

# Building a Comprehensive Early Childhood Development System

Centre of Excellence for Early Childhood Development

Quebec City, Quebec

---

## Experience-Based Brain Development

---

By J. Fraser Mustard  
Founding President, CIAR

May 25, 2004



CIAR

---

The Canadian Institute for Advanced Research

# CIAR - Programs

---

- Population Health
- Human Development

---

# **Brain Development in Early Life Sets Trajectories for Development Throughout Life**

---

# Summary (1): 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
- Experience and gene expression

# Summary (2): ECD – Health, Learning and Behaviour

---

- Experience-based brain development in early life (including in utero) can set trajectories for learning, behaviour and health that are difficult to change later in life.

# Experience and Brain Development

---

- Stimuli in early life switch on genetic pathways that differentiate neuron function – sensitive period
- Stimuli affect the formation of the connections (synapses) among the billions of neurons

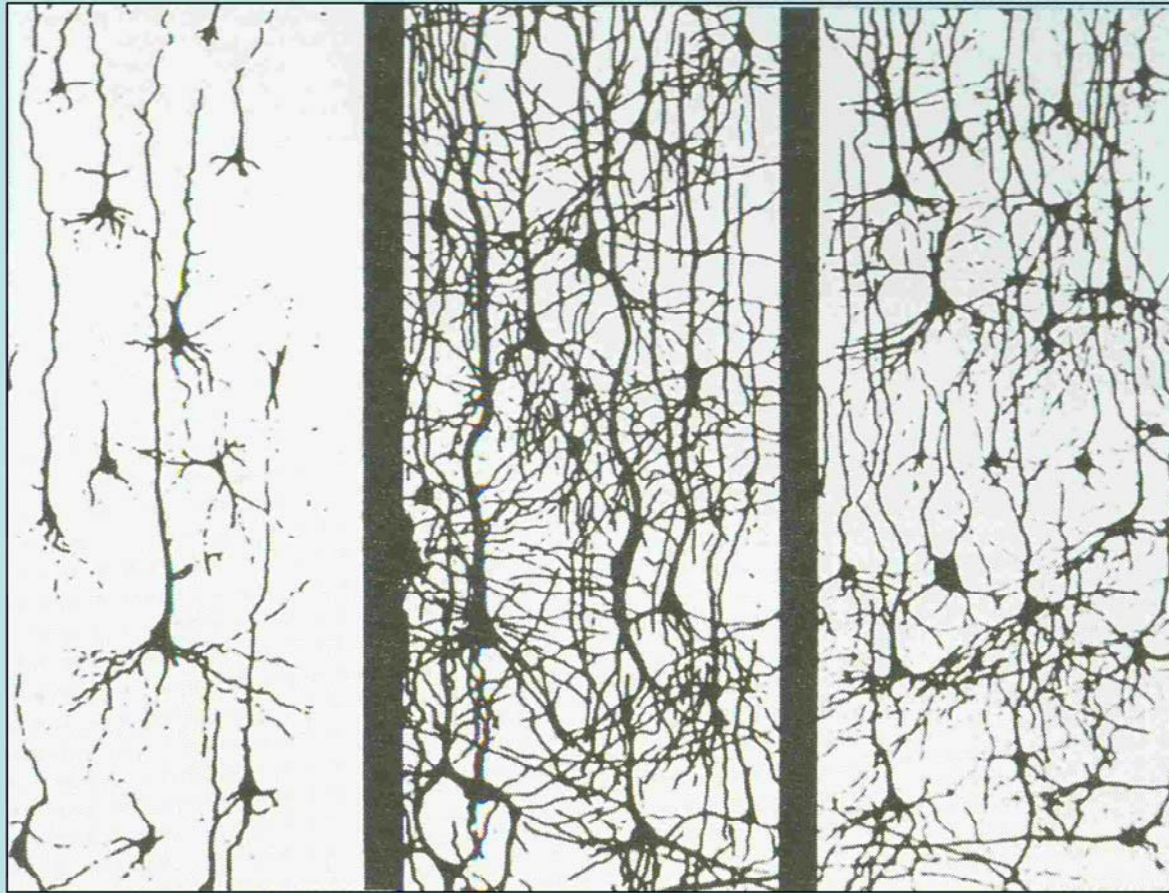
From studies in humans, monkeys and rats

