Mind - Brain - Gene:
Toward Psychotherapy Integration

John Arden, PhD, ABPP

Mind-Brain-Gene:

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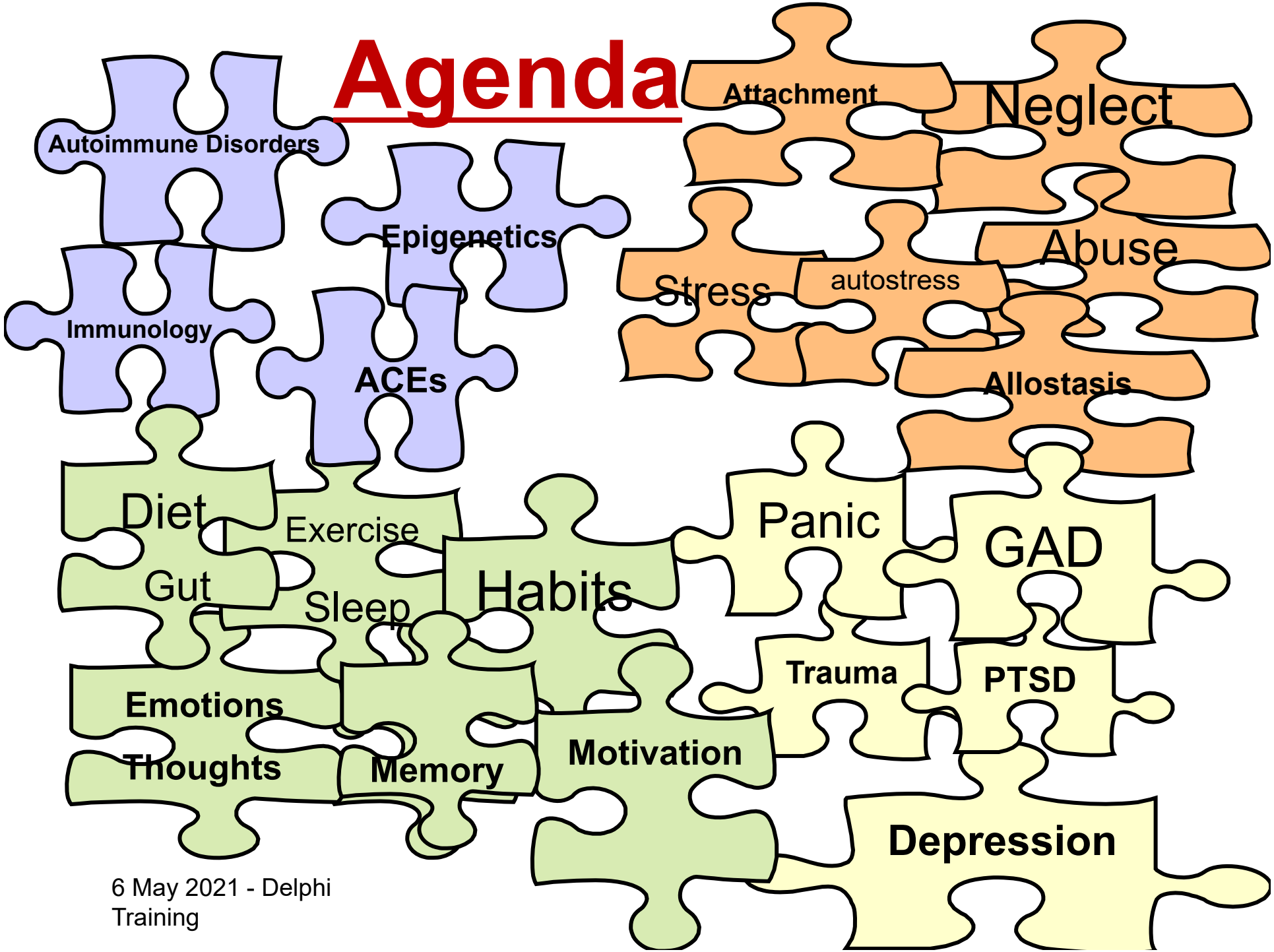
6 May 2021 - Delphi Training

John B. Arden, PhD, ABPP

Agenda


Autoimmune Disorders
Epigenetics
Immunology
ACEs
Attachment
Neglect
Abuse
Stress
autostress
Allostasis
Diet
Exercise
Gut
Sleep
Habits
Panic
GAD
Trauma
PTSD
Emotions
Thoughts
Memory
Motivation
Depression

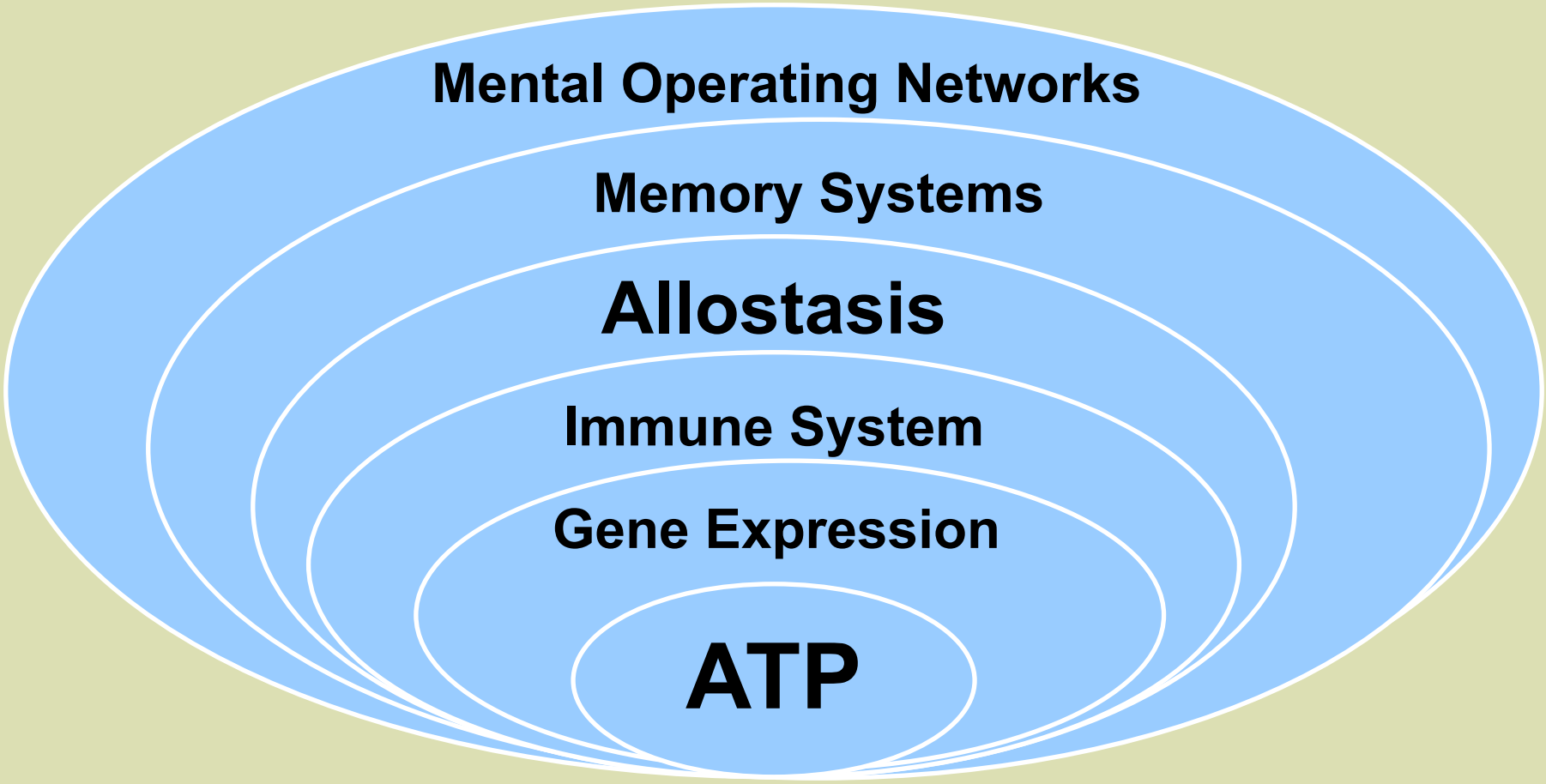

The Cartesian Blizzard
Abreaction therapy
ACT
Adlerian therapy
Adventure therapy
Analytical psychology
Art therapy
Attack therapy
Attachment-based psychotherapy
Attachment-based therapy (children)
Attachment therapy
Autogenic training
Behavior modification
Behavior therapy
Biodynamic psychotherapy
Bioenergetic analysis
Biofeedback
Body psychotherapy
Brief psychotherapy
Classical Adlerian psychotherapy
Chess therapy
Child psychotherapy
Client-centered psychotherapy
Co-counseling
Cognitive analytic therapy
CBT
Coherence therapy
Collaborative therapy
CFT
Concentrative movement therapy
Contemplative psychotherapy
Conversational model
Conversion therapy
Core process psychotherapy
Dance therapy
Depth psychology
Daseinsanalysis
DNMS
DBT
Drama therapy
Dreamwork
DDP
Ecological counseling
EFT
EFT
EMDR
Existential therapy
Exposure and response prevention
Expressive therapy
Family Constellations
Family therapy
Feminist therapy
Focusing
Freudian psychotherapy
FAP
Future-oriented therapy
Gestalt therapy
Gestalt theoretical psychotherapy
Group analysis
Group therapy
Guided affective imagery
Hakomi
Holotropic Breathwork
Holding therapy
Humanistic psychology
Human Givens
Hypnotherapy
Inner Relationship Focusing
Integrative body psychotherapy
Integral psychotherapy
Integrative psychotherapy
Intensive short-term dynamic psychotherapy
Internal Family Systems Model
Interpersonal psychoanalysis
Interpersonal psychotherapy
Jungian psychotherapy
Logotherapy
Marriage counseling
Milieu therapy
Mindfulness-based cognitive therapy
Mindfulness-based stress reduction
Mentalization-based treatment
MOL
MDT
Morita therapy
Motivational interviewing
Multimodal therapy
Multitheoretical psychotherapy
Music therapy
Narrative therapy
Nonviolent Communication
Nude psychotherapy
Object relations psychotherapy
Ontological hermeneutics
Orthodox psychotherapy
Parent–child interaction therapy
Parent management training
Pastoral counseling
Person-centered therapy
Play therapy
Positive psychology
Positive psychotherapy
Postural Integration
Primal therapy
Primal Integration
Process oriented psychology
Process psychology
Prolonged exposure
Provocative therapy
Psychedelic therapy
Psychoanalysis
Psychodrama
Psychodynamic psychotherapy
Psychosynthesis
Pulsing
RET
RLT
Reality therapy
Rebirthing-breathwork
Recovered-memory therapy
Re-evaluation Counseling
Reichian psychotherapy
Relationship counseling
Relational-cultural therapy
Remote therapy
Reprogramming
Rogerian psychotherapy
Sandplay Therapy
Schema Therapy
Self-relations Psychotherapy
Sensorimotor psychotherapy
Sexual Identity Therapy
Sex therapy
Social Therapy
Solution focused brief therapy
Somatic Experiencing
Somatic psychology
Status dynamic psychotherapy
Supportive psychotherapy
Systematic desensitization
Systemic Constellations
Systemic therapy
T-groups
Therapeutic community
Thought Field Therapy
Transactional analysis
Transference focused psychotherapy

The Science has Changed

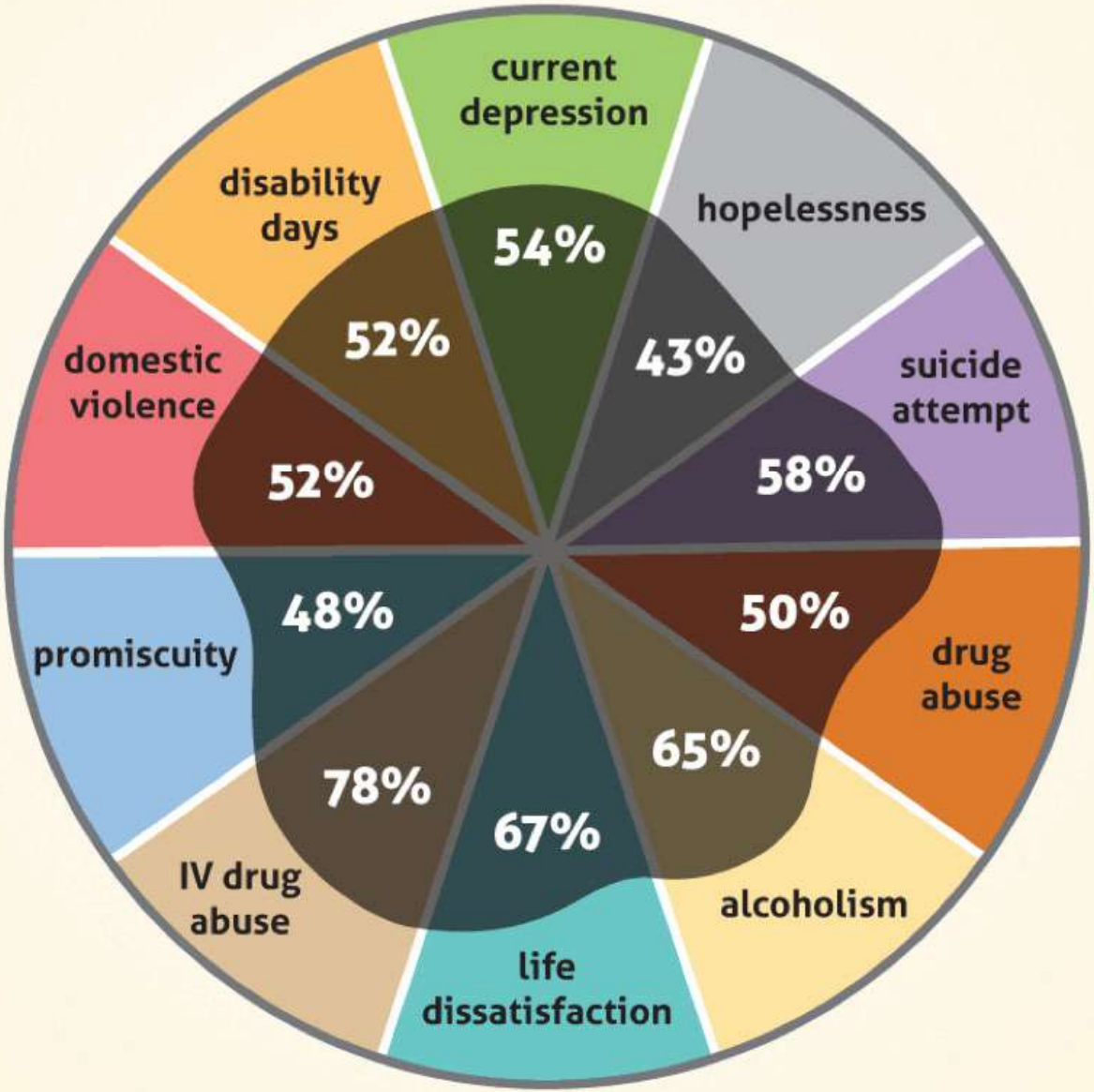
“Mental functions direct electrochemical traffic at the cellular level” Roger Sperry

“Psychotherapy works by producing changes in gene expression that alter the strength of synaptic connections…” Eric Kandel

