Building the Social Brain:

The Epigenetics of Early Stress

Louis Cozolino

how experience becomes flesh

Brains are **Social Organs**

Brains regulate one another via **Sociostasis**

Brains build brains via **Epigenetics**

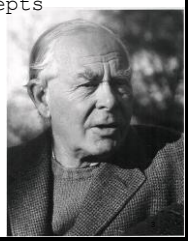
Attachment / Basic Concepts

John Bowlby

Proximity Seeking

Secure Base & Safe Haven

Attachment Schema



Attachment / Basic Concepts

Attachment Classifications

Infant Strange Situation (ISS)

4

Attachment / Basic Concepts

Adult Attachment Interview

Disorganized Attachment

5

Three Stages of Research

I. Home Observations of Dyadic Behavior

II. Infant Strange Situation (ISS)
measures reunion behavior
(schema activation under stress)

I. Adult Attachment Interview (AAI)
coherence analysis of monologue (neural coherence)

6

Home Observations Dyadic Behaviors

Child Categorization	*Maternal Behavior*
B (Secure)	emotionally available, perceptive & effective
A (Avoidant)	distant & rejecting
C (Anxious/Ambivalent)	inconsistent availability
D (Disorganized)	conflictual behavior

7

Infant Strange Situation

Child Categorization	*ISS Child Behavior*
B (Secure)	seeks proximity, easily soothed, quickly returns to play and exploration
A (Avoidant)	Does not seek proximity or appear upset – indifferent to mother
C (Anxious/Ambivalent)	Difficult to soothe after separation, angry and seeking comfort at the same time, slow to return to play
D (Disorganized)	Chaotic, self-injurious

8

Adult Attachment Interview

- A semi-structured clinical interview focusing on early attachment experiences and their effects.
  - "I' d like you to try to describe your relationship with your parents as a young child…if you could start from as far back as you can remember."
  - "Chose adjectives that reflect your relation ship with your mother, father, etc…"
  - "Which of your parents did you feel closest to and why?"

9

Grice's Maxims

Rational discourse follows a cooperative principle that requires adherence to four maxims:

1. **Quality**: Be truthful, and have evidence for what you say;
2. **Quantity**: Be succinct, and yet complete;
3. **Relevance**: Let the direction of the conversation be relevant to the topic at hand; and
4. **Manner**: Be clear and orderly.

Adult Attachment Interview

(F) - free/autonomous	Narrative coherence Balanced perspective Access to episodic memory Adjectives supported by details
(DIS)- dismissing	Lack of recall & supportive details Minimizing/idealizing perspective Dismissing of important attachments

Adult Attachment Interview

(E) - preoccupied	Intrusion of past into present Preoccupied with parents & emotions Lots of intrusive & pressured output Idealizing or engaged (splitting)
(U) - unresolved	Becomes disoriented/disorganized when discussing traumatic experiences

What are Attachment Schema?

Adaptational Patterns of Physiological Arousal,

Social Behavior, and

Emotional Responses to Others

What are Attachment Schema?

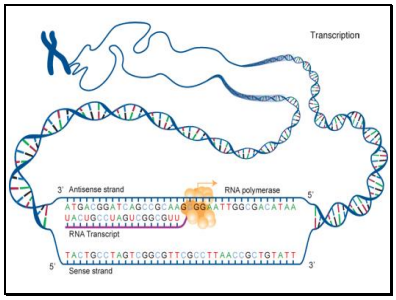
How are they encoded and where

are they stored?

The central dogma of molecular genetics

Genetic Information flows from

DNA > mRNA > proteins > biological structures



Video of transcription

https://www.youtube.com/watch?v=2BwWavExcFI

Epigenetics & Early Caretaking

The first research was done by Michael Meaney & his colleagues with mother rats and their pups. They contrasted pups who had either high or low maternal attention.

Caretaking was found to modulate 3 primary systems:

- Brain health & neuroplasticity
- Metabolic functioning & hormonal regulation
- Future caretaking behavior

Neuroplasticity

More maternal attention results in:

> neural survival and growth

> levels of neural growth hormones

> synapses & longer dendrites

Neurochemistry

More maternal attention results in:

> medial PFC dopamine in response to stress

> benzodiazepine receptors in the amygdala

> cortisol receptor gene promoter in hipp

Behavior

Less maternal attention results in:

> anxiety, fearfulness, & startle response

< exploratory behavior

> vulnerability to addiction

Future Maternal Behavior

More maternal attention:

> metabolic activation in attachment circuitry

> oxytocin and estrogen receptors in MPOA

> maternal attention and behavior

General Effects of Child Abuse on the Brain

Decreased…

Activation in the cerebellum vermis — Teicher et al., 2003

Corpus calossum volume

Electrical instability / limbic system — Teicher et al., 2004

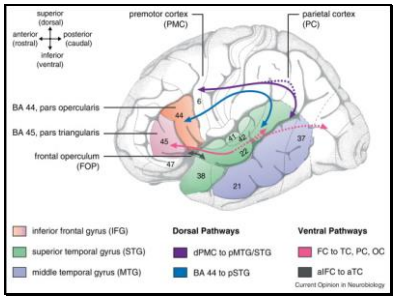
Cortical thickness
Surface area
Gyrification — Kelly et al., 2013

White matter tract abnormalities in young adults exposed to childhood parental abuse.

Young adults exposed to verbal abuse as children demonstrate abnormalities in the neuronal connectivity of language areas…

the white matter tract connecting Wernicke's & Broca's with each other and with the rest of the frontal lobes.

Choi et al., (2009). *Biological Psychiatry*, 65, 227-234.



Epigenetic regulation of the glucocorticoid receptor in human brain is associated with childhood abuse.

Compared the brains of suicide victims with and without histories of childhood abuse.

Those with a history of abuse had lower levels of glucocorticoid (GC) receptor RNA and other neurochemicals related to the construction of GC receptors.

McGowan et al., (2009) *Nature Neuroscience*, *12*(3), 243-248.

Childhood sexual abuse is associated with reduced gray matter volume in the visual cortex of young women.

Subjects demonstrated significant reductions in bilateral gray matter in their primary visual cortex (V1) and visual association areas: left fusiform, left middle occipital, and right lingual gyri.

The gray matter reductions were directly related to the duration of the abuse before age 12.

Tomoda et al., (2009). Biological Psychiatry, 66, 642-648.