# Synaptic Density

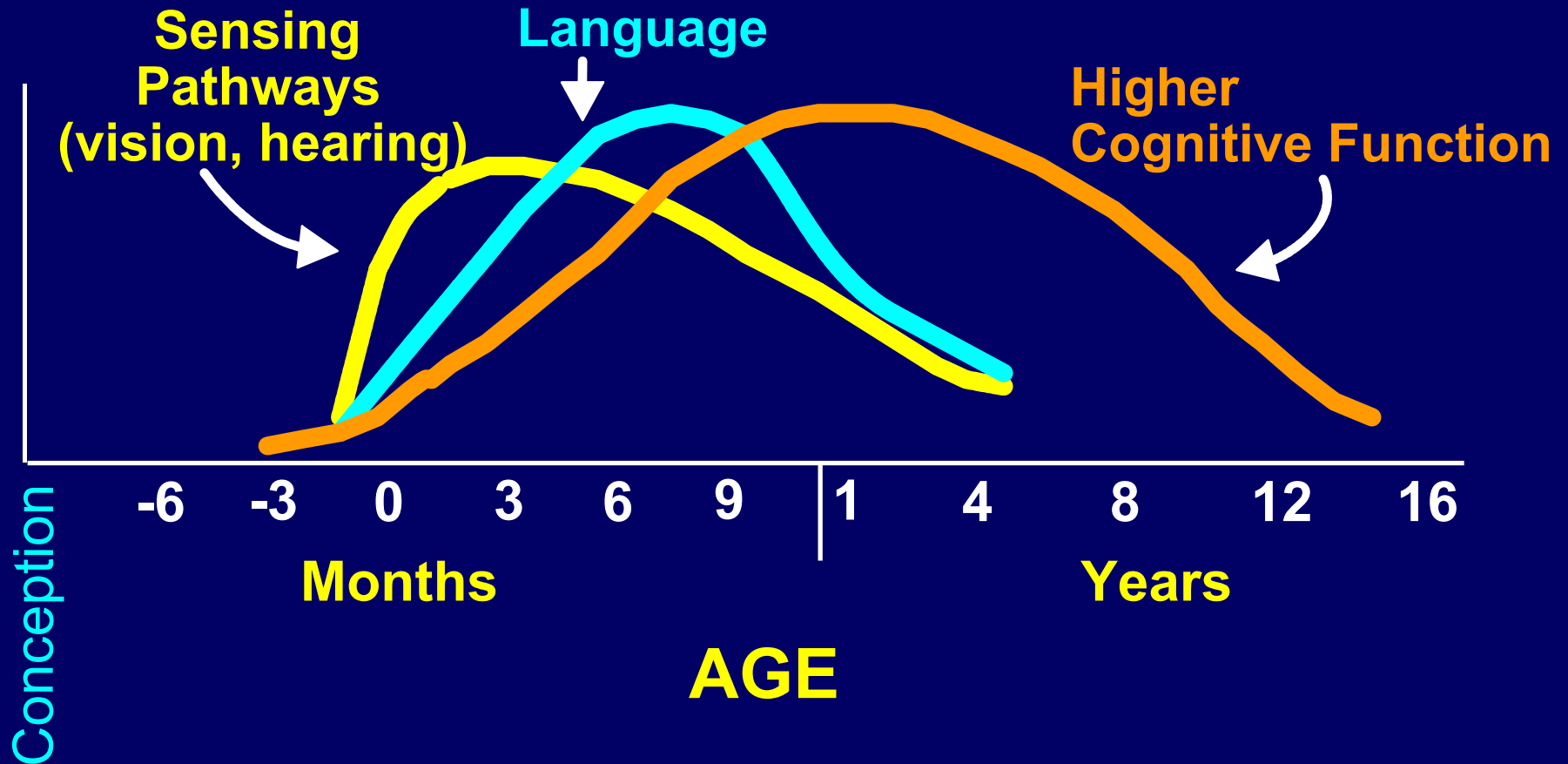
At Birth

6 Years Old

14 Years Old



# Human Brain Development – Synapse Formation

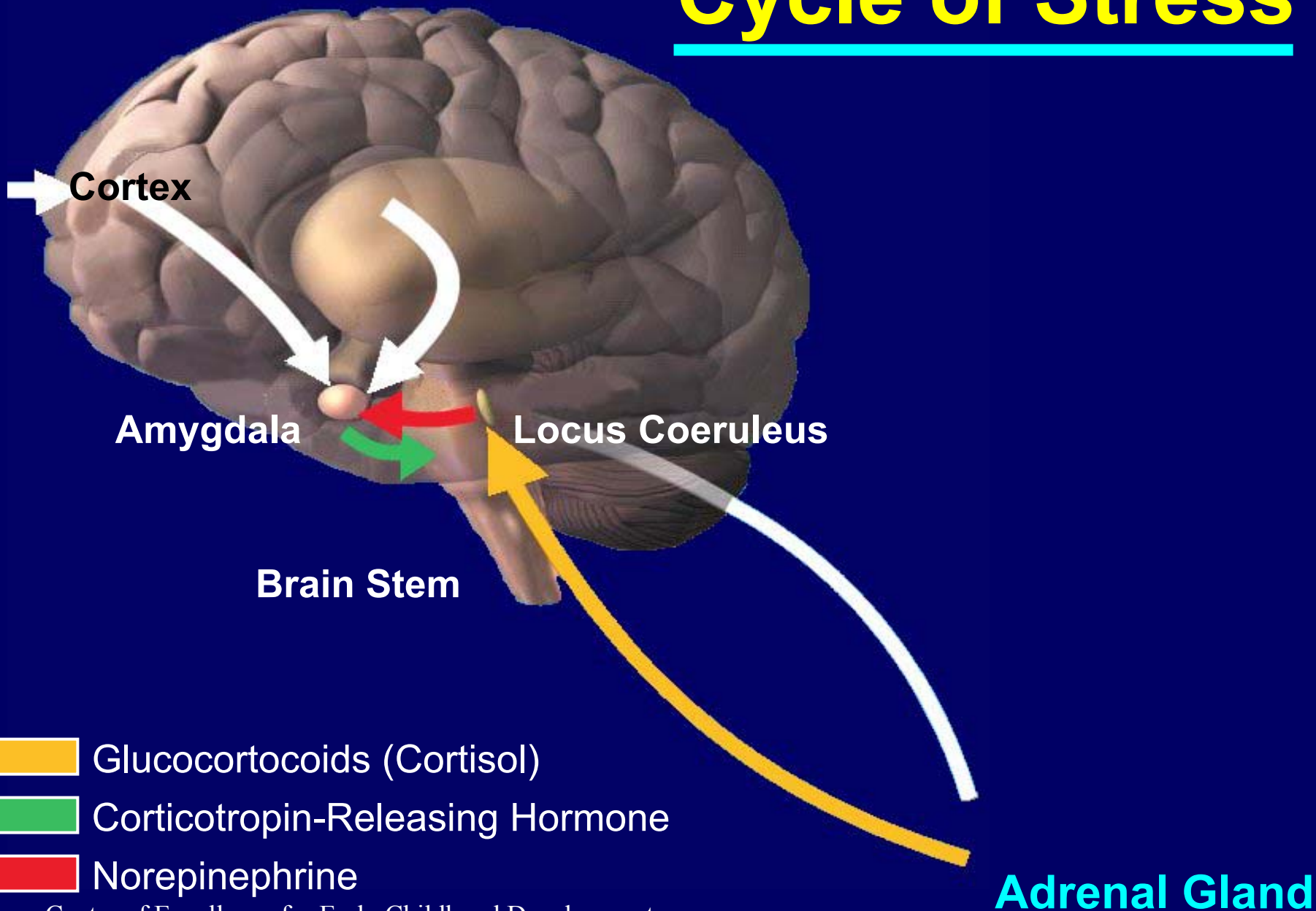


# Stress: Two Key Pathways

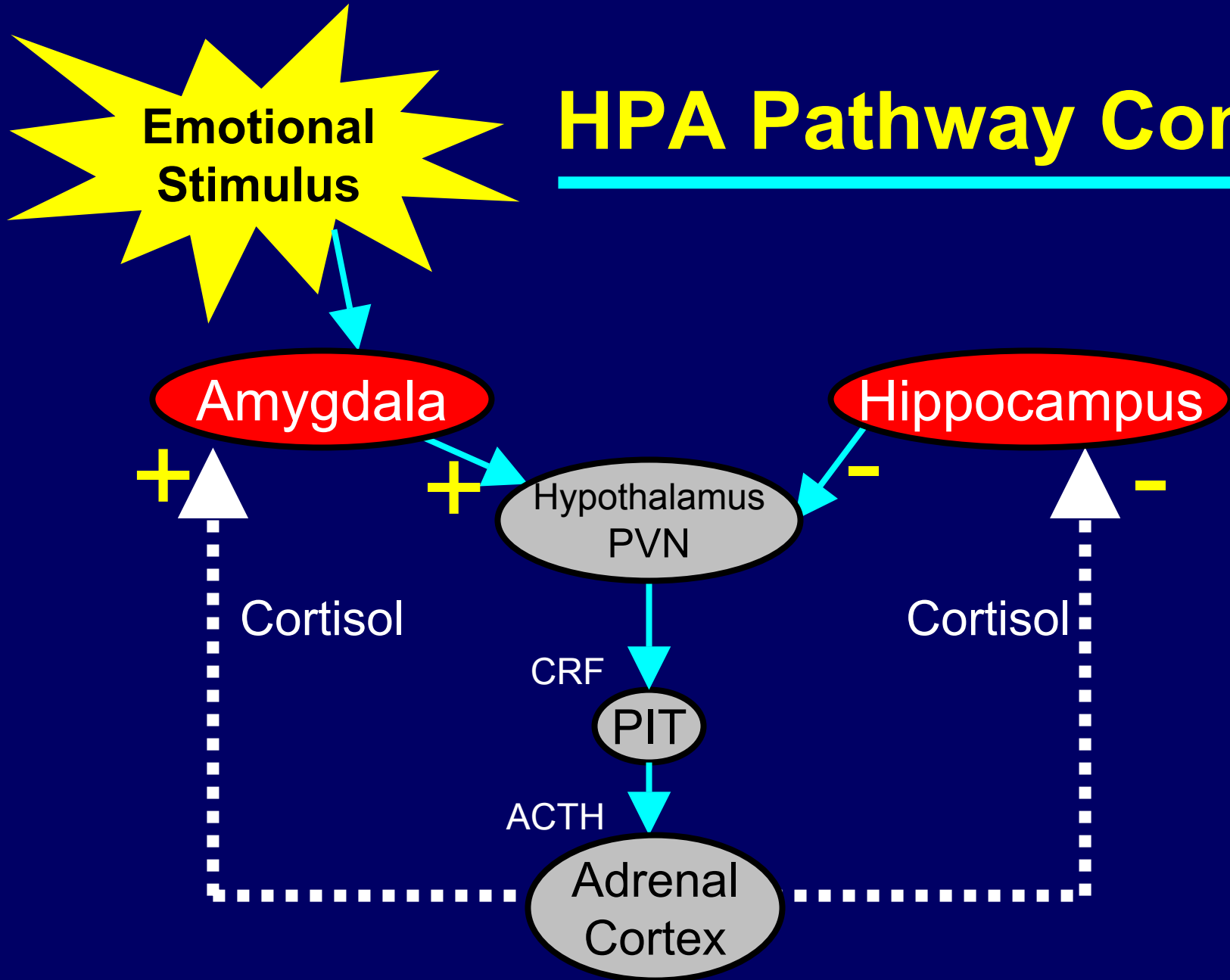
---

1. Autonomic Nervous System  
- Epinephrine
2. Hypothalamus Pituitary Adrenal  
Gland (HPA) Pathway

# Cycle of Stress



# HPA Pathway Control



---

# HEALTH

---