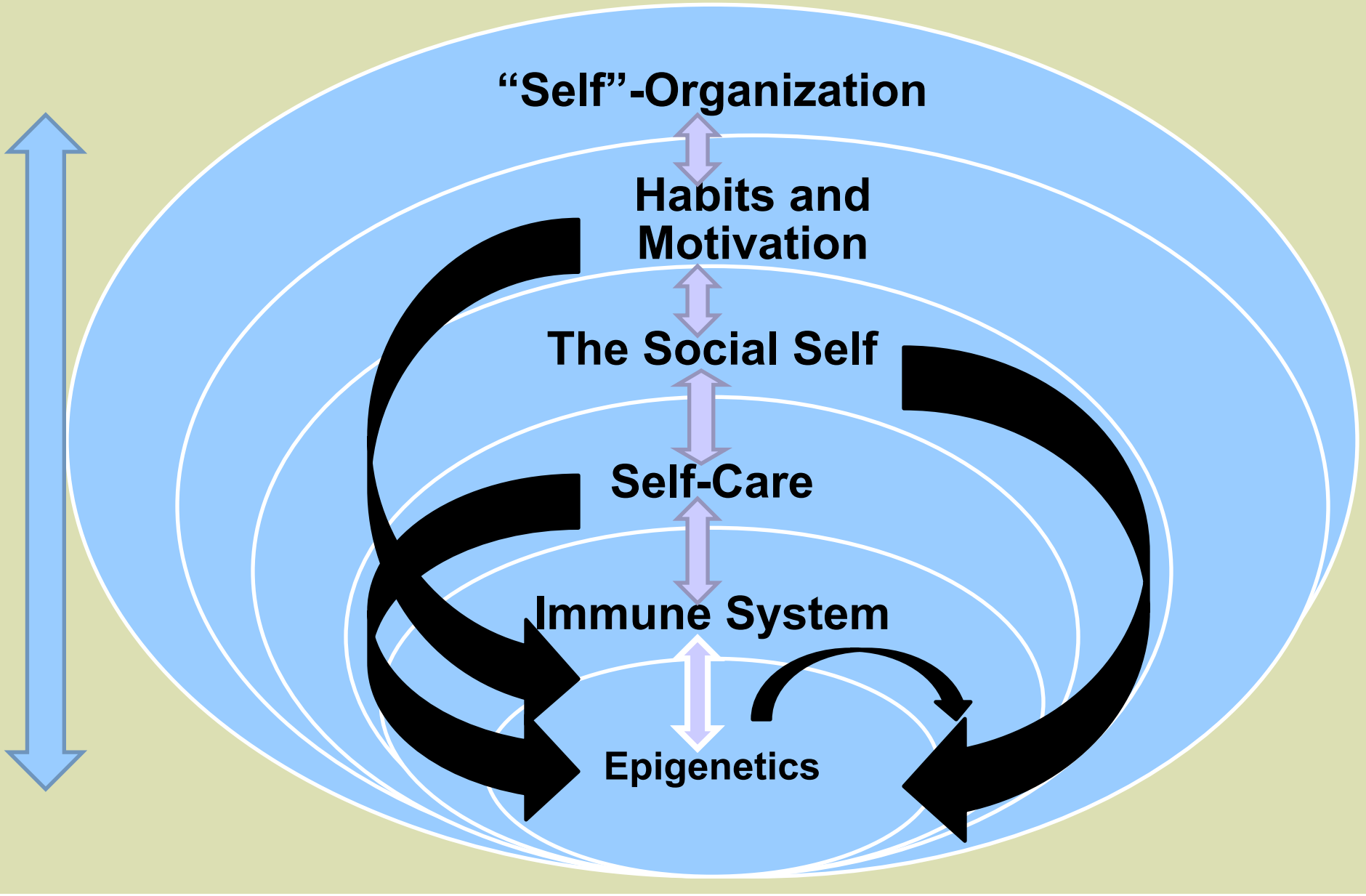
“Self”-Organization



ACEs and Population Attributable Risks



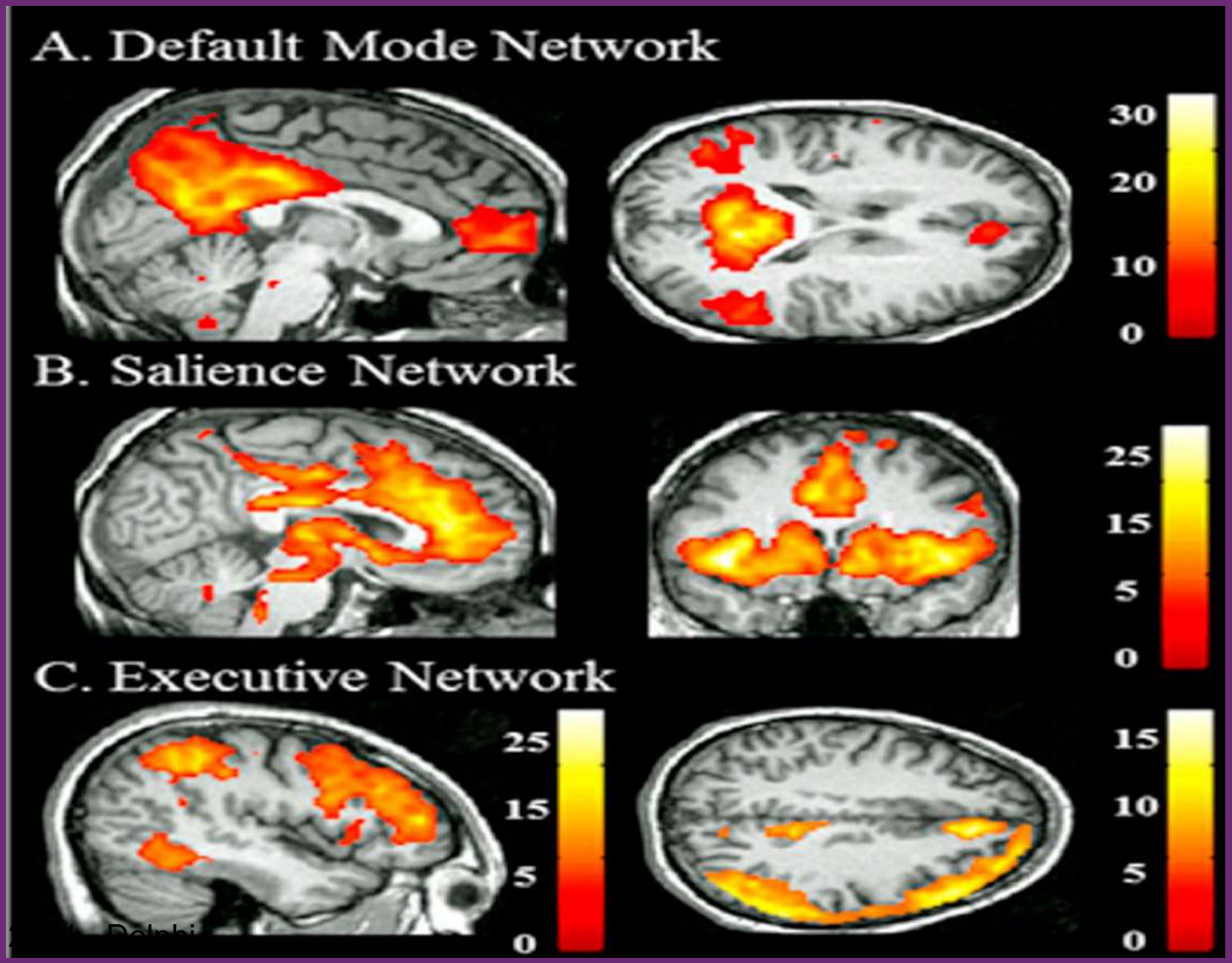
Mind-Brain-Gene Feedback Loops



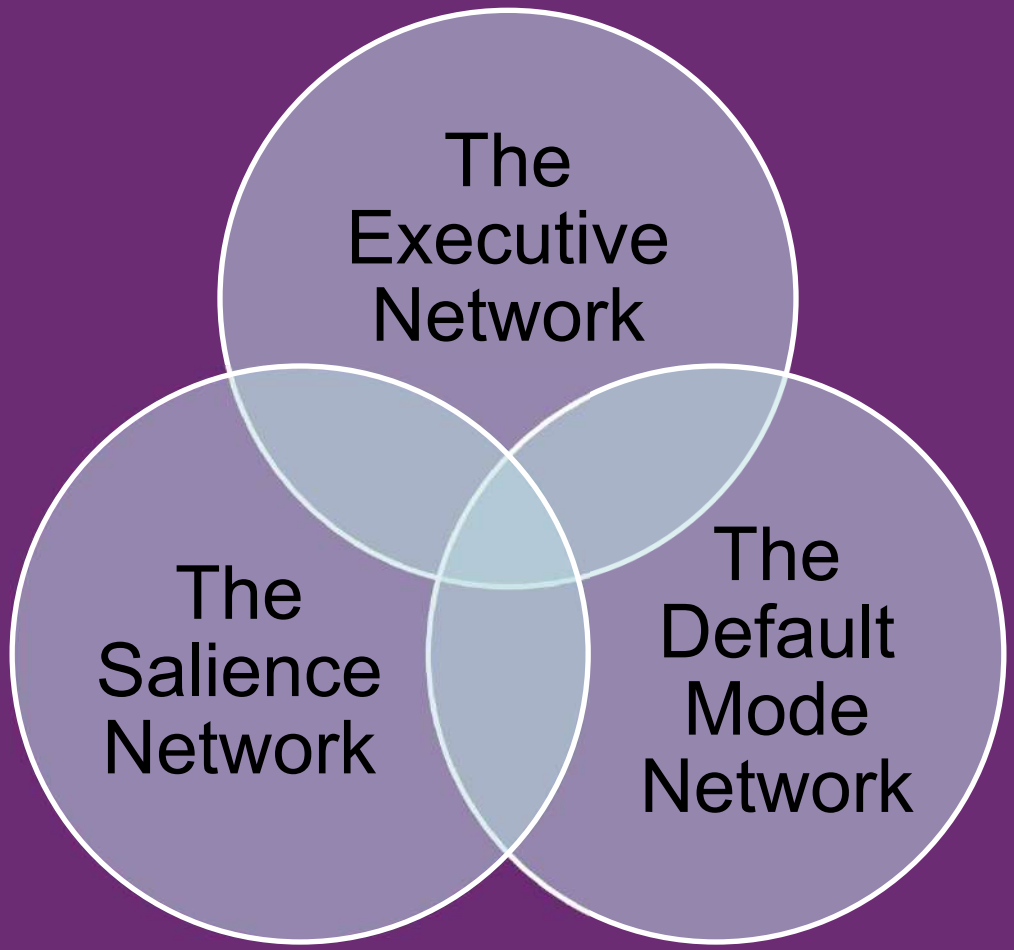
The Mind's Operating Networks:

- **Salience Network:**
- the material "me"
- emotional and reward saliency;
- **Default Mode Network:**
- mind-wandering; fantasying, ruminating
- mentalizing, projecting to the future or past;
- **Central Executive Network:**
- moment to moment monitoring of experience
- selection, planning, toward goals;

