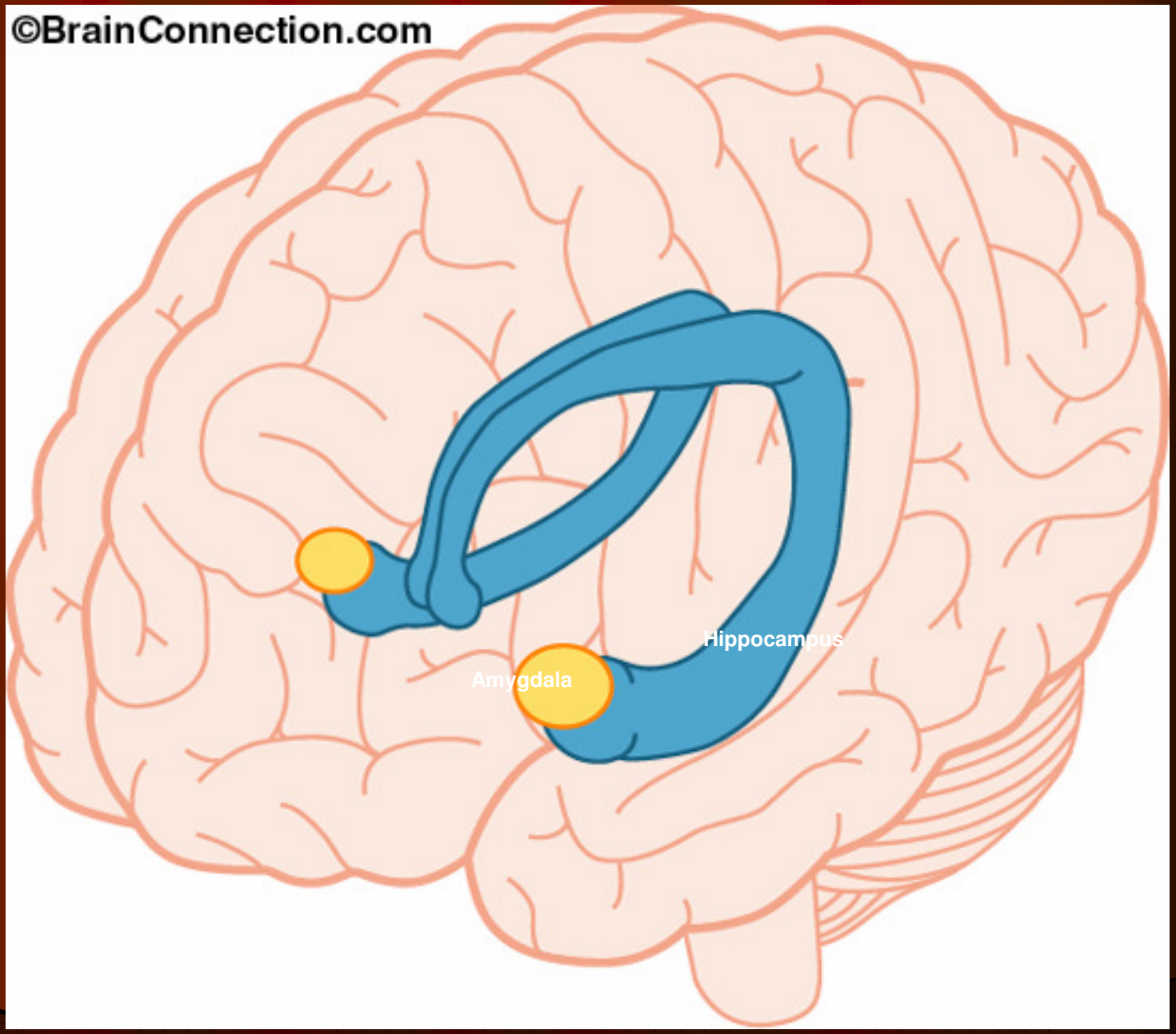


Scientific American
The Hidden Mind, 2002, Volume 12, Number 1

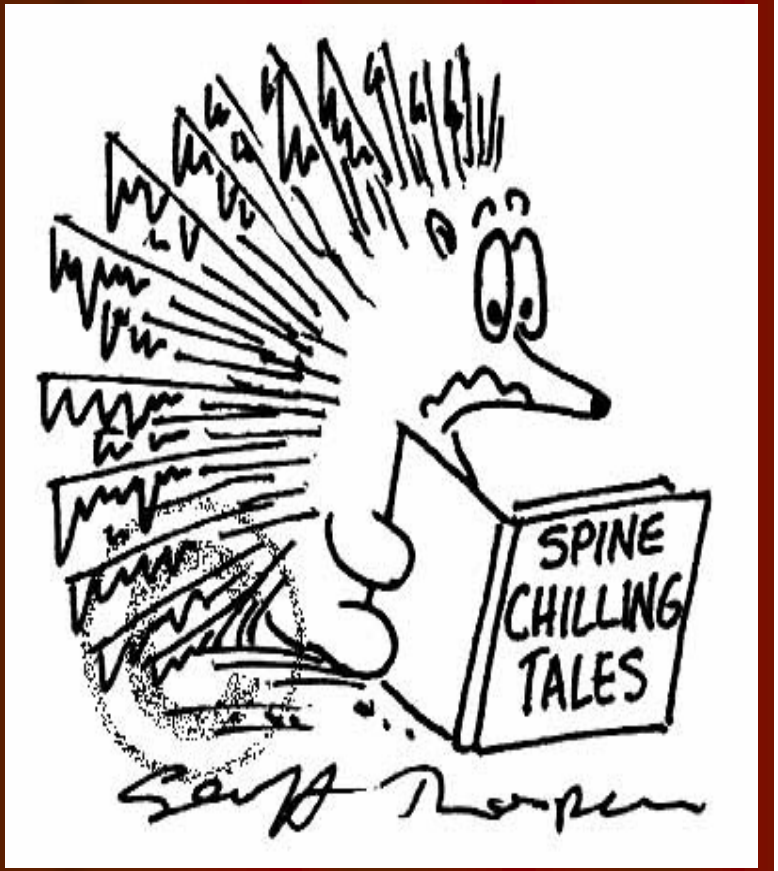

03-002
Emotional Stimulus
Amygdala
Hippocampus
+
+
-
-
Hypothalamus PVN
Cortisol
Cortisol
CRF
PIT
ACTH
Adrenal Cortex
LeDoux, Synaptic Self

Anterior Cingulate Cortex




©BrainConnection.com