# Swedish Longitudinal Study – ECD and Adult Health

Number of Adverse ECD Circumstances\*

0      1      2      3      4

**Adult Health**

**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

# Health Problems Related to Early Life

---

- Coronary Heart Disease
- Non-insulin Dependent Diabetes
- Obesity
- Blood Pressure
- Aging and Memory Loss
- Mental Health (depression)




"Follow up through life of successive samples of birth has pointed to the crucial influence of early life on subsequent mental and physical health and development."

Acheson, Donald - Independent Inquiry into Inequalities in Health, 1998

---

# BEHAVIOUR

---



"Longitudinal studies show ... most seriously antisocial adolescents and adults who had behavior problems during childhood showed as antisocial behavior when they enter the school systems."

Tremblay, R. - Developmental Health and the Wealth of Nations, 1999

---

# LEARNING

---

# Learning:

## Early Life and Learning Trajectories

---

- Longitudinal studies of birth cohorts
- Randomized controlled trials of interventions in the early years
- Observational studies  
eg. Orphans and adoption

# 1970 British Birth Cohort

---

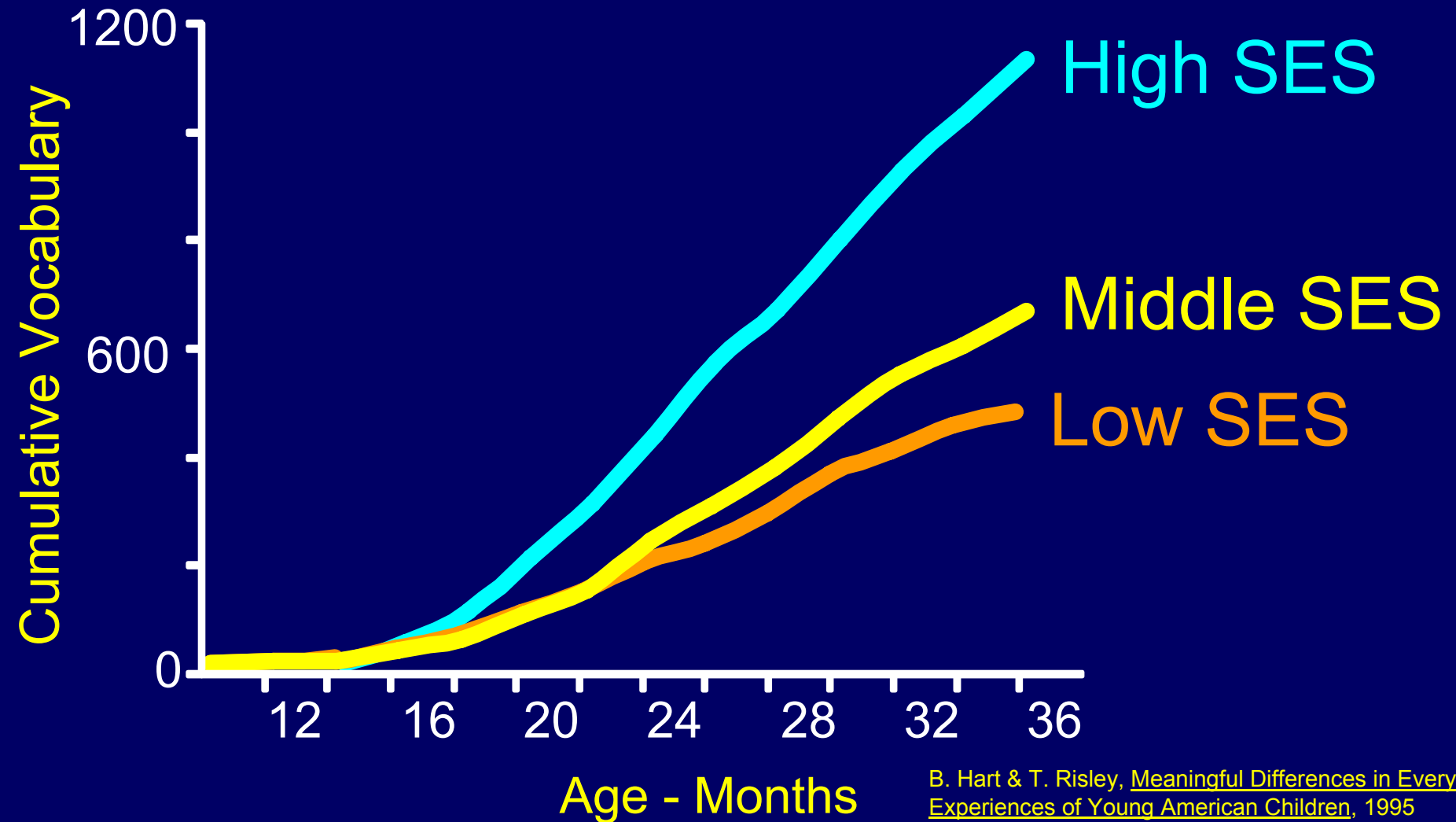
- Preschooling improved performance in school system
- Benefits children in all social classes
- The effects of preschooling persist