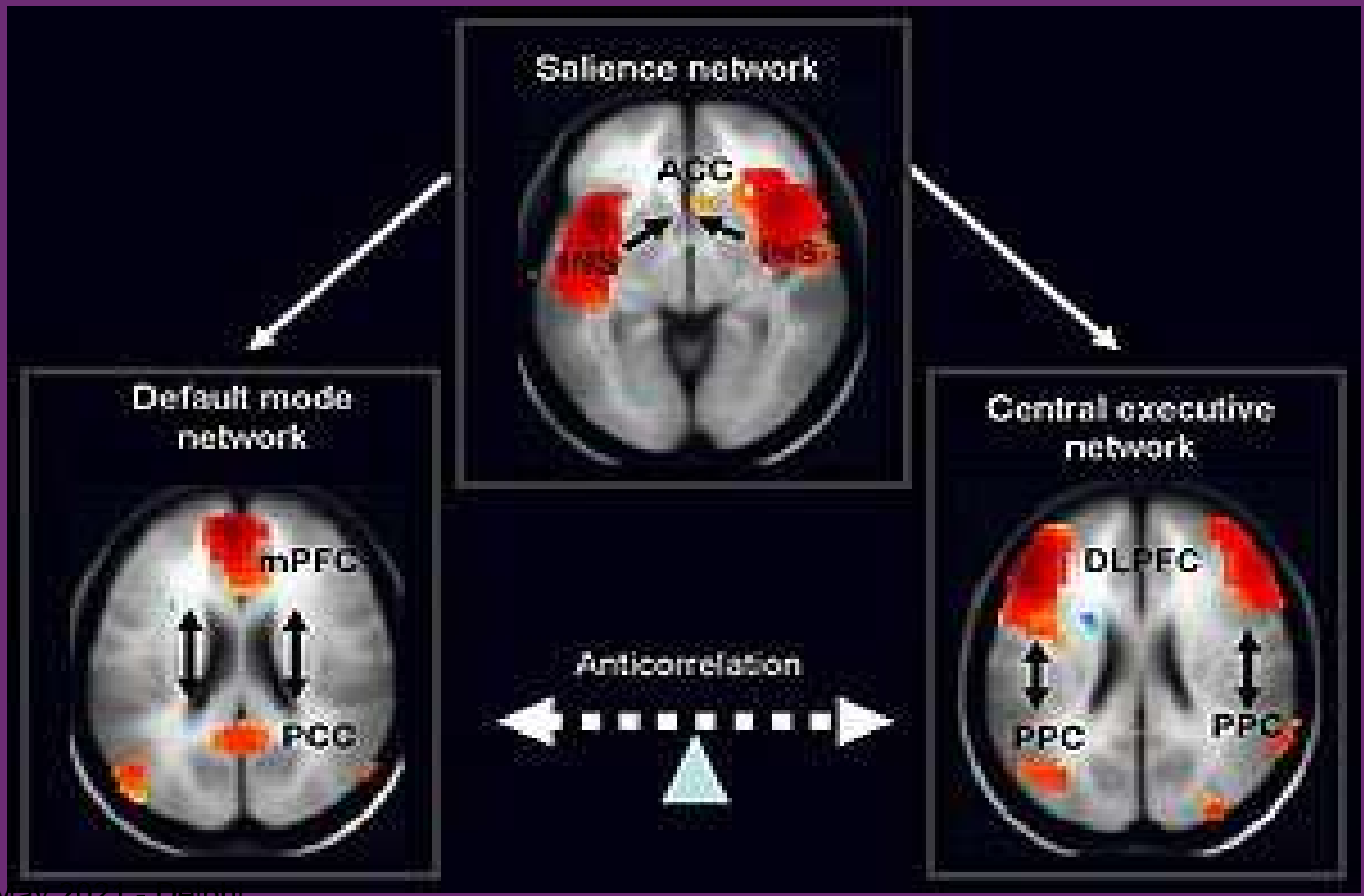
The Mental Networks



Balancing the Mental Networks



The Mental Neworks

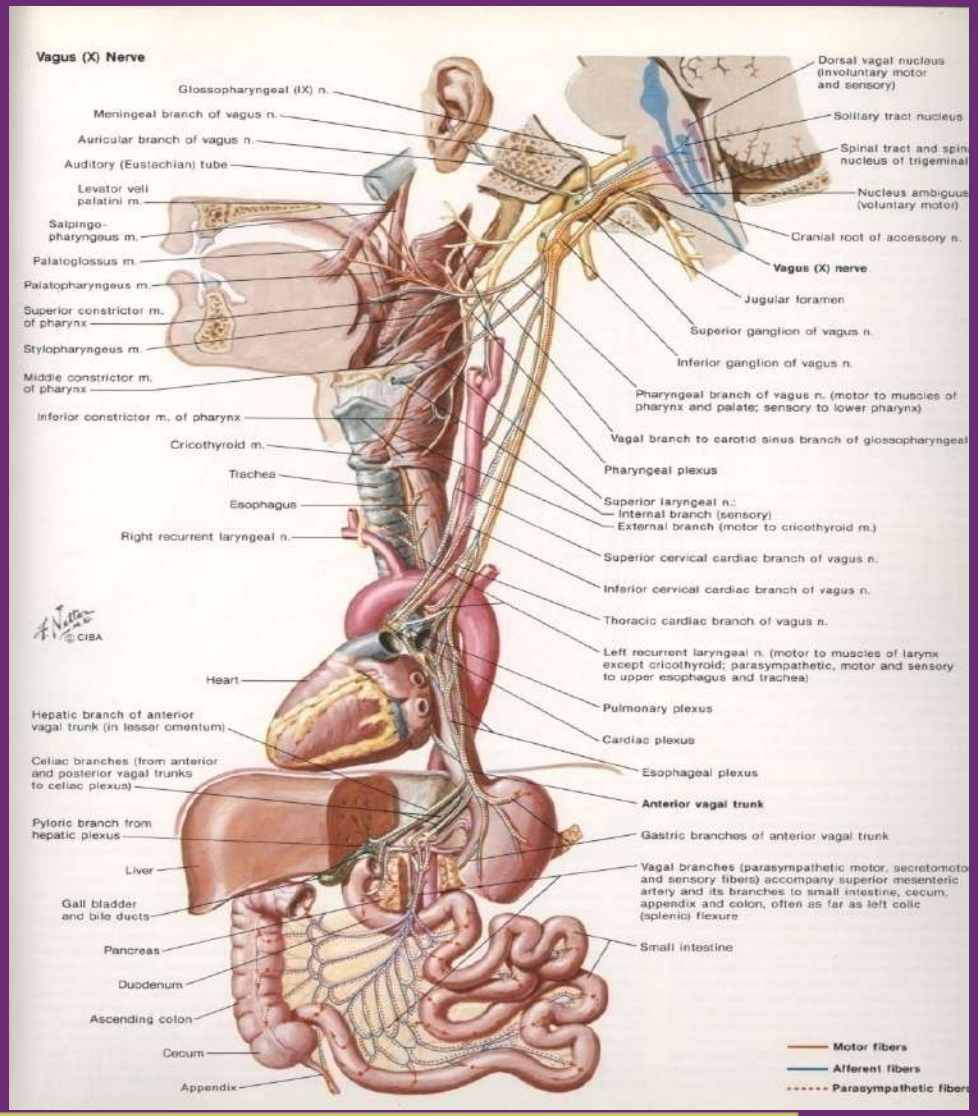


Salience Network:

- referred to as the ‘sentient self’ (the material “me”)
- detecting emotional and reward saliency;
- detecting and orienting toward external events in bottom-up fashion;
- bilateral anterior insula, dorsal anterior cingulate, amygdala

The Vagus Nerve System

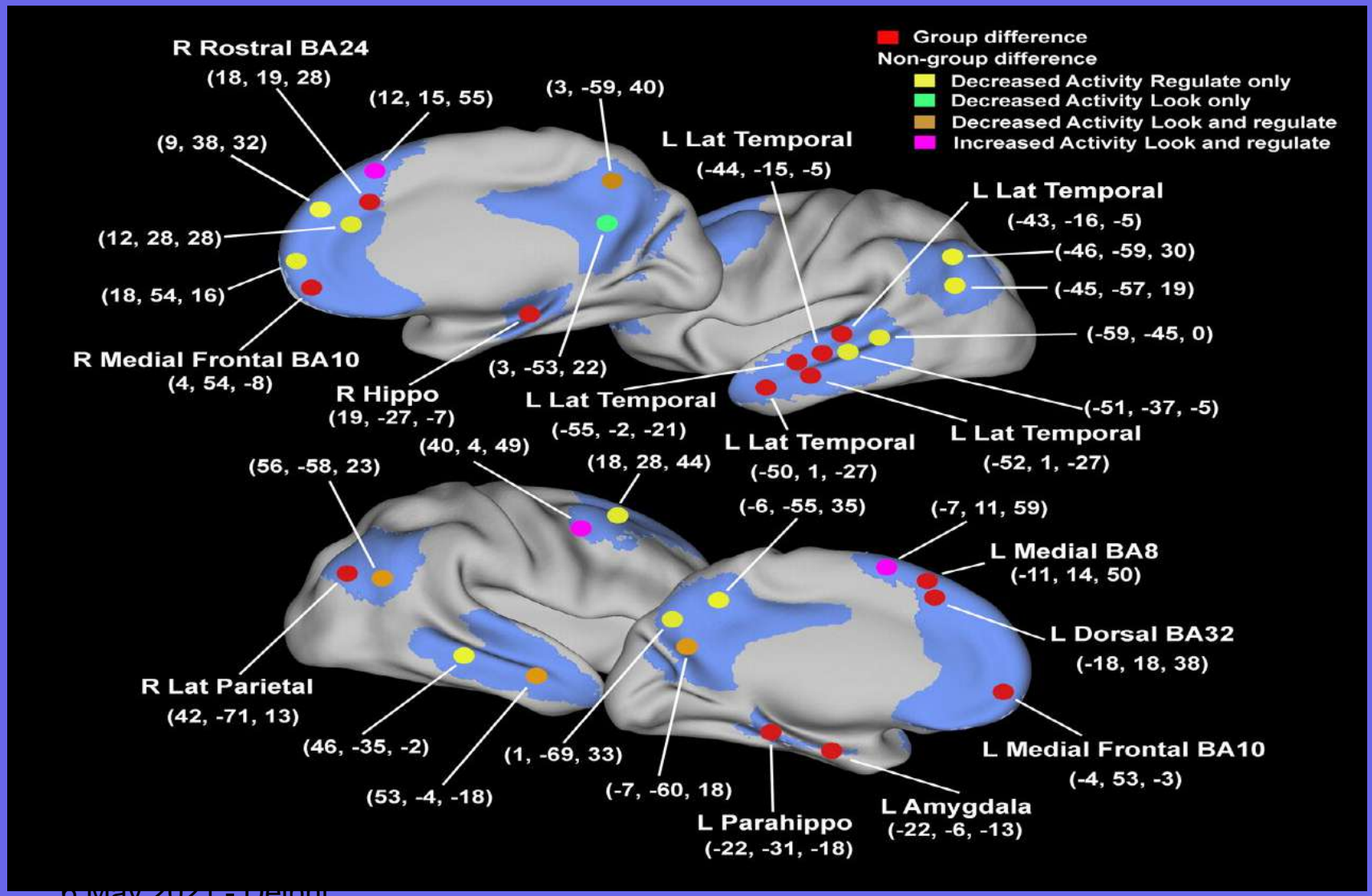
- Tenth Cranial Nerve --a complex of sensory and motor nerve fibers.
- *Vagal tone*- the ability to modulate target organs without sympathetic arousal
- allows attachment and sustained relationships.



Default Mode Network:

- reflecting, spontaneous thoughts or mind-wandering;
- activated during tasks of mentalizing, projecting oneself into the future or past;
- activation when reflecting on social relationships;
- anterior and posterior midline and cingulate cortex

Activity in the default mode network



Sheline Y I et al. (2009)

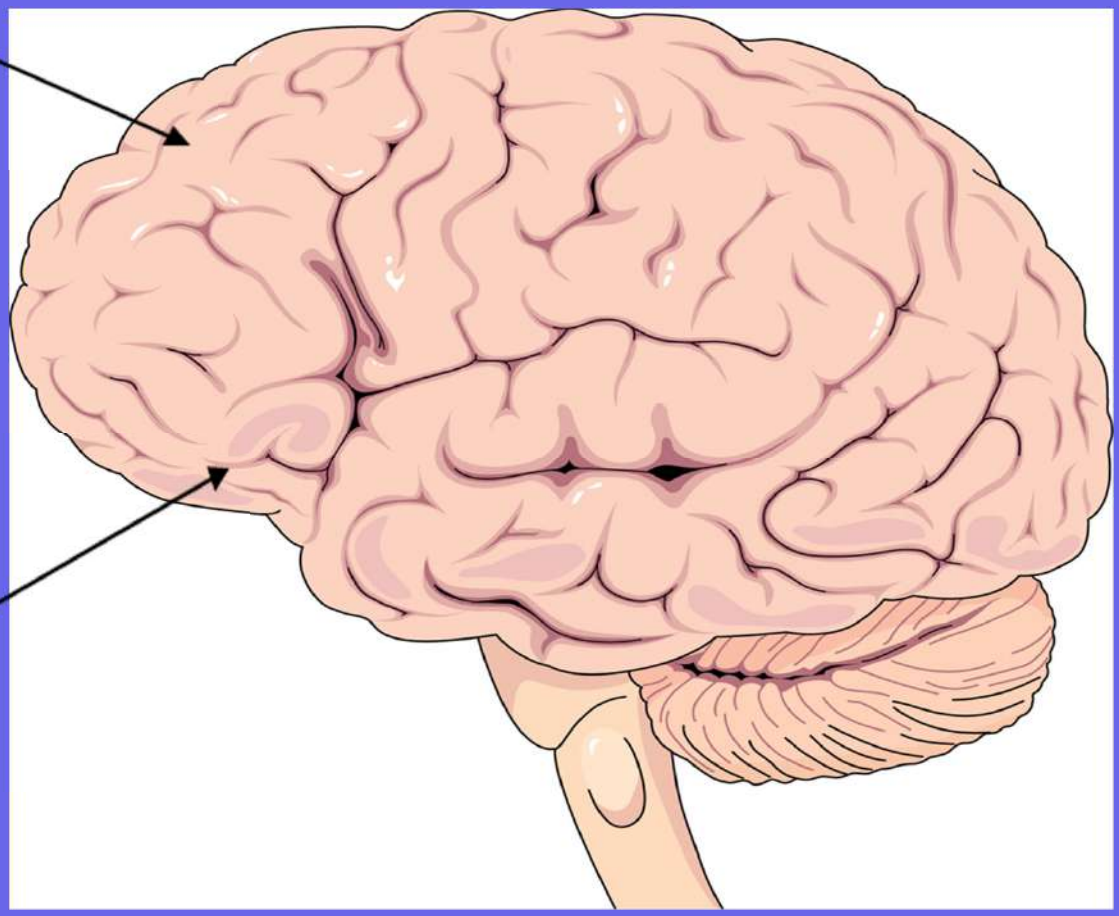
Central Executive Network:

- moment to moment monitoring of experience (meta-cognition)
- responsible for selection, planning, and decision-making toward goals;
- working memory that helps select, orient, and maintain an object in the mind;
- bilateral dorsolateral prefrontal cortex