Hippocampus
Amygdala

Amygdala and Hippocampus



Cortisol can be bad for the brain

Hippocampus

- high sterol levels cause loss of dendrites and cell death

Frontal brain

- attention deficits

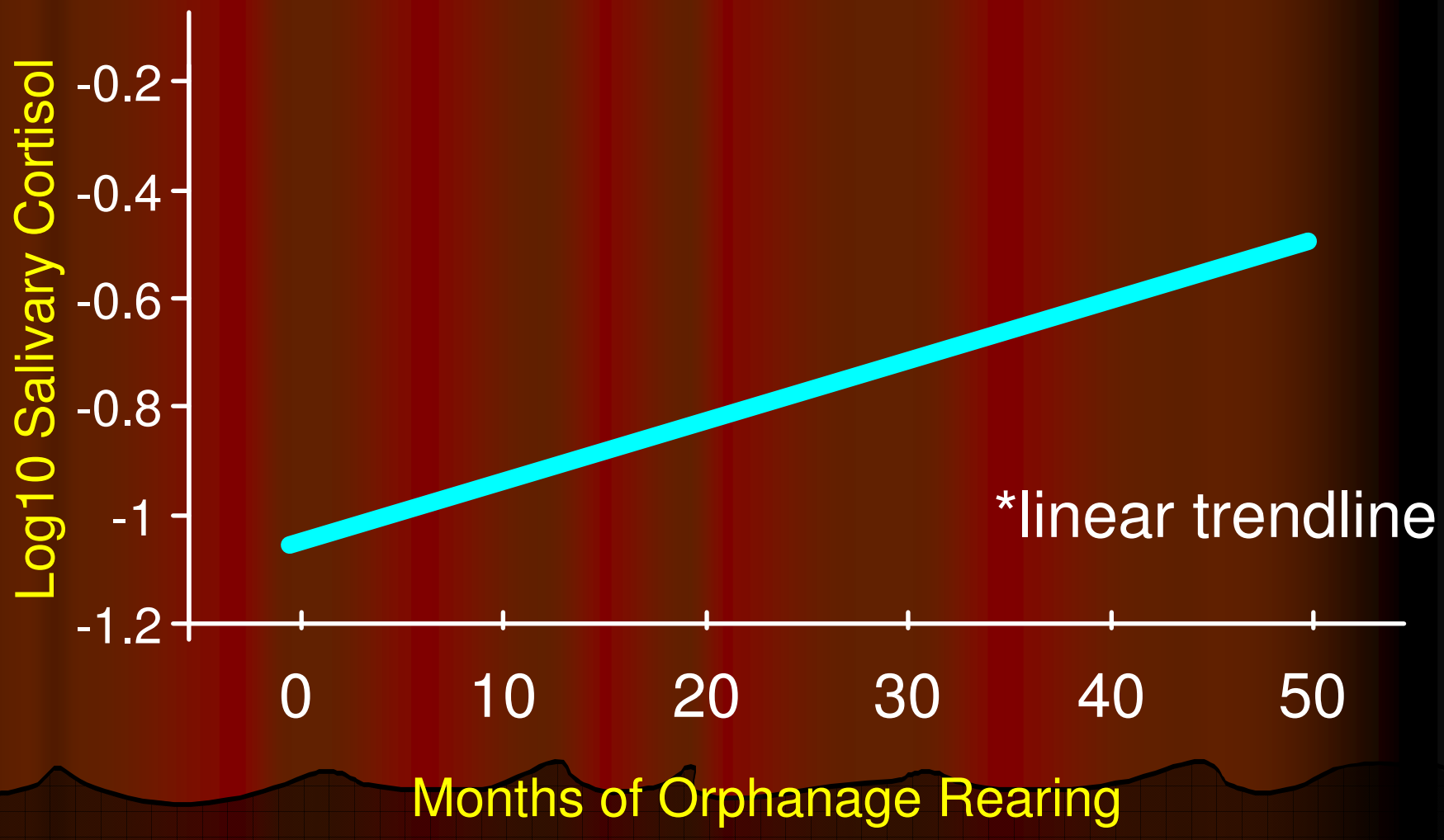
Children's Stress Pathway

- "Children's number one fear is PUBLIC HUMILIATION. They will do anything to belong".