---

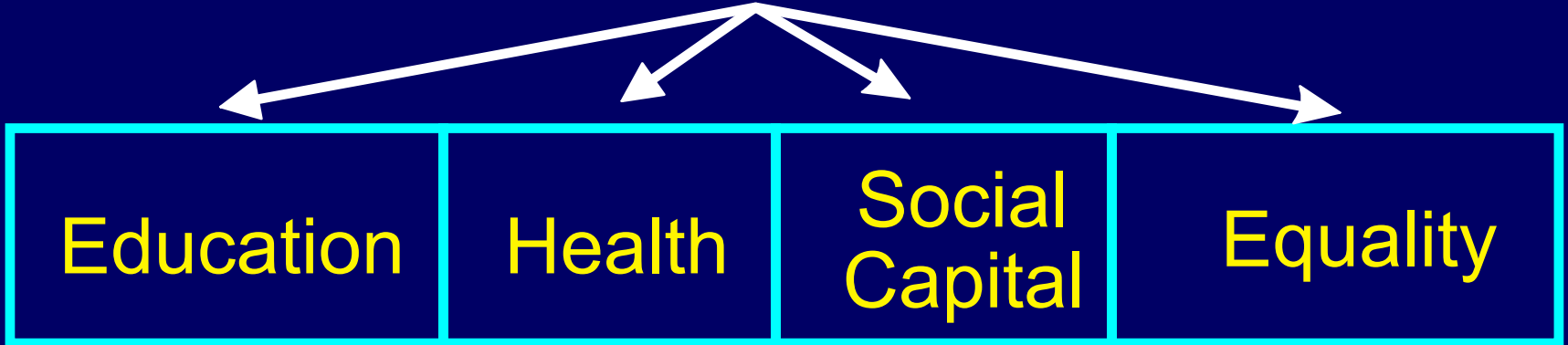
# LITERACY

---

# Literacy – Early Vocabulary Growth



**ECD**



**Economic Growth**

**Human Development**

# ECD

---

Unacceptable gap between  
what we know and what we do

---

## Why?

---

# From Early Child Development To Human Development \*

---

*World Bank Report, 2002*

*[www.founders.net](http://www.founders.net)*

To download this presentation, go to:  
Slides - Slide Shows