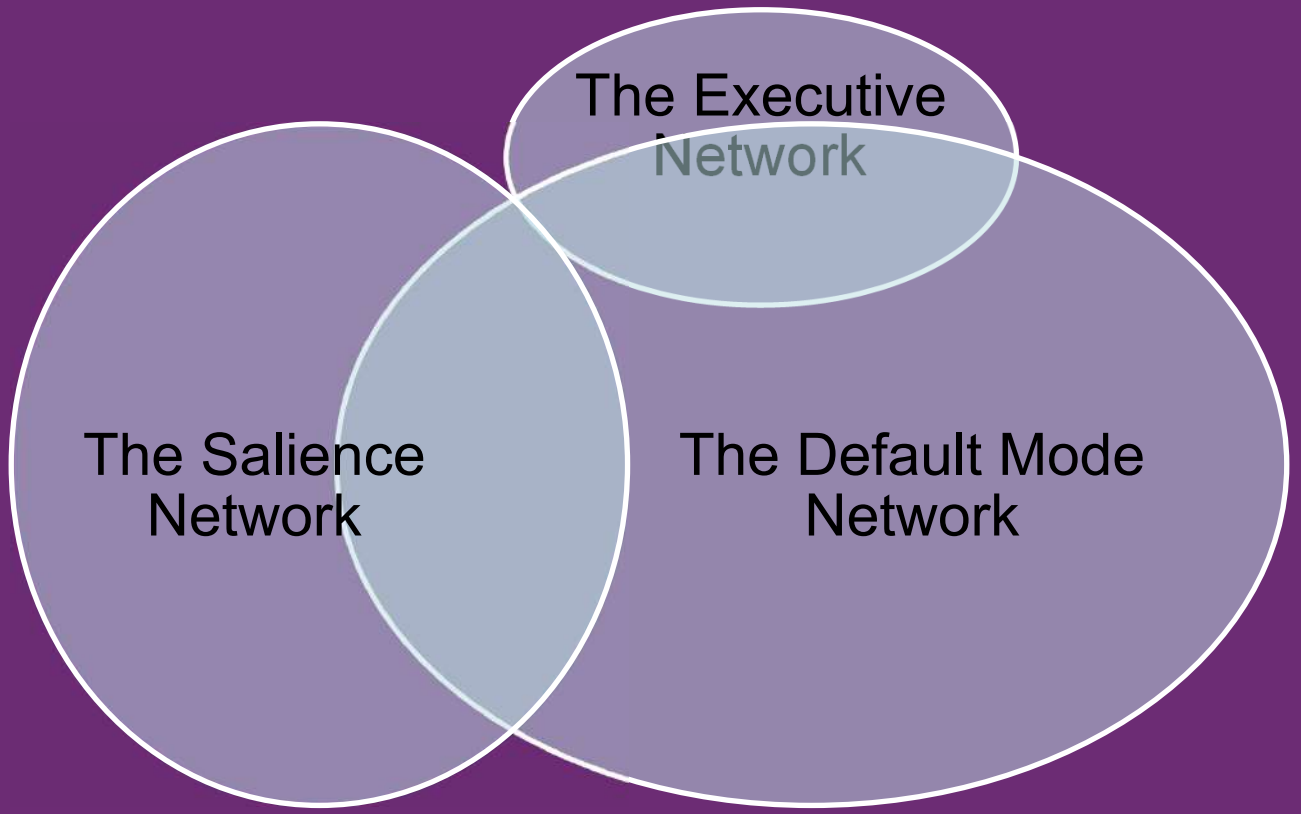
DLPFC and the OFC

Dorsolateral Prefrontal Cortex

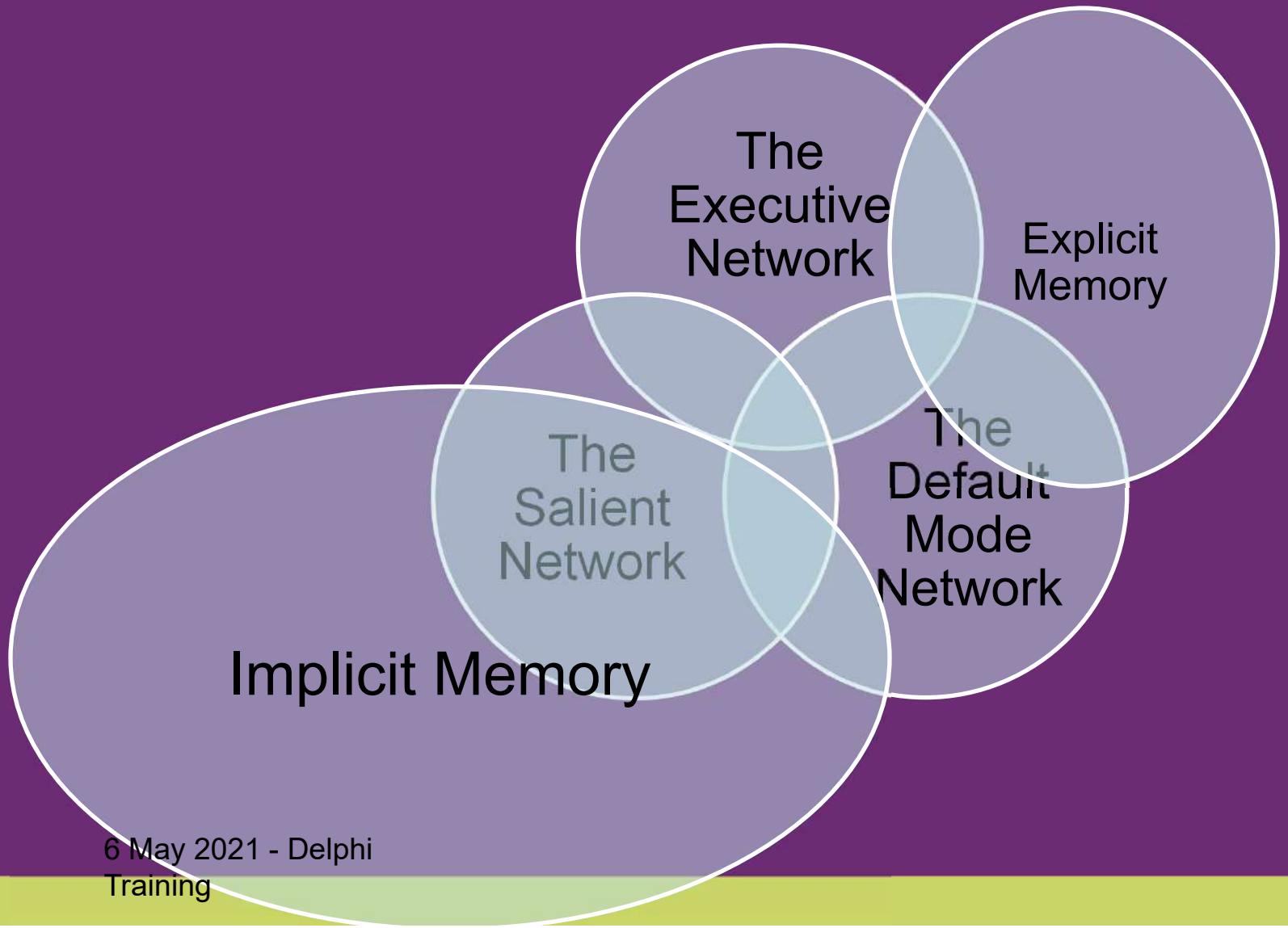
Orbital Prefrontal Cortex



Imbalanced Mental Networks



The Mental Neworks & the Long-Term Memory Systems



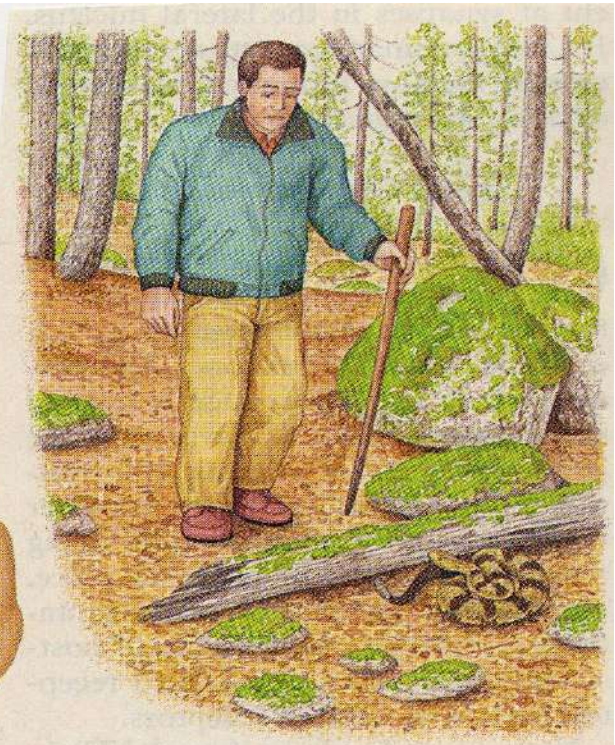
AMYGDALA
Implicit Memory System

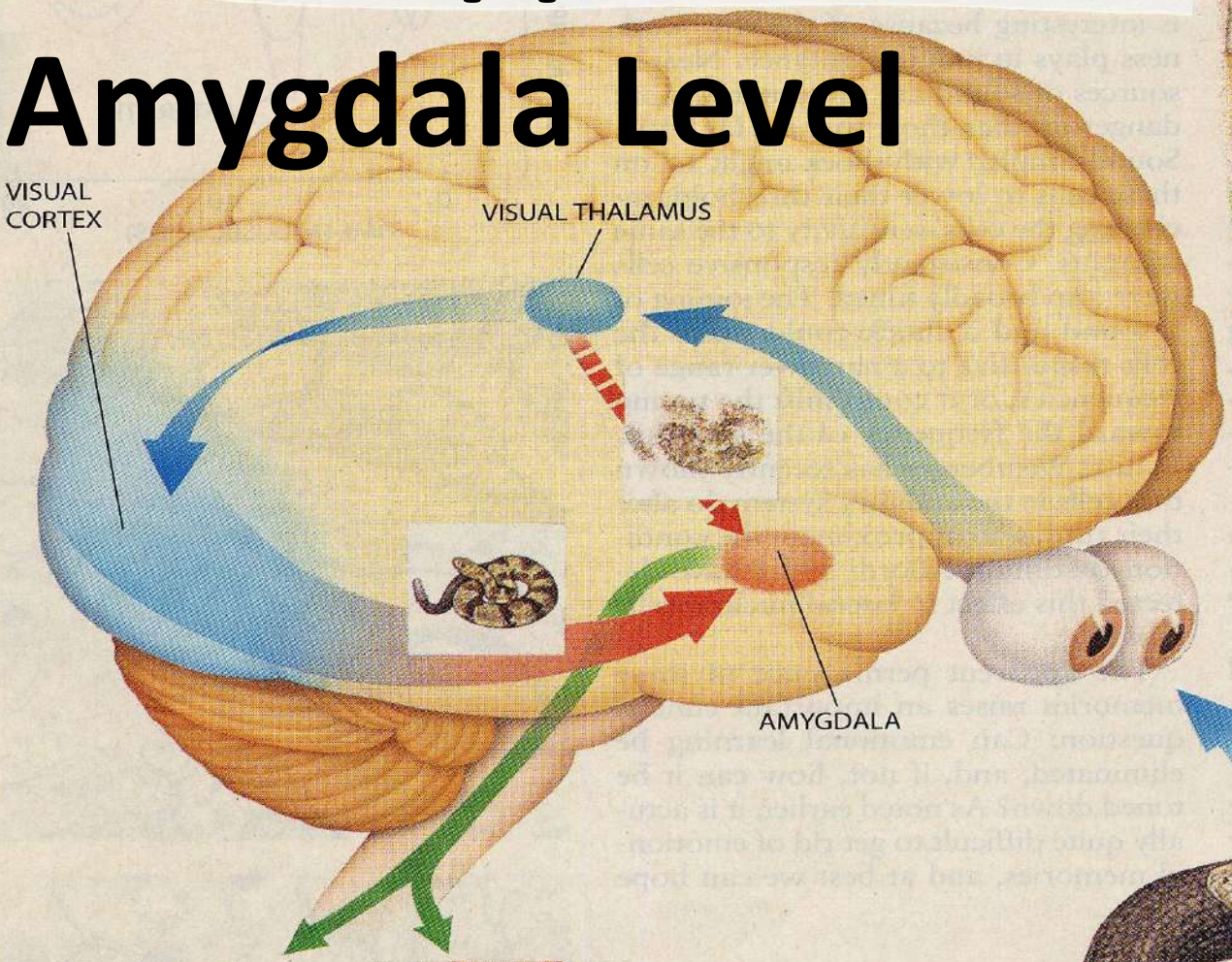
- Fear Conditioning
- Emotional Valance
- Generalized
- Cortisol Heightened
- Sensitivity
- (Hypervigilence)
- Matures Early
- "Little Albert"
- "LSMFT"

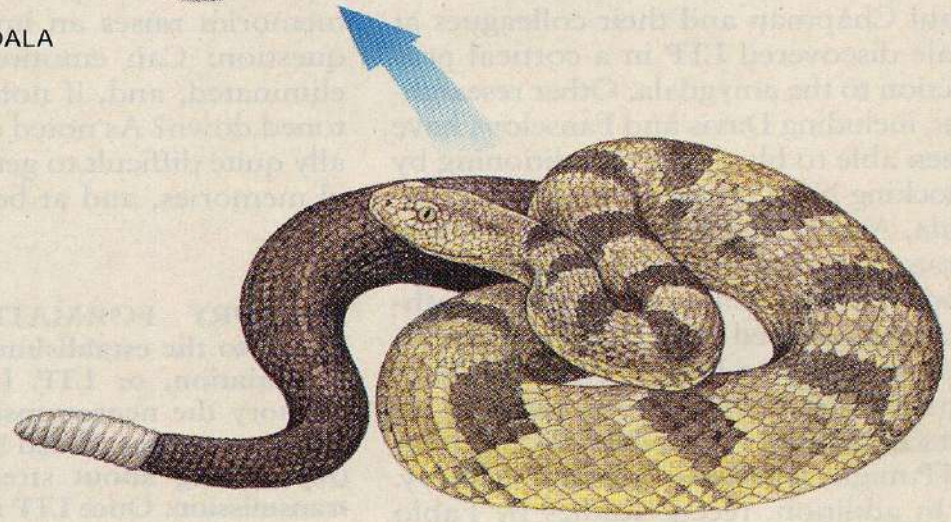
HIPPOCAMPUS
Explicit Memory System

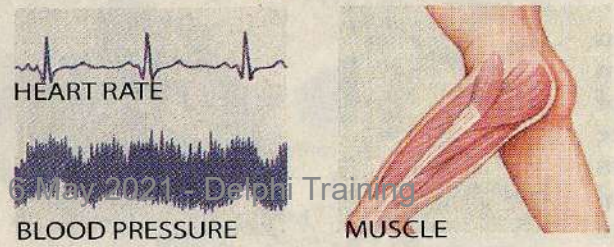
- Many Cortisol Receptors
- Context Specific
- Heightened Cortisol leads to atrophy
- Matures Later
  - Vs. Infantile Amnesia
- "H.M."

Threat Appraisal: Amygdala Level





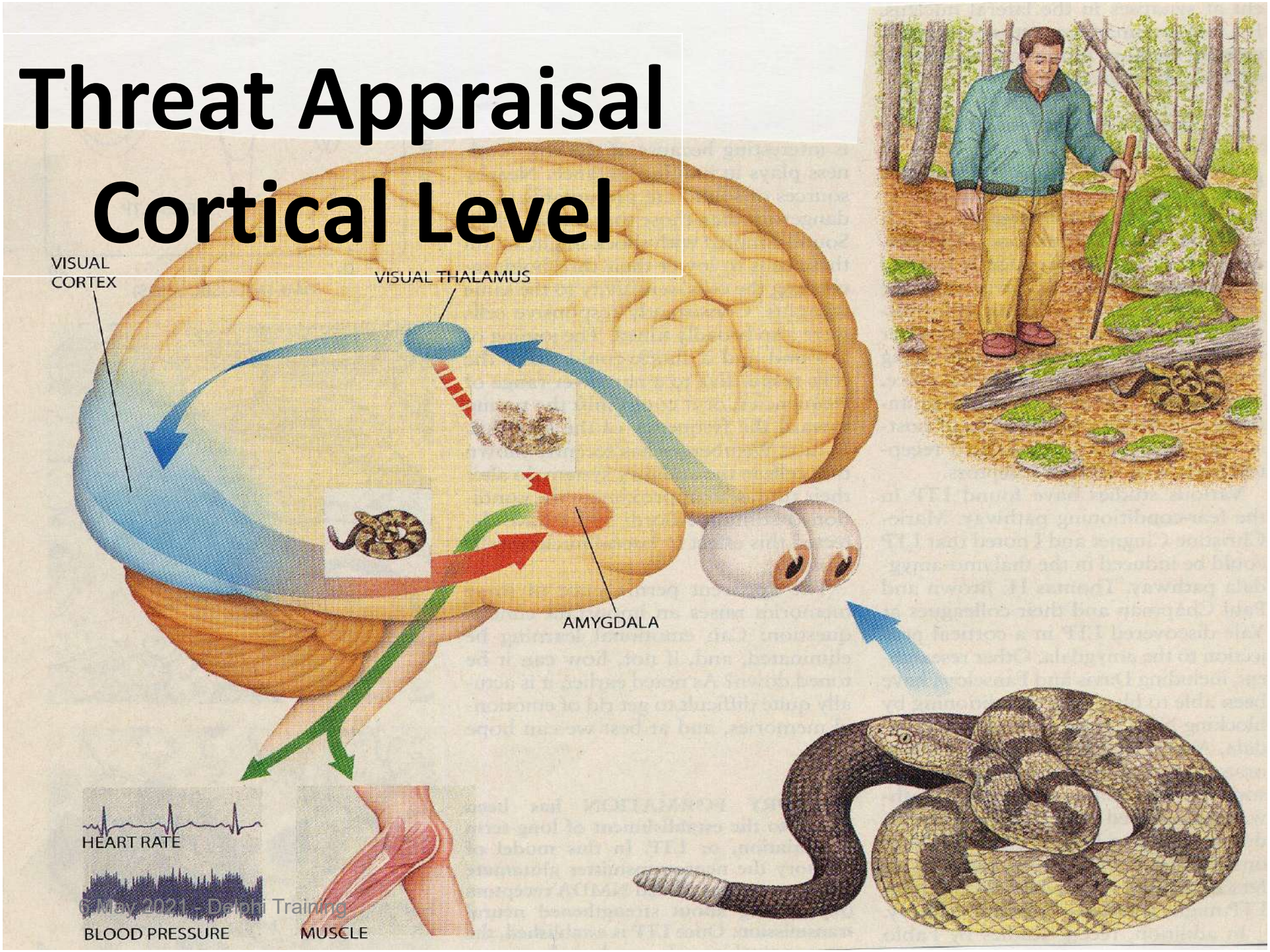




The Fast Circuit to the Amygdala

- Sensory info goes to the Thalamus then directly to the Amygdala:
- Fight or Flight: SNS and HPA activation
- Emotional Learning
- Fear Conditioning
- PTSD, panic, etc.
- Flashbacks
- “Bottom up”

Threat Appraisal Cortical Level



The Slow Circuit to the Amygdala

Sensory info goes to the Thalamus through the Cortex and Hippocampus to the Amygdala

Complications:

- **Worries and GAD**
- **Fears and Phobias**

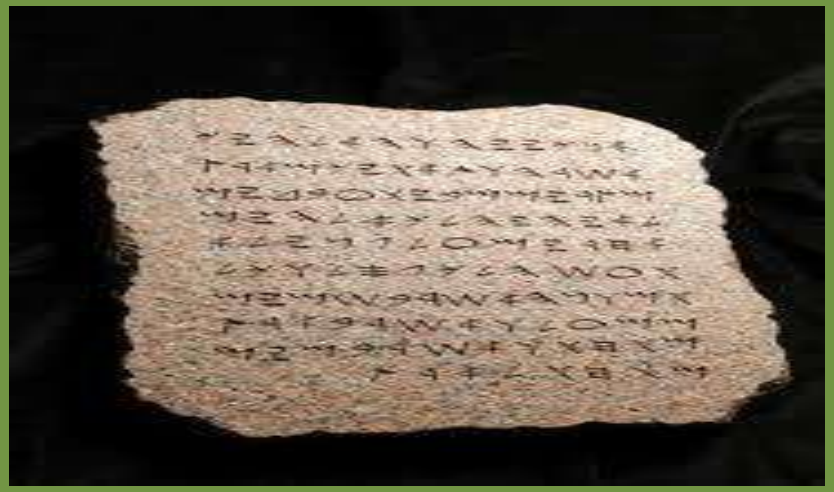
Benefits:

- **Tames the Amygdala**
- **With exposure, New Thinking (cortex)**

"Top down"

The Dynamics of Fear

- Amygdala memories are hard to forget ("Stone tablet")

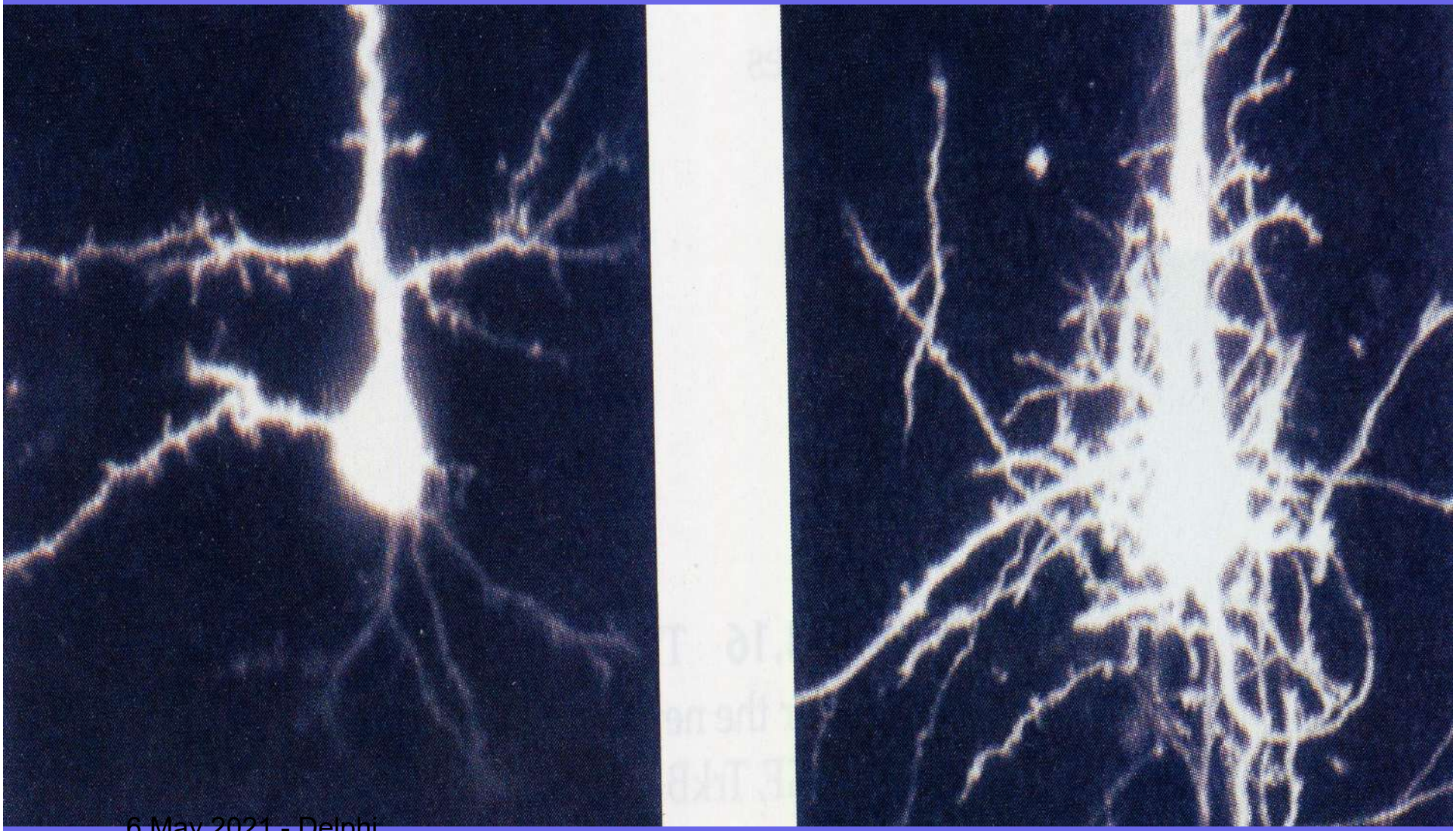


- Hippocampal circuits tell us what to fear and in what context ("Etch-a-Sketch")

Brain Derived Neurotropic Factor

- BDNF plays a crucial role in reinforcing neuroplasticity and neurogenesis. It helps:
  - Consolidate the connections between neurons.
  - Promotes the growth of myelin to make neurons fire more efficiently
  - Act on stem cells in the hippocampus and PFC to grow into new neurons

BDNF: Impact on Dendrite growth: 24 hours



Mind-Brain-Gene Feedback Loops

Self-Regulation Factors

- **Social**
- **Exercise**
- **Education**
- **Diet**
- **Sleep**

Hunter-gatherer Adaptation Boosted the Social Brain

Hungry Social Networks

- Brain development involves many forms:
  - the establishment of synaptic connections
  - the pruning of others
  - changes to the behavior of a single ion channel
  - dendritic outgrowth
  - changes to the shape and number of sprouting new axons
  - modifying their dendritic surfaces

(Kolb & Gibb, 2001)

The Effects of Social Medicine

- ↓ Cardiovascular reactivity (Lepore, et al, 1993)
- ↓ Blood pressure (Spitzer, et al, 1992)
- ↓ Cortisol levels (Kiecolt-Glaser, et al, 1984)
- ↓ Serum cholesterol (Thomes, et al, 1985)
- ↓ Vulnerability to catching a cold (Cohen, et al, 2003)
- Depression (Russell & Cutrona, 1991)
- ↓ Anxiety (Cohen, 2004)
- ↓ Natural killer cells (Kiecolt-Glaser, et al, 1984)
- ↑ Slows cognitive decline (Bassuk, et al 1999)
- Improves sleep (Cohen, 2004)

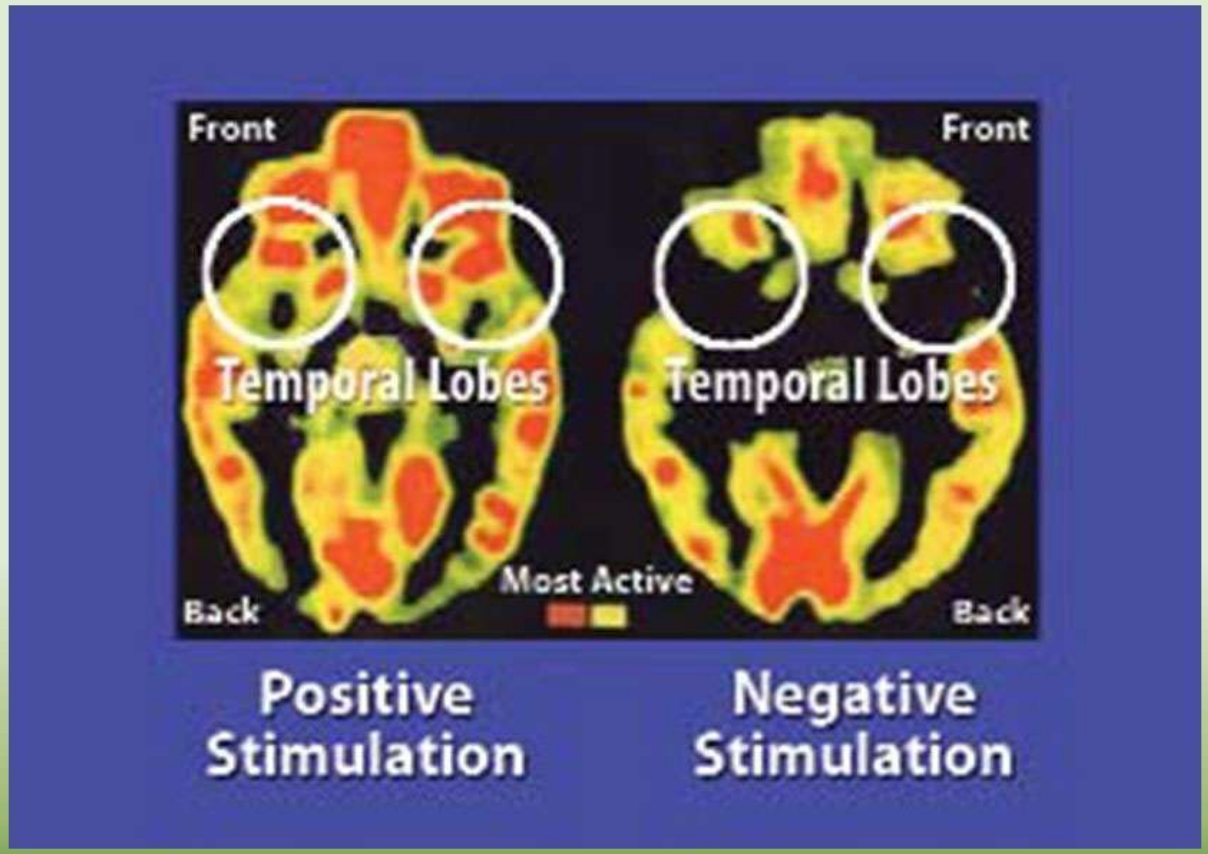
Deprived Social Brain Networks

- 150,000 children found languishing in Romanian orphanages. They were emotionally neglected.
- They missed human contact during critical periods (Kuhn & Schanberg, 1998).

Sustained impairment if over one year

- Increased Cortisol
- Impaired OFC
- Cognitive impairments (i.e. ADD)
- Shorter Telemeres

“Normal” vs Romanian Brains

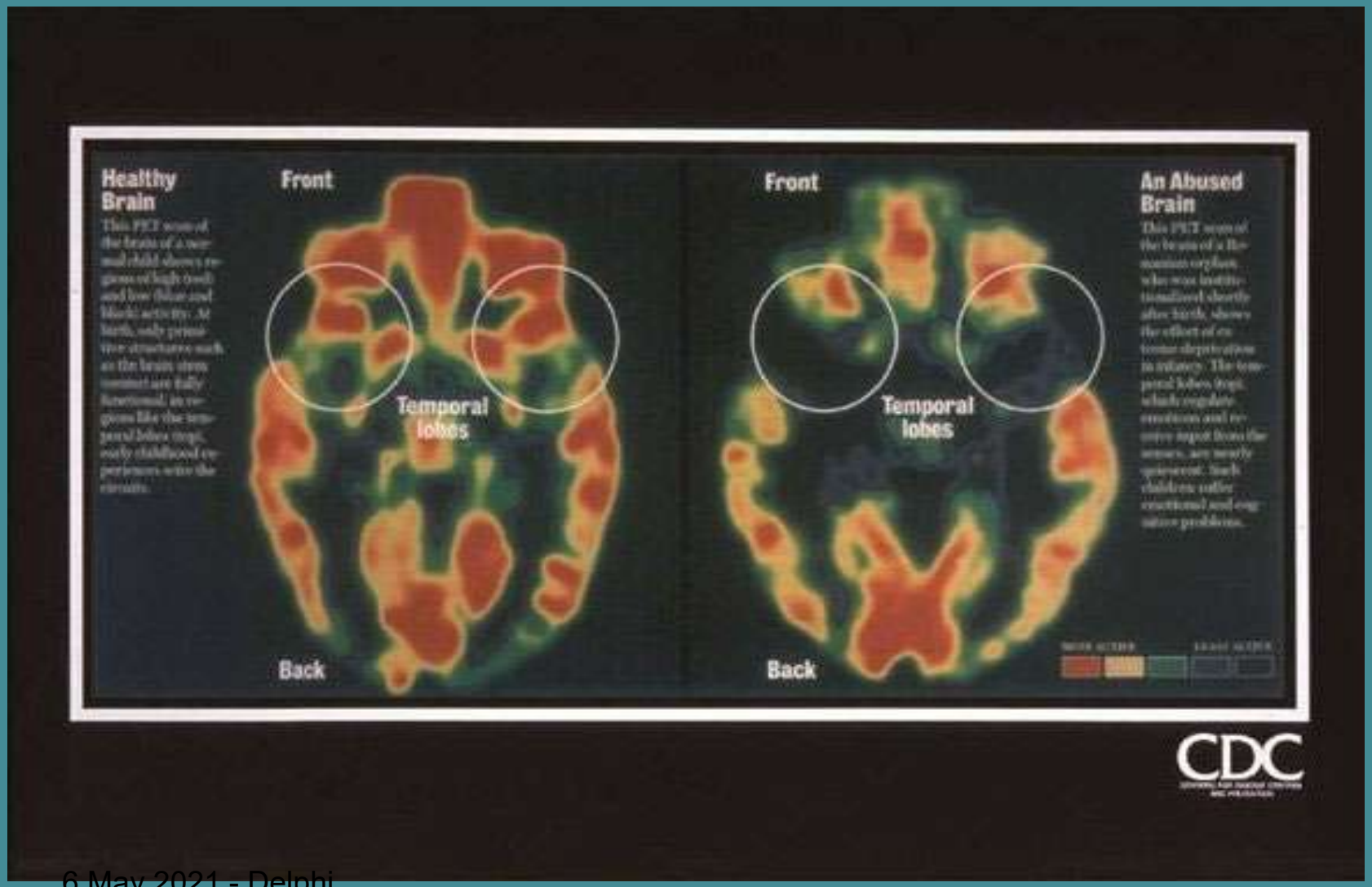


Brain activity of a normal five-year-old child (left)
and a five-year-old institutionalized orphan neglected in infancy (right).

Child Abuse and Neuropathology

- **Diminished left hemisphere and left hippocampal volume** (Bremner et al., 1997).
- **Accelerated loss of neurons** (Simantov, et. al., 1996)
- **Delays myelination** (Dunlap, et. al., 1997)
- **Abnormalities in developmentally appropriate pruning** (Todd, 1992)
- **Inhibition of neurogenesis** (Gould, et. al., 1997)
- **Adults who were physically or sexually abused as children – high IL-6 & CRP**
  - **diminished left hippocampal development** (Howe, Roth, & Cicchetti, 2006).