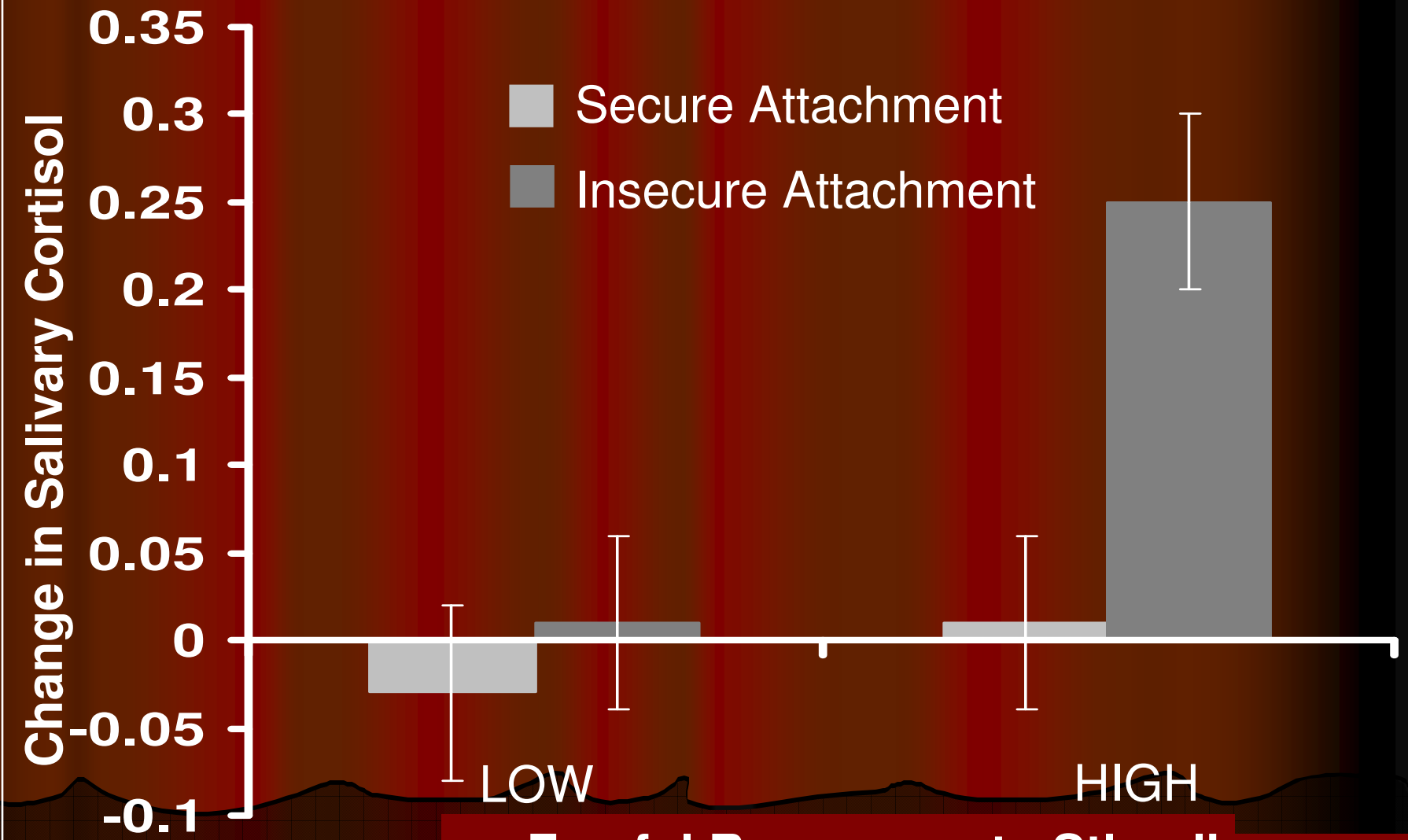
- "If a child is not sure if they are going to be embarrassed or humiliated they can't learn"
- Mary Gordon

00-046

Evening Cortisol Levels Increase with Months of Orphanage Rearing *



Secure Attachment Buffers Cortisol Response to Threatening Events

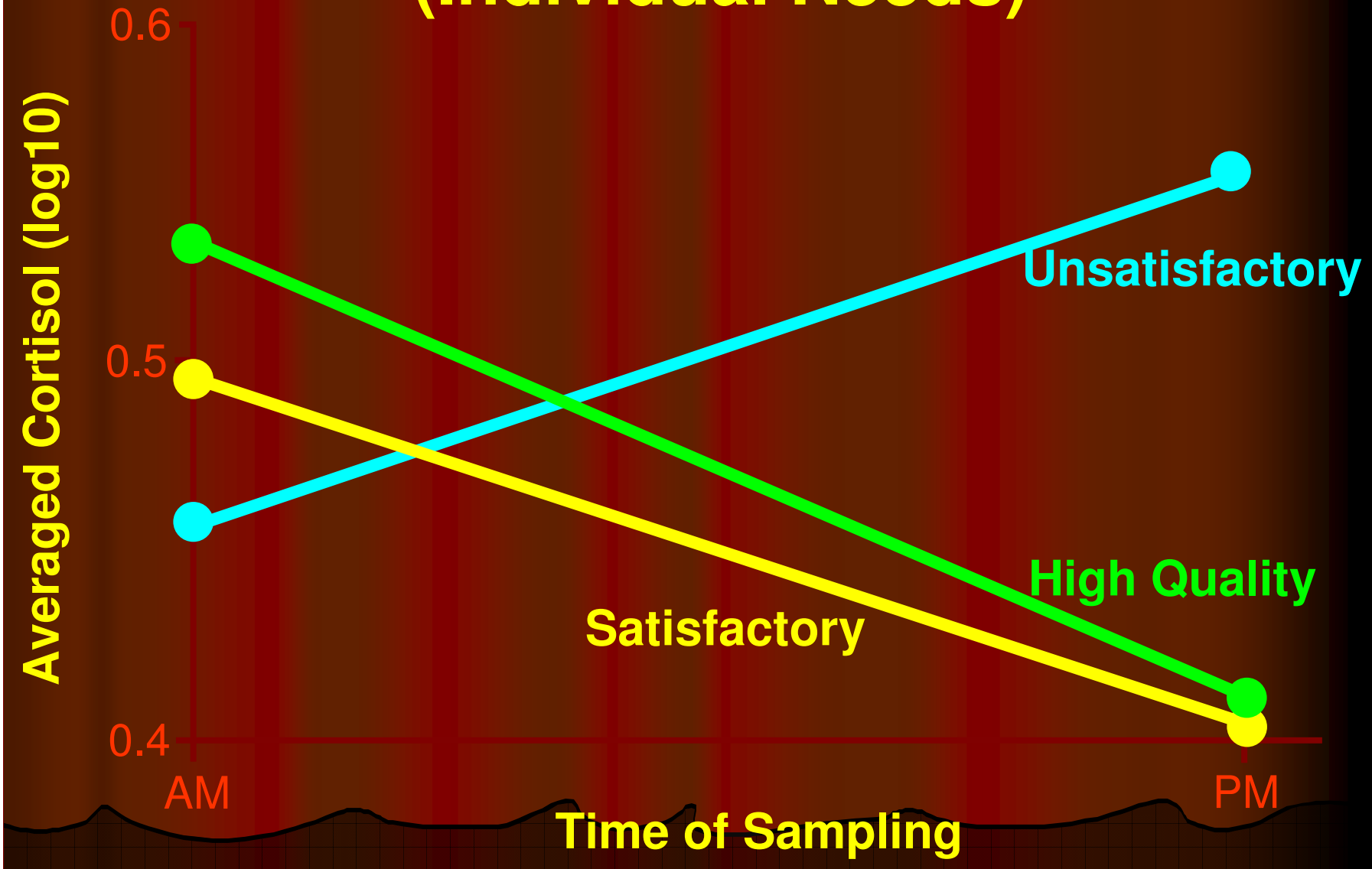


Fearful Responses to Stimuli

Gunnar (1996).

05-063

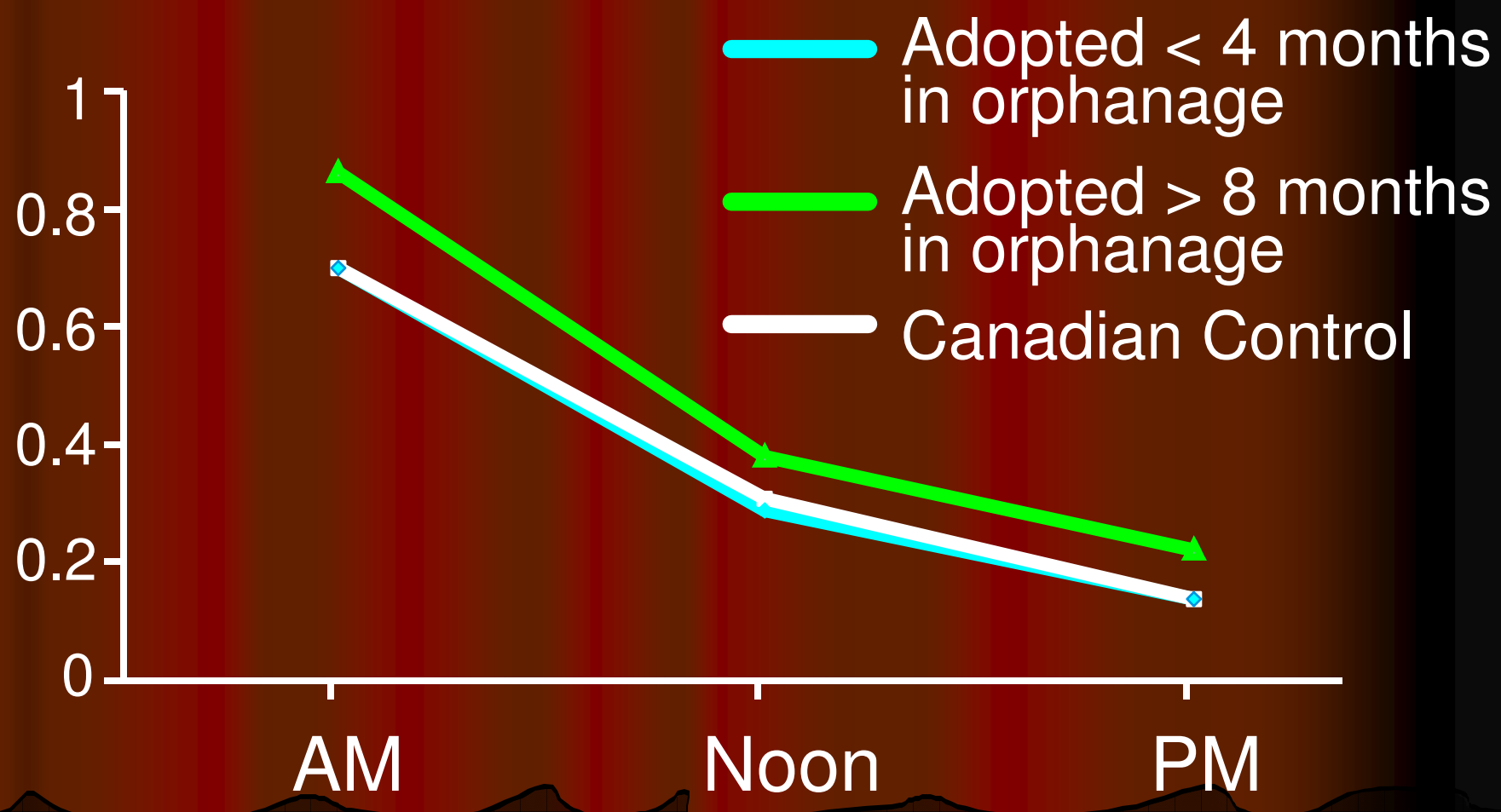
Daycare Quality & Cortisol Levels (Individual Needs)