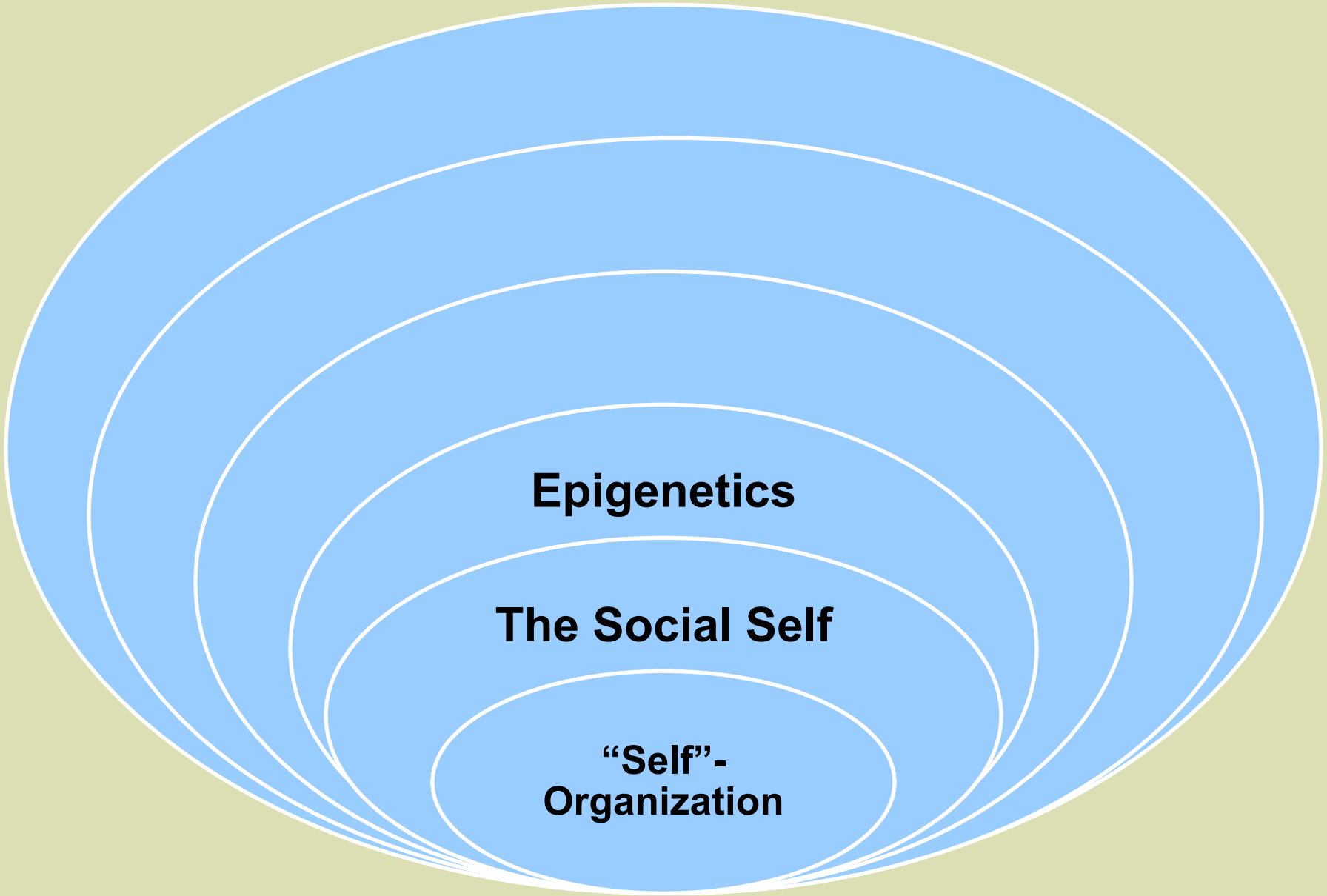
“Normal” vs Abused Brains



The Neuroscience of Attachment

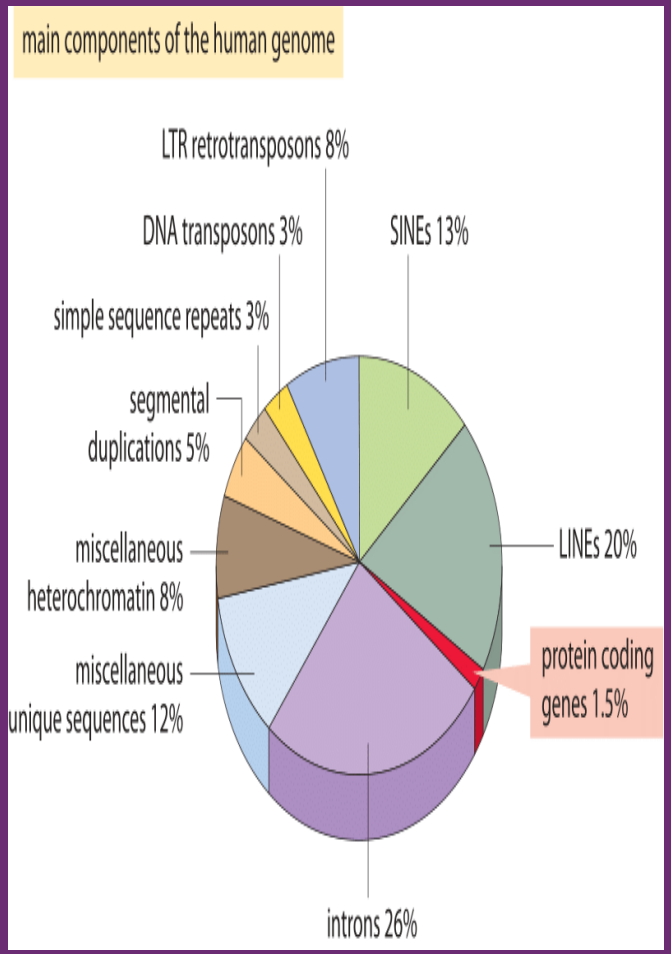
- Balance Between the two branches of the Autonomic Nervous System
- Endorphin & Benzodiazepine receptors
- Cortisol Regulation
- Positive Immunological Functioning
- Neural Growth and Plasticity

Mind-Brain-Gene Feedback Loops



Epigenetics

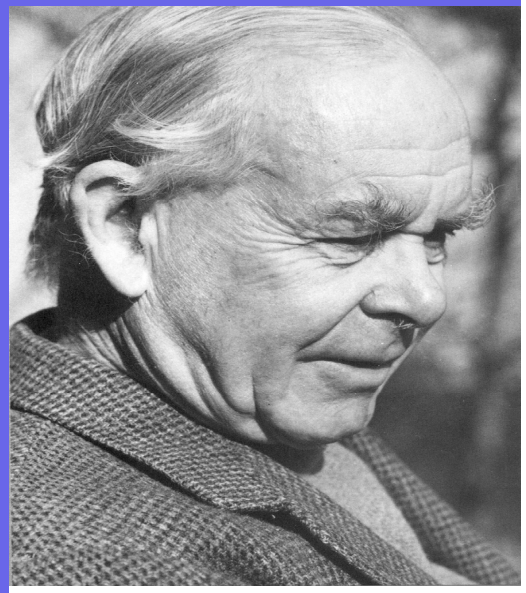
- 24,00 genes (that code for protein)
  - Worm and human
- 2% (the rest—”junk DNA”)
- As the complexity of the species increases so does the amount of “junk DNA”



Epigenetics and Attachment

- Good parenting produces kids with less methylation of the cortisol receptor gene

- The kids have a better thermostat for cortisol and can turn of the stress response system more easily



Cortisol level

Epigenetics and Decreased Stress

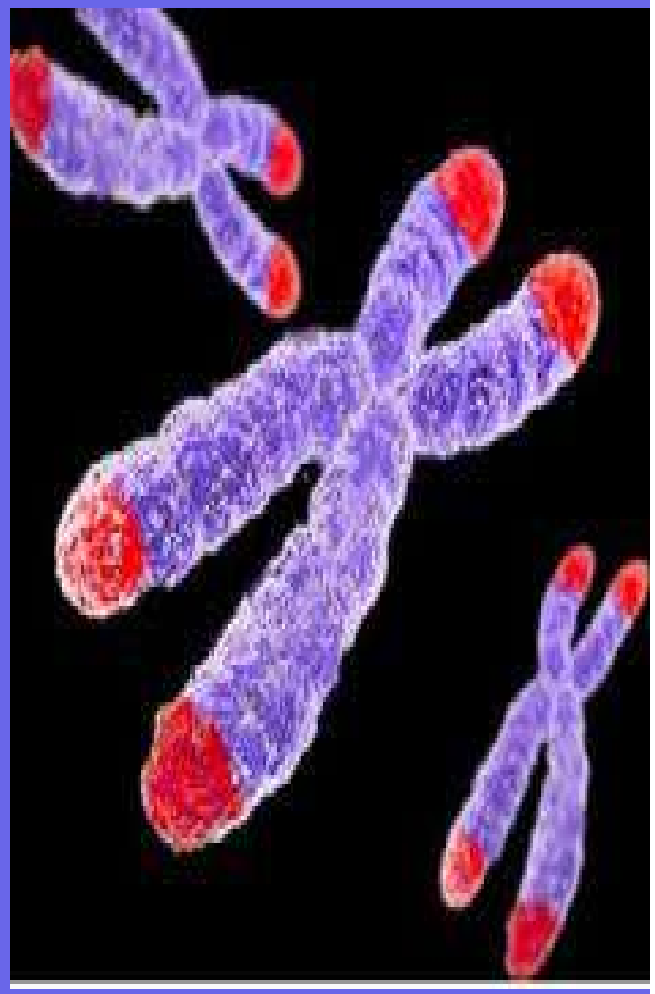
- Decreased methylation levels of cortisol receptor gene:
  - In offspring who had good nurturing produces more cortisol receptors on the hippocampus
    - Lower levels of CRH, ACTH, and cortisol
    - More 5-HT
    - Stress tolerance (Good thermostat)

Epigenetics and Increased Stress

- With methylation of the cortisol receptor gene, fewer cortisol receptors
  - it is difficult to turn off the stress response.
- Increased methylation levels of cortisol receptor gene:
  - In suicide victims with a family history of abuse and/or neglect
  - In preemies:

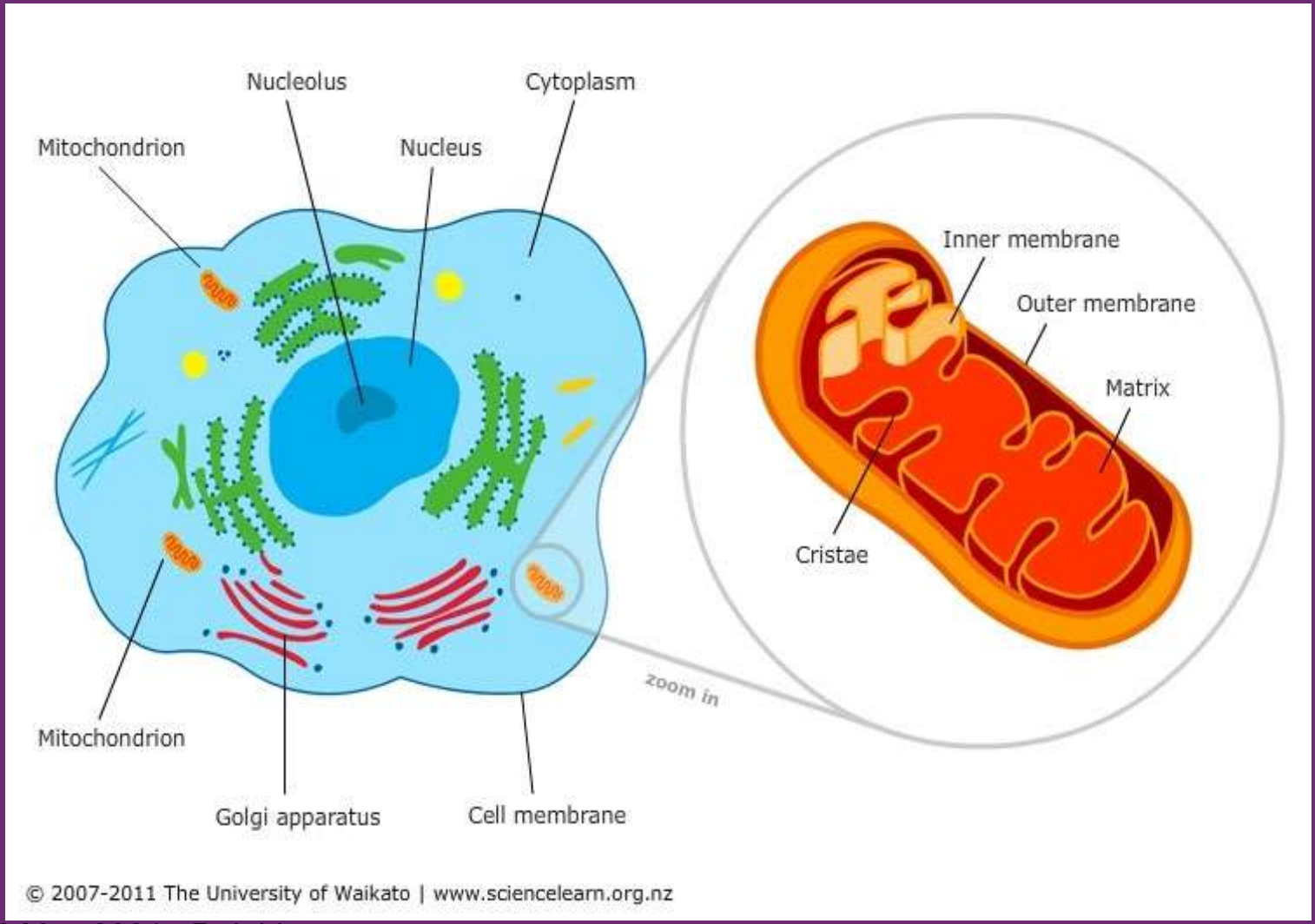
Factors that Shorten Telemeres

- Smoking
- Obesity (more than smoking!)
- Type 2 Diabetes
- Social isolation
- Poor diet
- No exercise
- Poor sleep
- Alcohol and other drugs