Sims et al. 2005.

00-045

Cortisol Levels in Romanian Adopted Children 6 Years Post Adoption



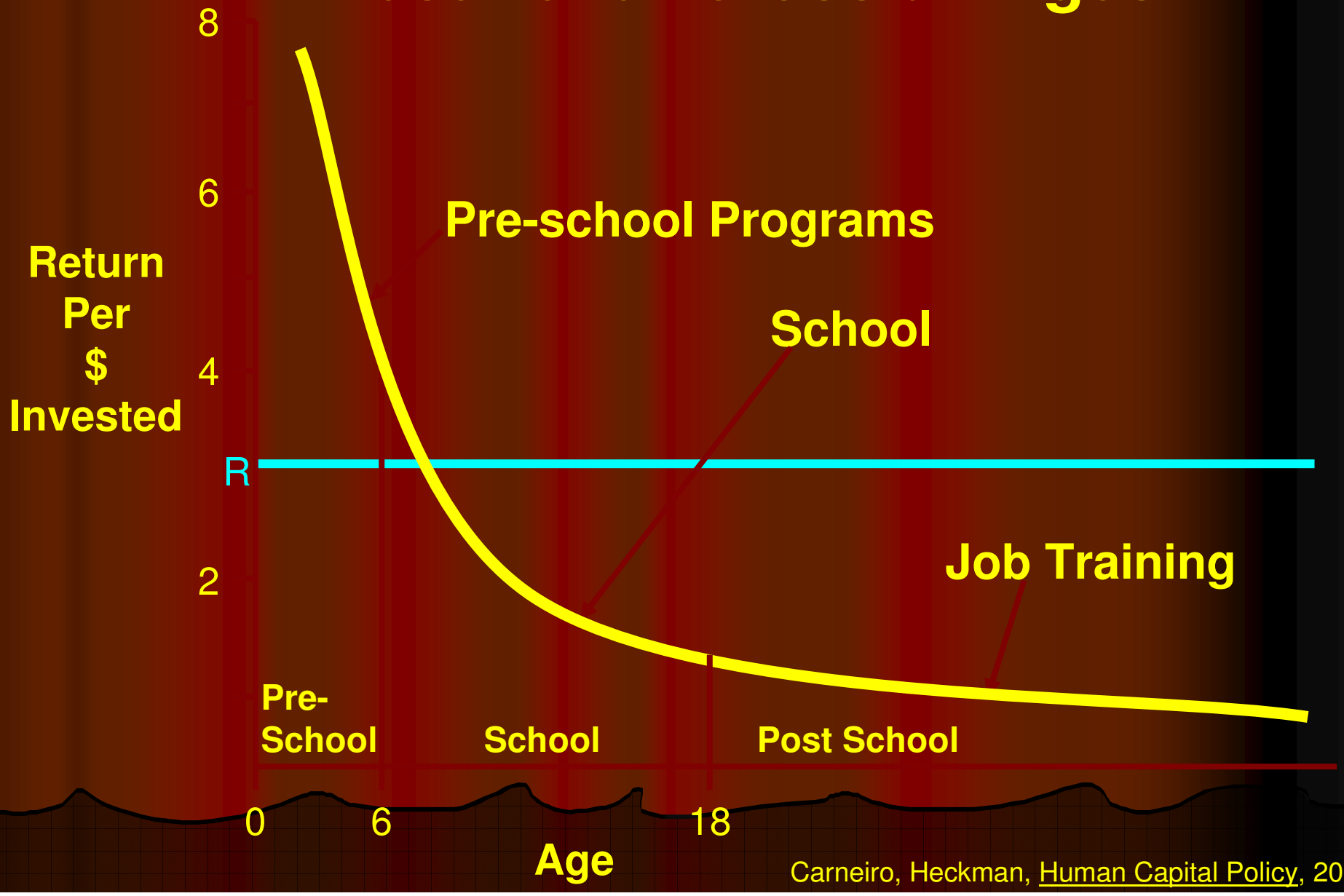
Economic Returns of Pre-K

	Cost Savings per $1 Invested
Perry Preschool	**$17**
Abecedarian	**$4**
Chicago Child Parent Centers	**$7**

Includes savings from less welfare usage, decreased crime and incarceration costs, and higher participant productivity/earnings

Rates of Return to Human Development Investment Across all Ages

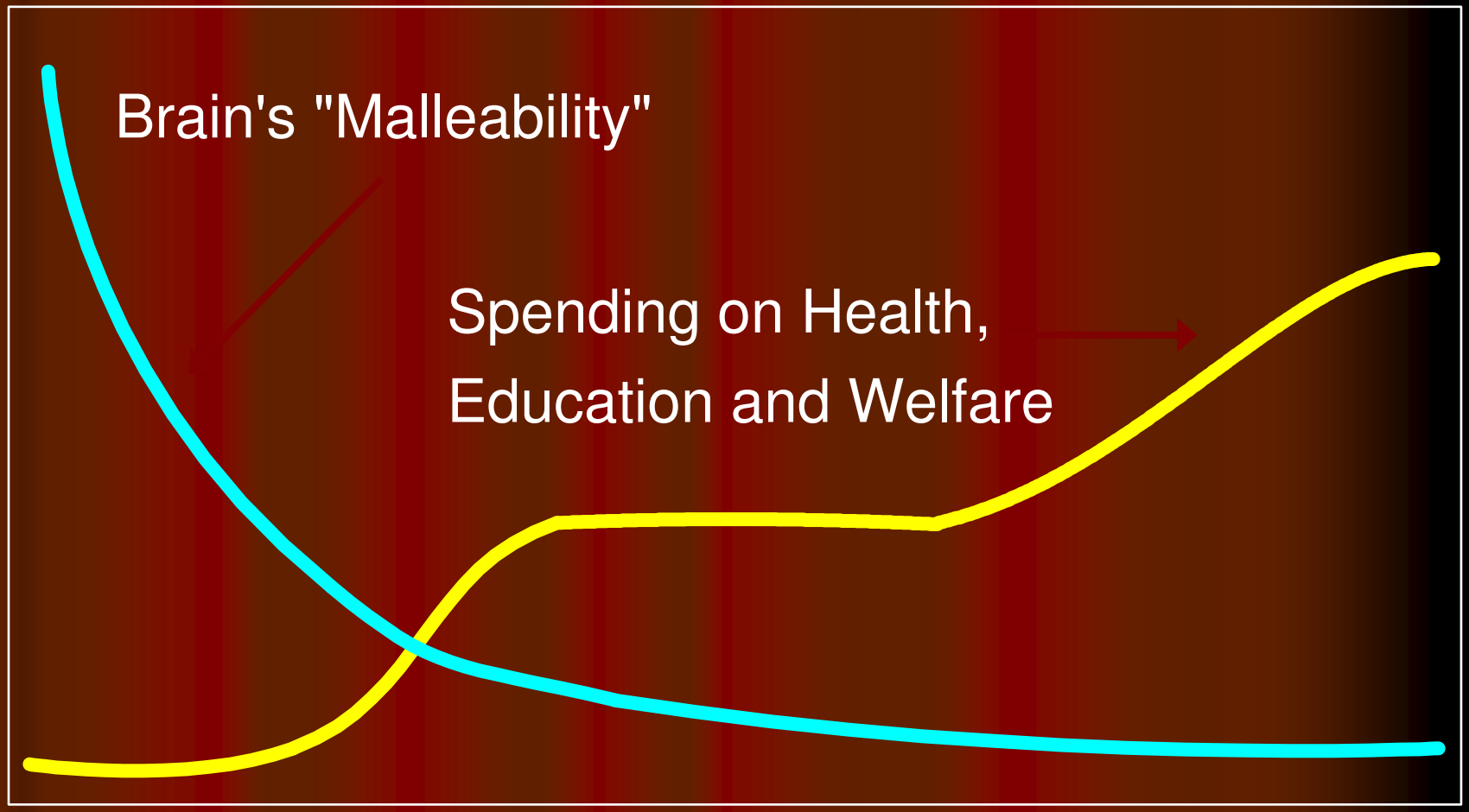
03-074



Carneiro, Heckman, Human Capital Policy, 2003

97-044

The Mismatch Between Opportunity and Investment



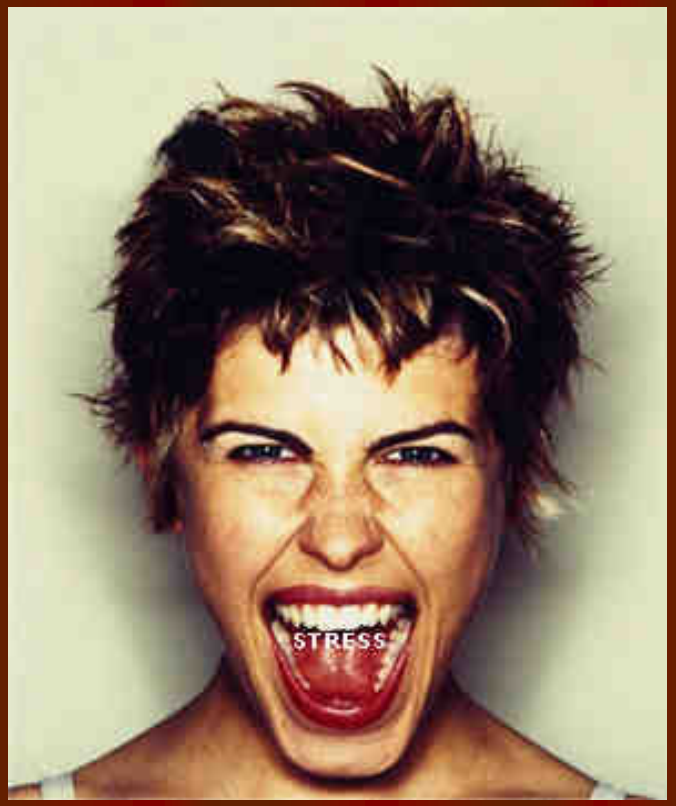
0 3 10 70

Age

05-042

S. Suomi

Maternal Stress



- Affects HPA axis in offspring
- Can alter susceptibilty to later disease/ drug taking
- Affects males more than females

00-053

Non Human Primate Development

Poor Mothering First 6 Months of Life

- Increased anxiety and depression as adults
- Excessive alcohol consumption
- Impulse aggression and violent behaviour
- Females tend to be poor mothers
- Highest risk genetically predisposed to high cortisol levels during development

00-054

Poorly Nurtured Rhesus Monkey Infants

Biological Changes

- High cortisol levels to mild stress
- Chronic deficits in serotonin metabolism
- Disrupted circadian rhythms for cortisol