- **All rendering DNA vulnerable to damage**

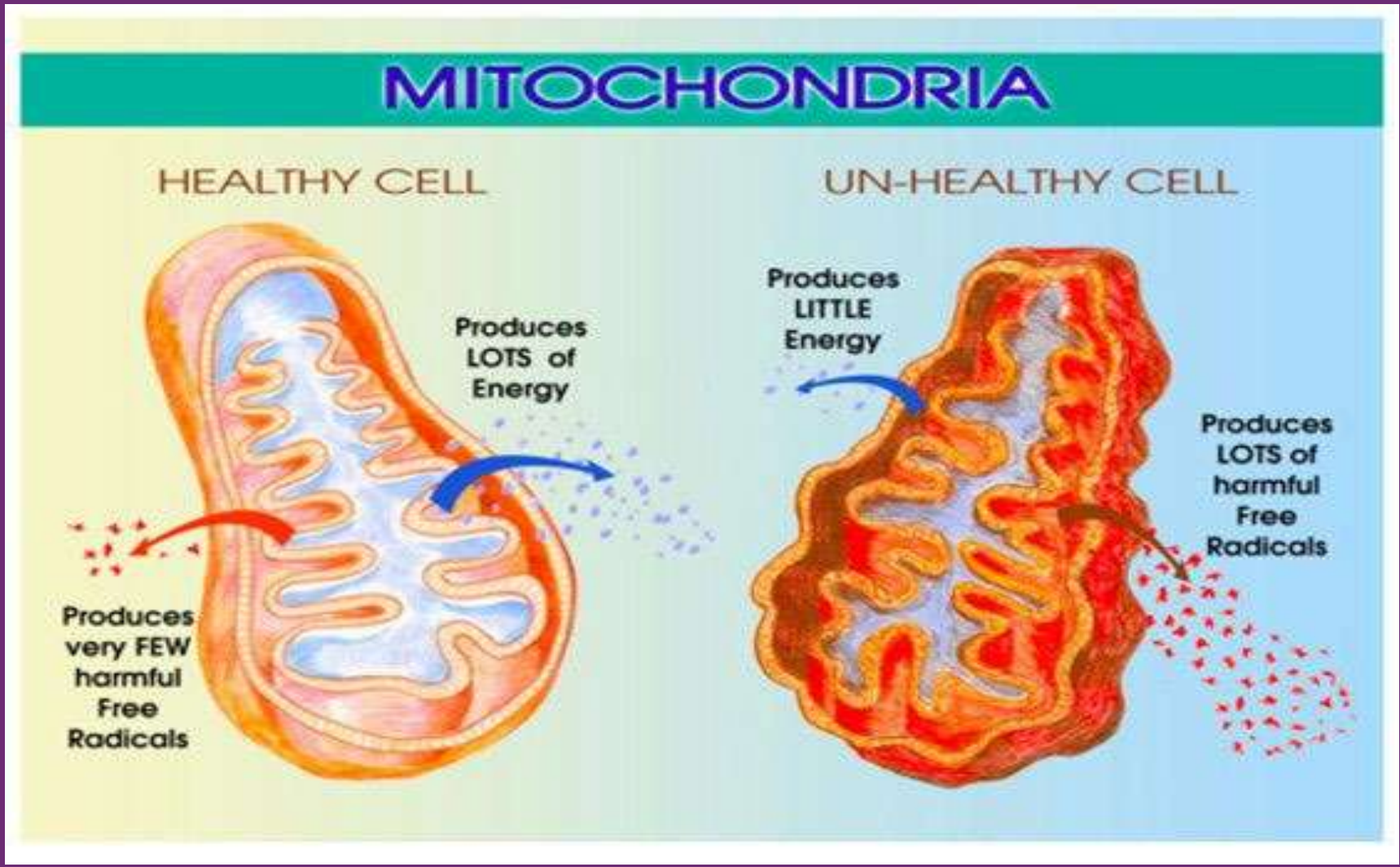
Cells and Their Energy Factories



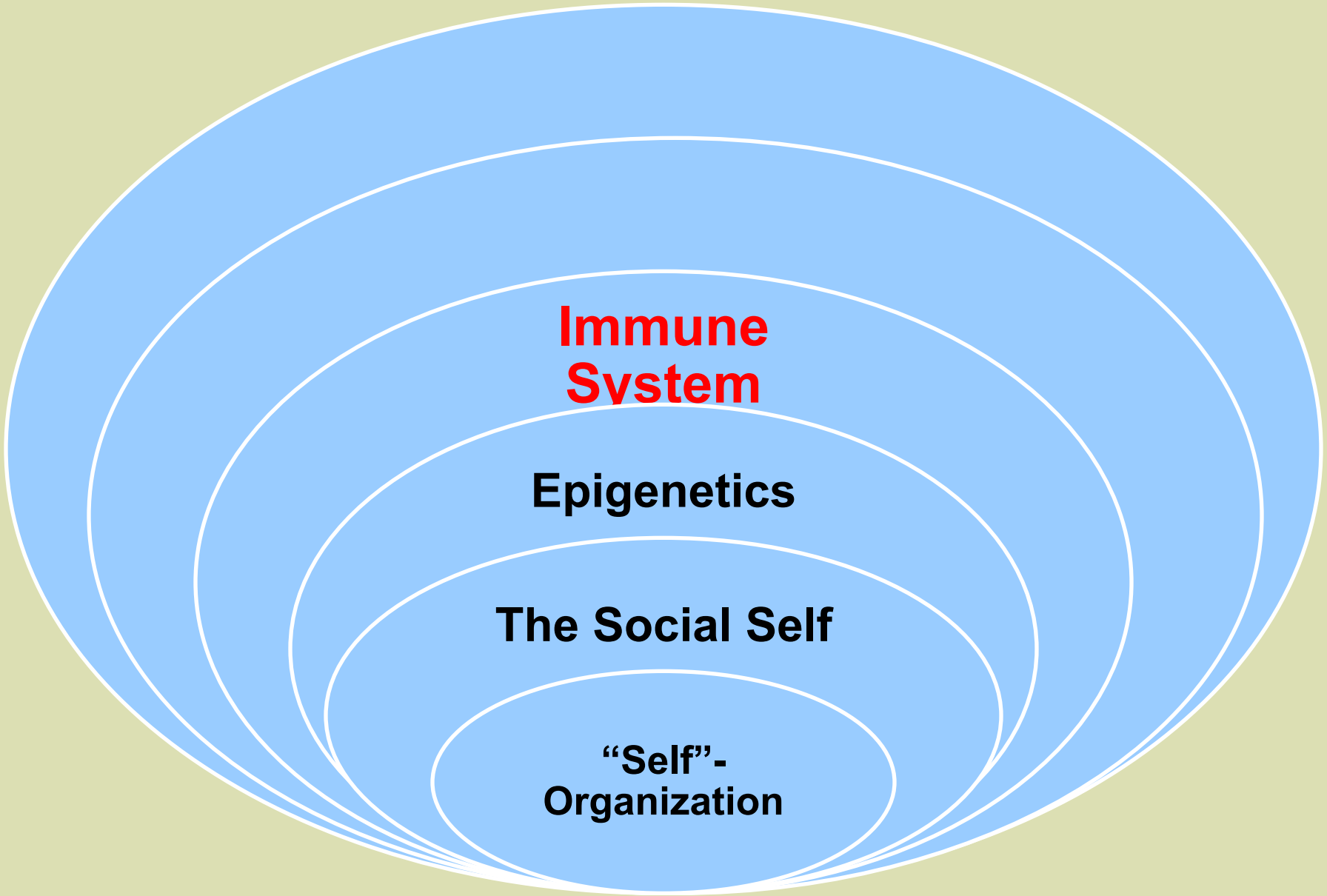
Free Radicals

- Highly reactive molecules that contribute to oxidative stress
- They lost an electron and are on the prowl to steal one from neighboring molecules.
  - Cells malfunction
  - Cells age
  - Cells are more vulnerable to disease
  - DNA more vulnerable to inaccurate gene expression

Free Radical Damage



Mind-Brain-Gene Feedback Loops



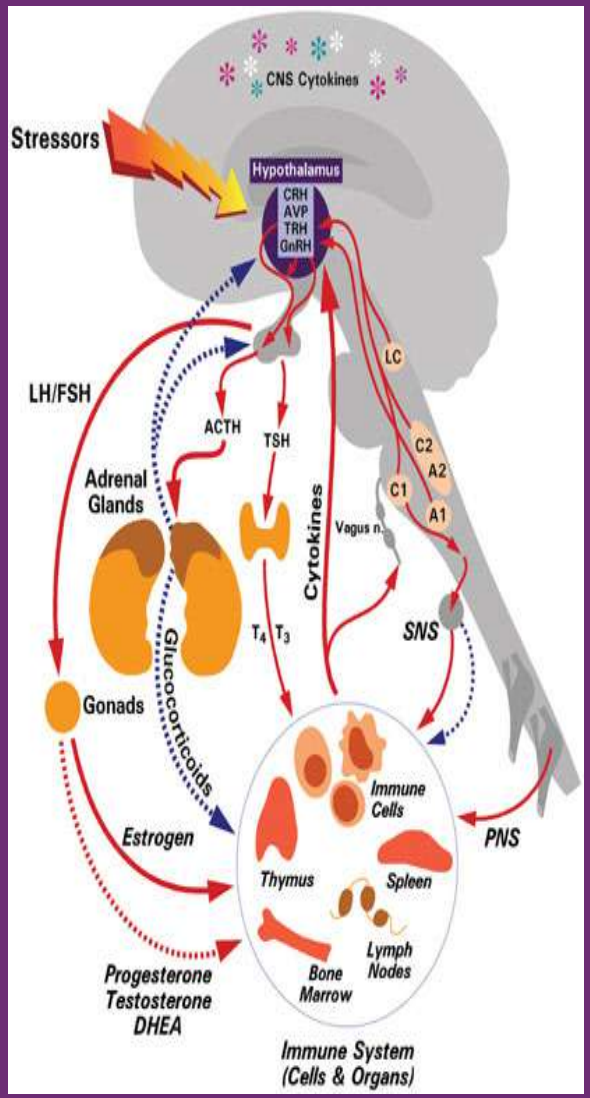
The Brain Controls the Stress Pathways

Distress, via the cortex and amygdala signal to the hypothalamus.

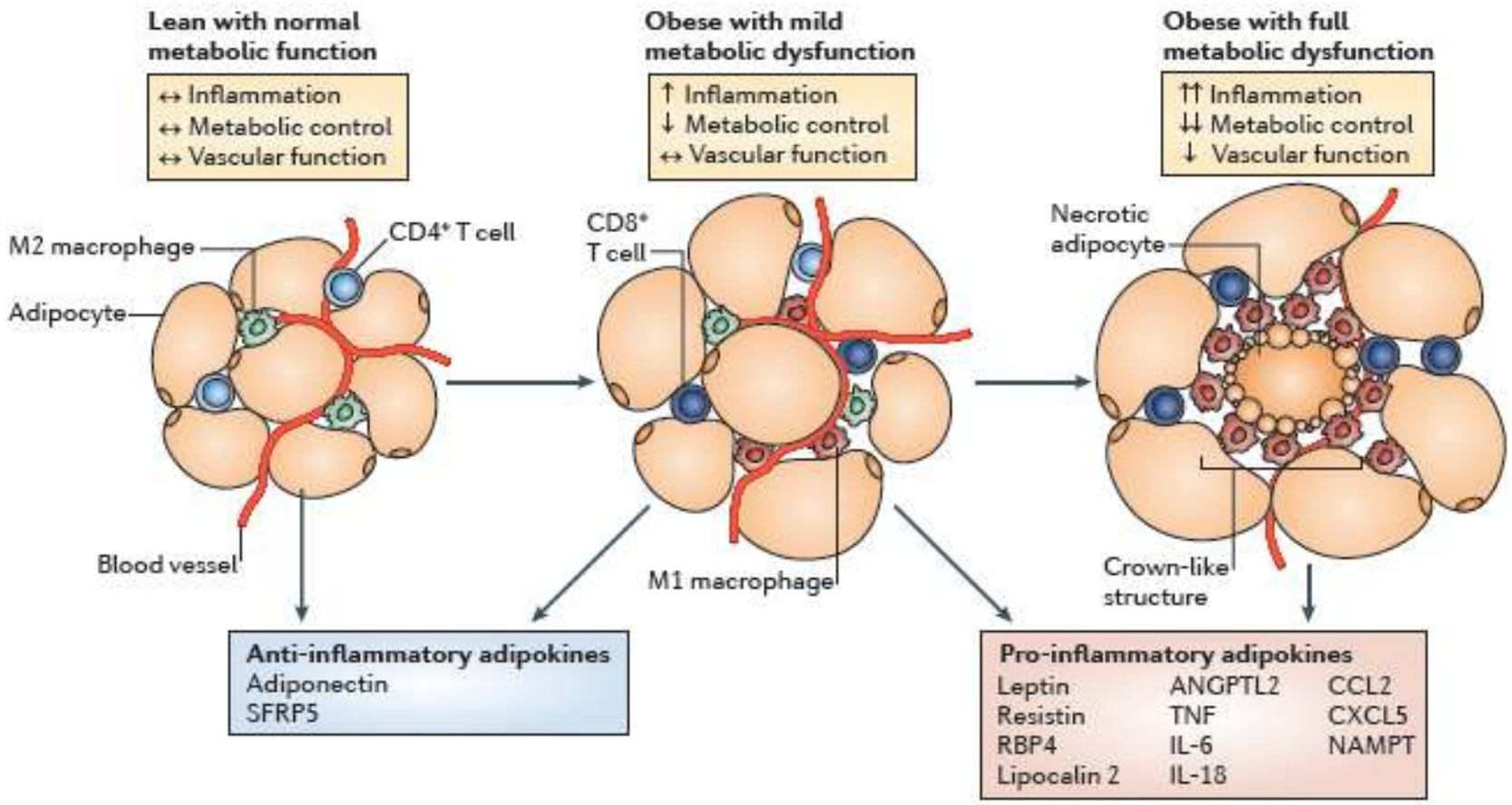
The hippocampus (memory) also has inputs to the hypothalamus.

The hypothalamus maintains homeostasis by regulating visceral activities: heart rate, blood pressure, body temperature, thirst, hunger, weight, sleep/wakefulness.