00-054

Poorly Nurtured Rhesus Monkey Infants

Biological Changes

- High cortisol levels to mild stress
- Chronic deficits in serotonin metabolism
- Disrupted circadian rhythms for cortisol

00-055

Development of High Genetic Risk Rhesus Monkey

Infants with Nurturant Mother

- Precocious exploratory patterns
- Females become very nurturant mothers
- Rise to top of social groups - dominance hierarchy
- Robust immune responsiveness

EPIGENETICS

- Any Functional Change in the Genome that does not involve an alteration of sequence.
- Familial transmission of traits vulnerabilities) from parent(s) to offspring can occur through a nongenomic mechanism of inheritance

05-056

Individual differences in stress reactivity of the **adult** are **determined by maternal behaviour during infancy**

HIGH LG

LOW LG

Development of Stress Reactivity

Modest Stress Reactivity

Reduced Risk for Disease

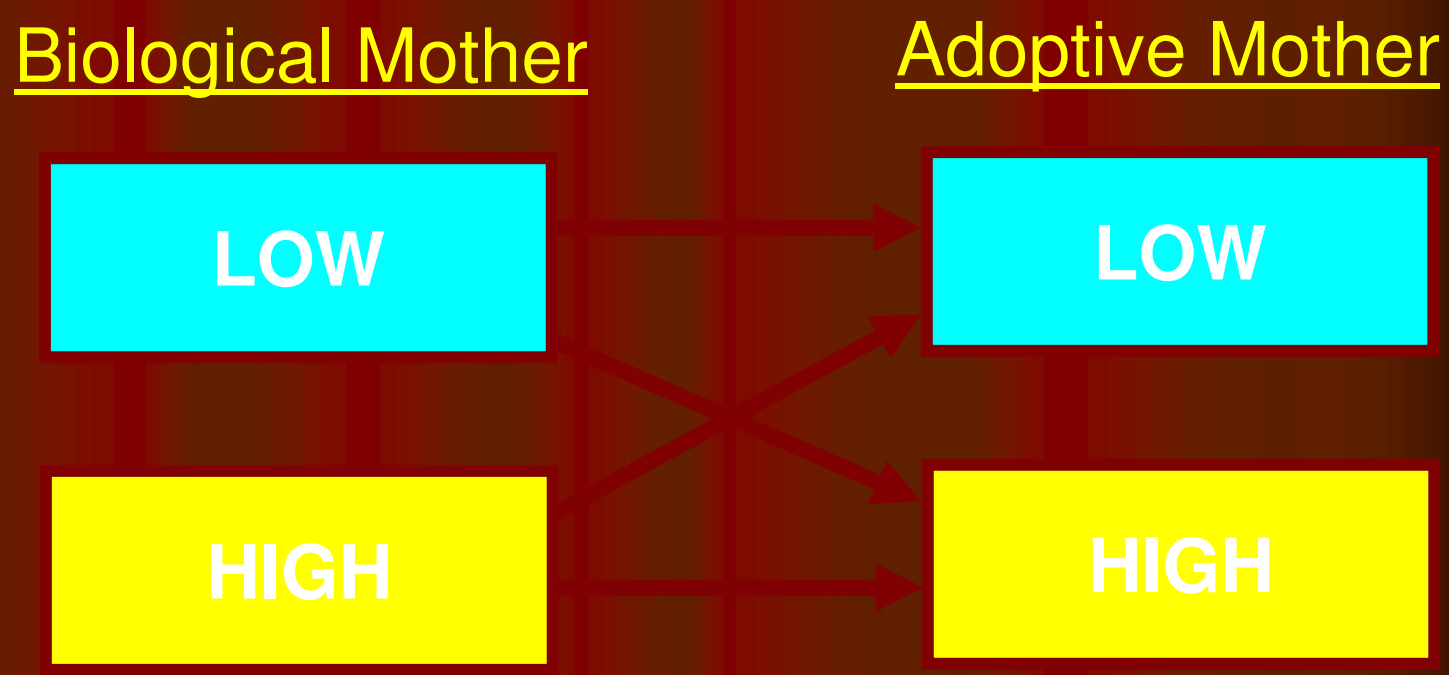
Increased Stress Reactivity

Increased Risk for Heart Disease, Type II Diabetes, Alcoholism, Affective Disorders, Brain Aging, etc.

M. Szyf

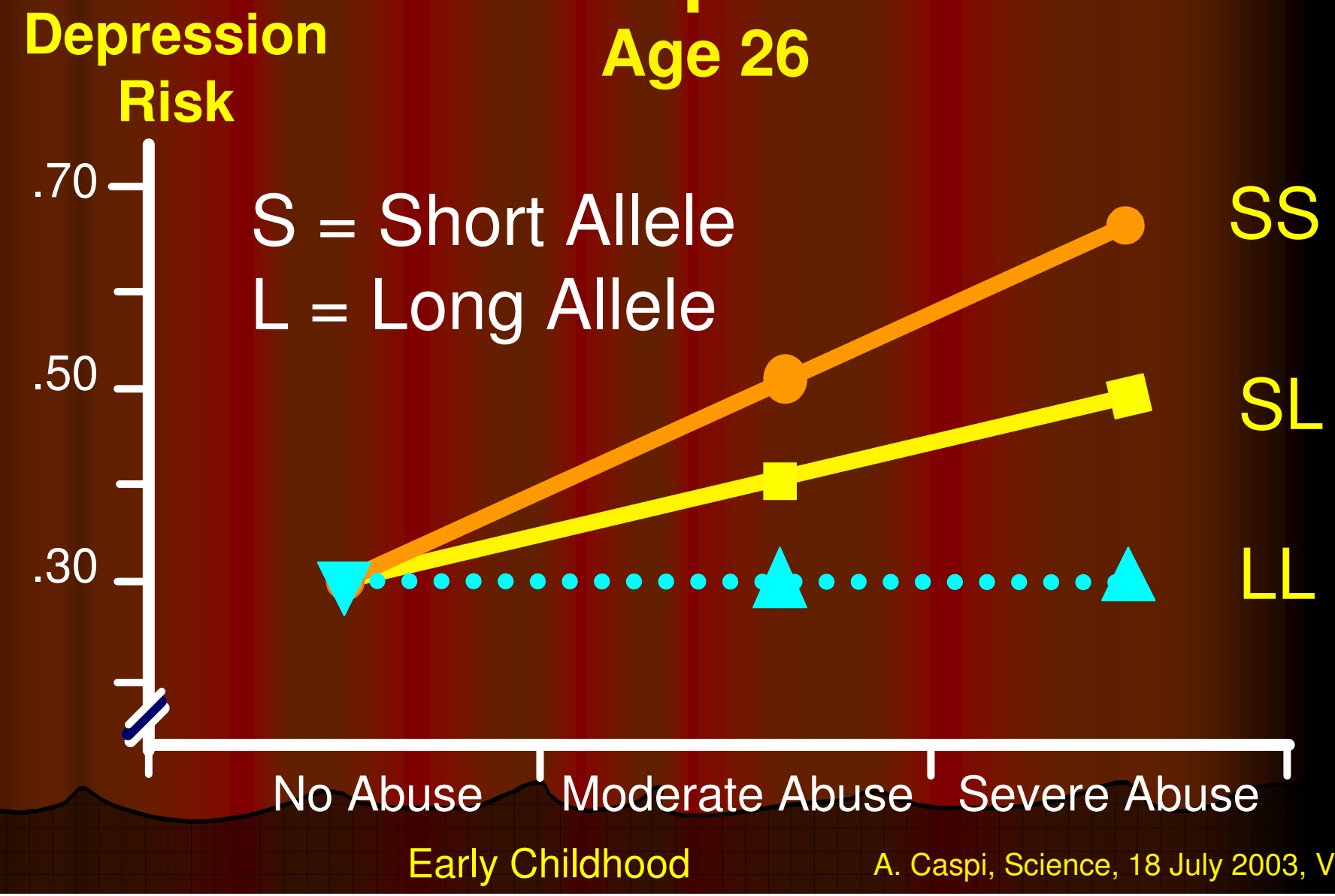
Is maternal care the mediator of these effects on hippocampal (GR(1_7) promoter methylation?

ADOPTION/CROSS FOSTERING STUDIES



Serotonin Gene, Experience, and Depression

Age 26



A. Caspi, Science, 18 July 2003, Vol 301.

Epigenetics and Brain Plasticity

- Experience and methylation of DNA
- Imprints environmental experiences on the fixed genome
- Maternal behaviour affects DNA methylation
- Can be transmitted to offspring

Summary:
Brain Plasticity

- Sensing pathways – set in early life
  - Vision
  - Hearing
  - Touch
- HPA Pathway (stress) – set in early life
  - (HPA-Immune Pathway)
- Hippocampus - Memory
  - Plasticity sustained throughout life
  - Affected by HPA Pathway

99-004

ECD and Experience-Based Brain Development

age - 0 1 2 3 4 5 6

Components of Early Childhood Development and Parenting Centres:

- Universal – available, accessible, affordable and optional
- Parental and non-parental care
- Parent- and child-oriented
- Quality early child development environments
- Responsive relationships and parent involvement
- Detect development problems early

Importance of Relationships

"Human beings of all ages are happiest and able to deploy their talents to best advantage" when they experience *trusted others* as "standing behind them."

Bowlby, 1973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