The hypothalamus also controls HPA stress response system



Obesity-Associated Adipose Tissue Inflammation

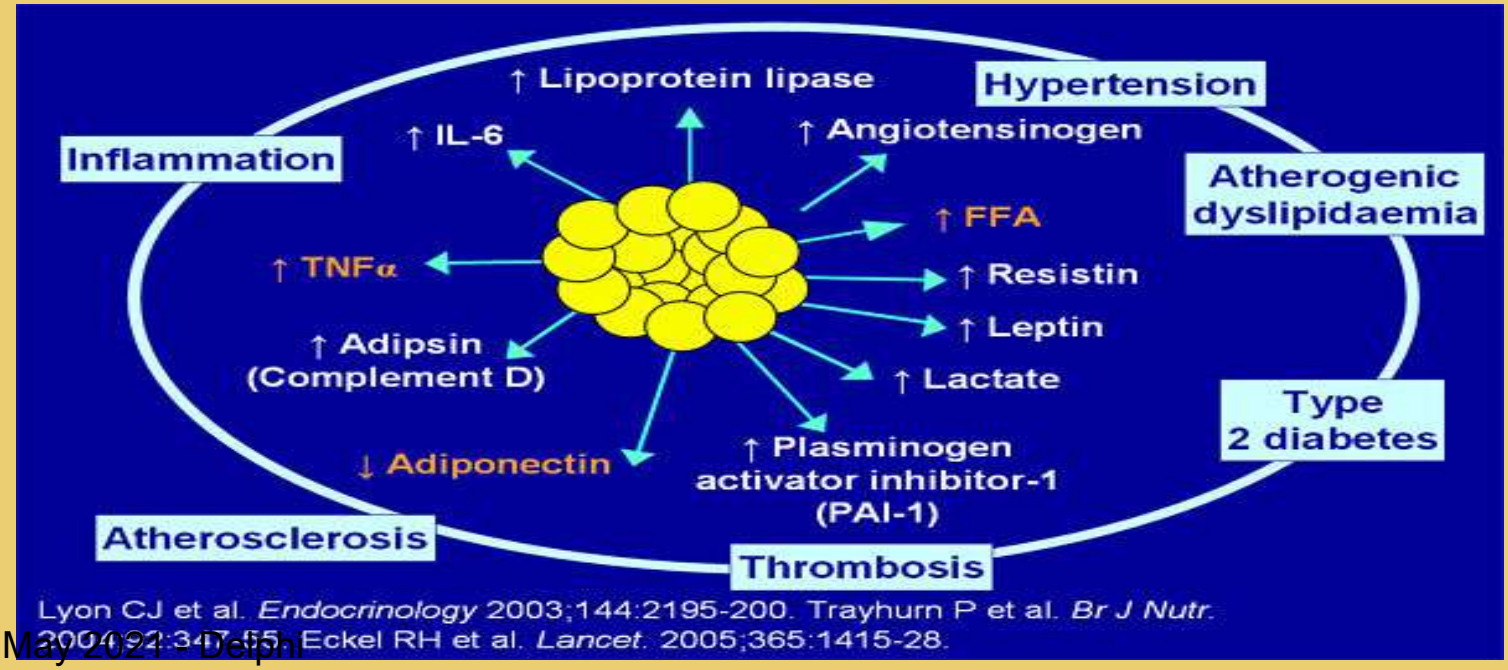


INFLAMMATION

Obesity, Inflammation, and Diabetes

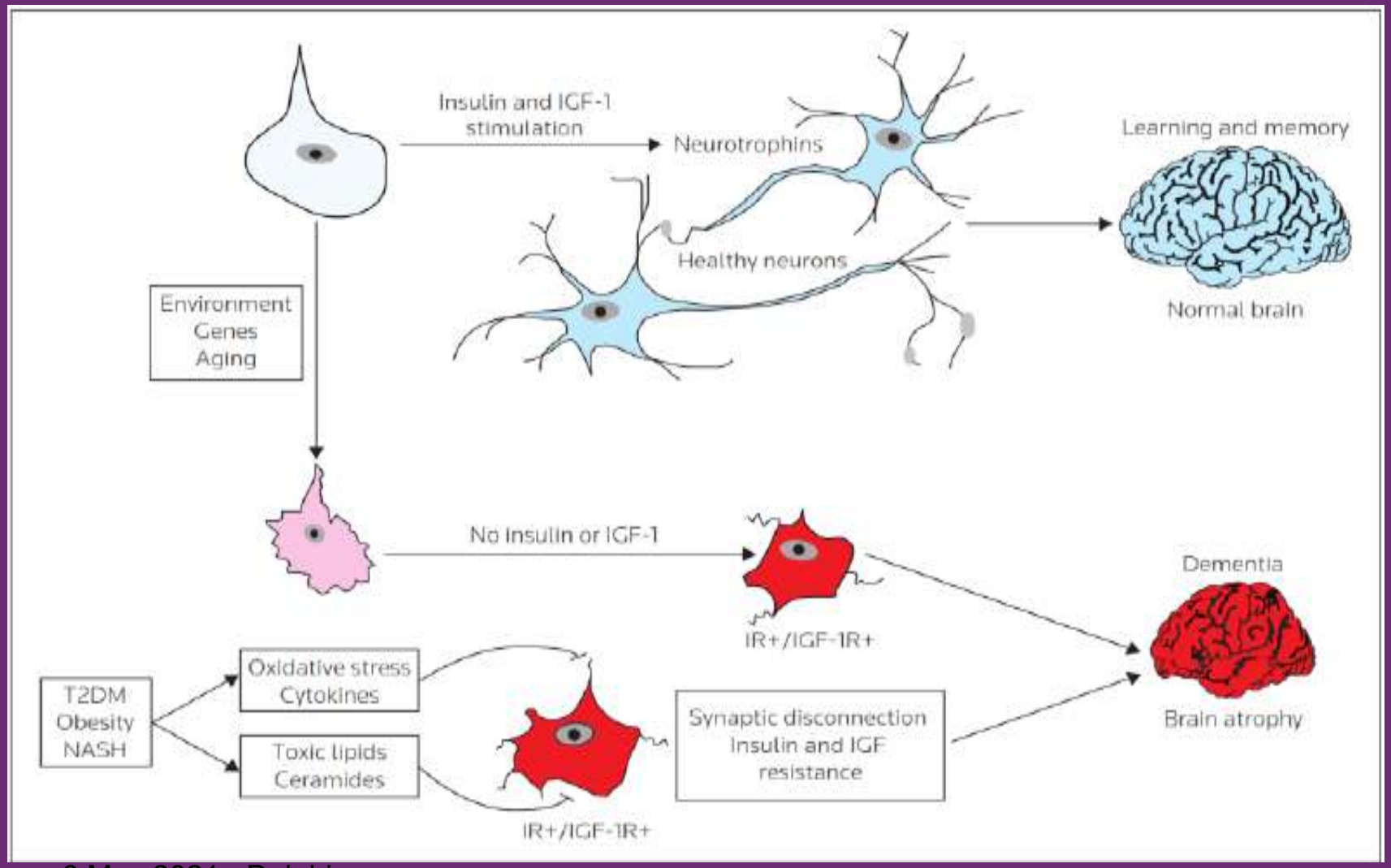
- Fat cells secrete IL-6
- IL-6 can induce insulin resistance

Higher IL-6 may predict diabetes type 2

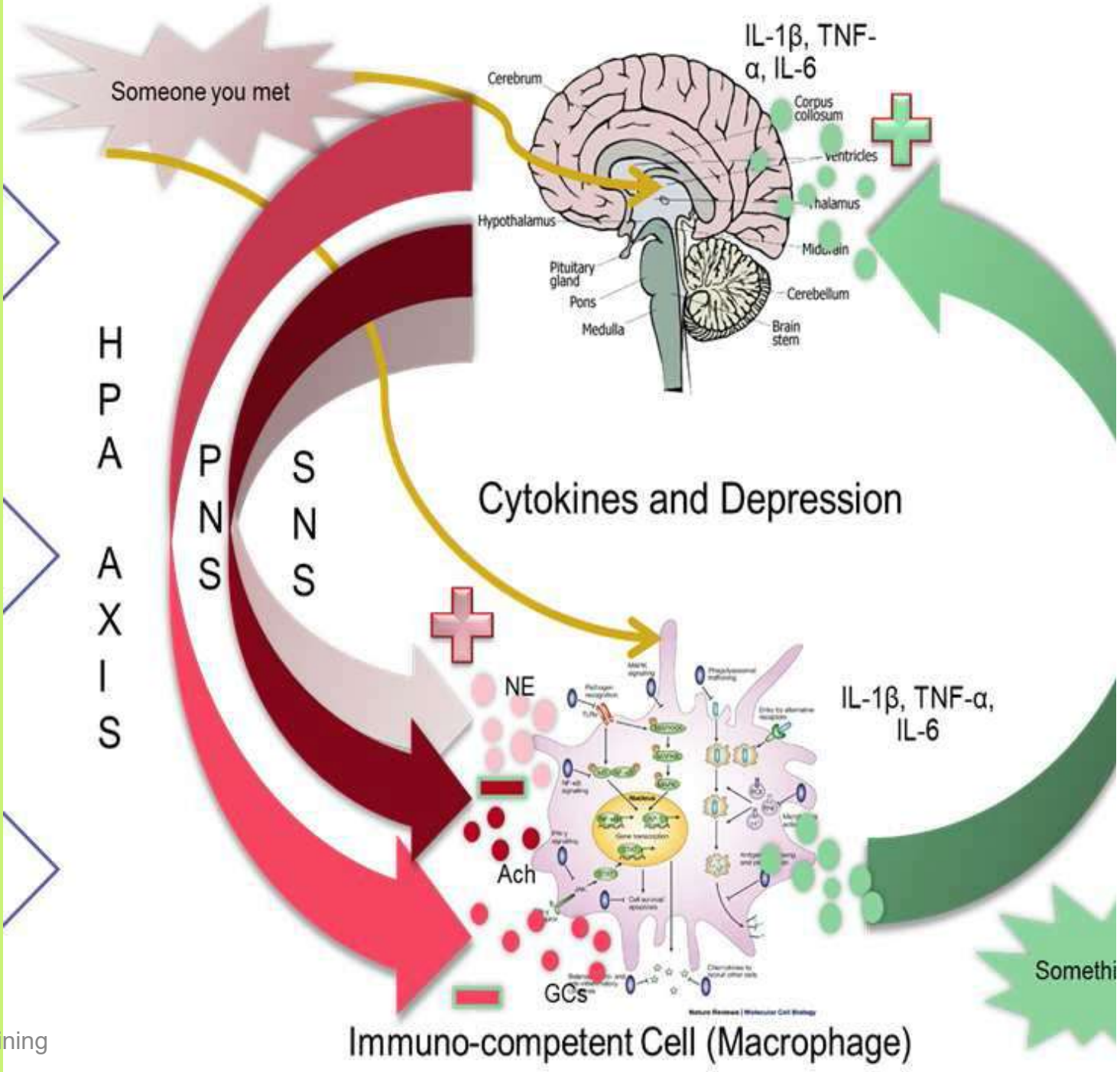


Lyon CJ et al. *Endocrinology* 2003;144:2195-200. Trayhurn P et al. *Br J Nutr.* 2004;92:347-55. Eckel RH et al. *Lancet.* 2005;365:1415-28.

Diabetes and Brain Shrinkage



- **Bad Diet**
  - **Simple carbs**
  - **Transfatty acids**
  - **Saturated fats**
  - **Food allergies**
  - **Bad oils**
  - **High dairy**
  - **High gluten**
- **No exercise**
- **Chronic illnesses**
- **Autoimmune disorders**
- **Chronic pain**
- **Chronic stress**
- **Being overweight**
  - **Apple shape**
- **Leaky gut**

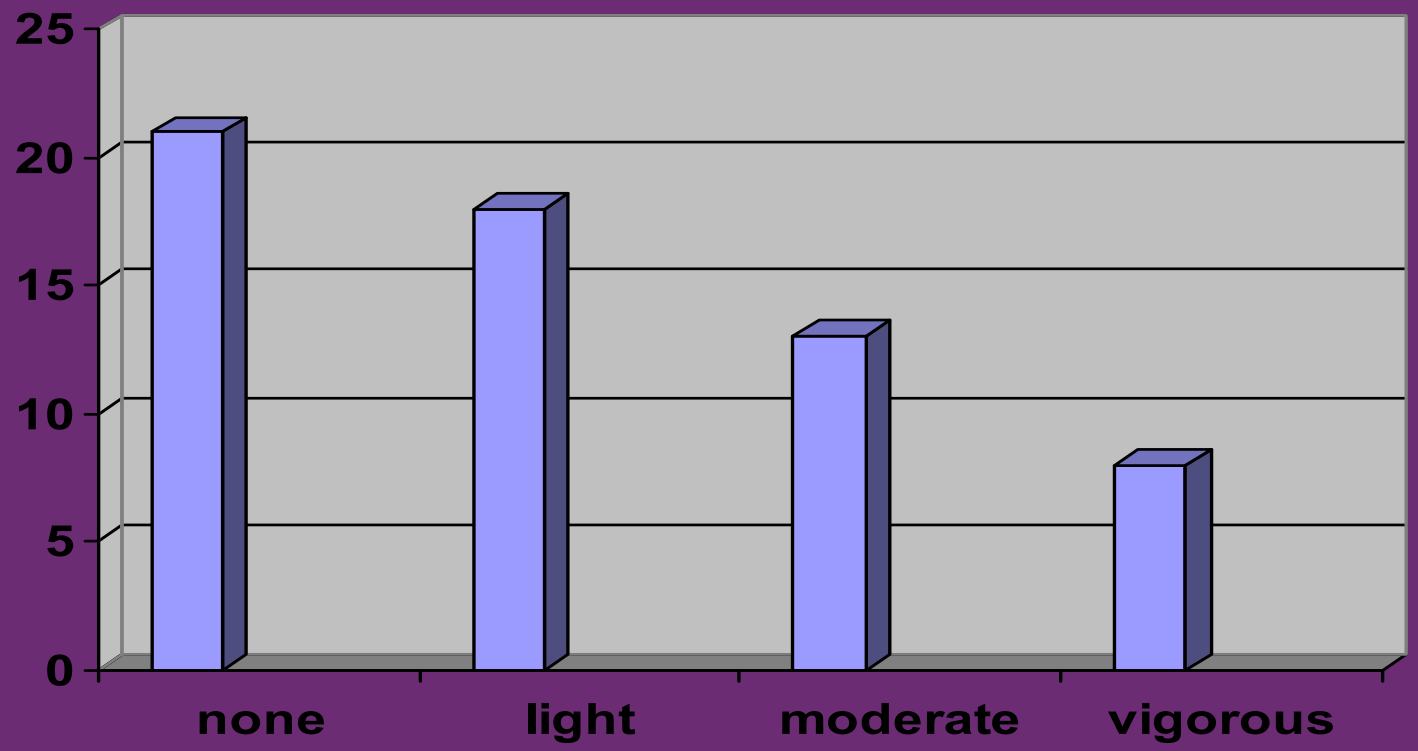


The Five Risiliency Factors

- Social
- Exercise
- Education
- Diet
- Sleep

Effect on C-Reactive Protein

- **The effect of exercise on C-Reactive Protein (inflammation chemical). Degree of physical activity by level of C-Reactive Protein Based on study of 13,748 people (Ford, 2002)**



Allostasis

- **Allostatic adjustments are adaptive over the short term with moderate and fluctuating levels of cortisol to help orchestrate adjustments by:**
  - **enhancing or inhibiting gene transcription**
  - **regulation of BDNF**
  - **up regulates amygdala activity**
  - **targets prefrontal systems involved in stress and the emotion** (Sullivan & Gratton, 2002).
  - **maintaining stability through a change** (McEwen, 1998).
- ***Allostatic load* --When demands exceed the balance of energy and regulatory gains from rest and recuperation.** (McEwen and Wingfield, 2003).

CBT vs. Metacognitive Models

(ACT, DBT, MBCBT, etc.)

CBT

Rationale=control

Cognitive restructuring

Breathing retraining

Interoceptive exposure to lessen fear & avoidance

Situational exposure to lessen fear fear and avoidance

MC Models

Rationale=relinquish control

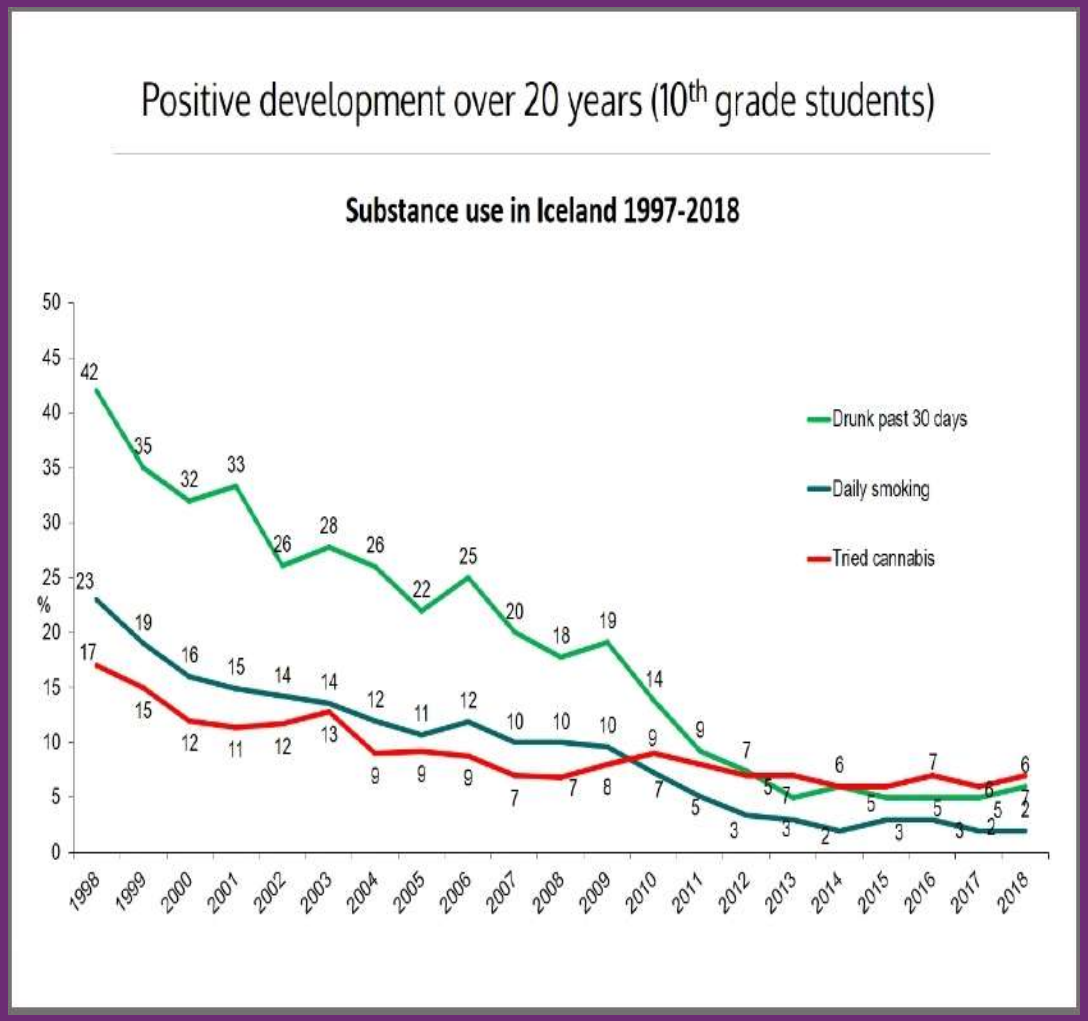
Thought Diffusion

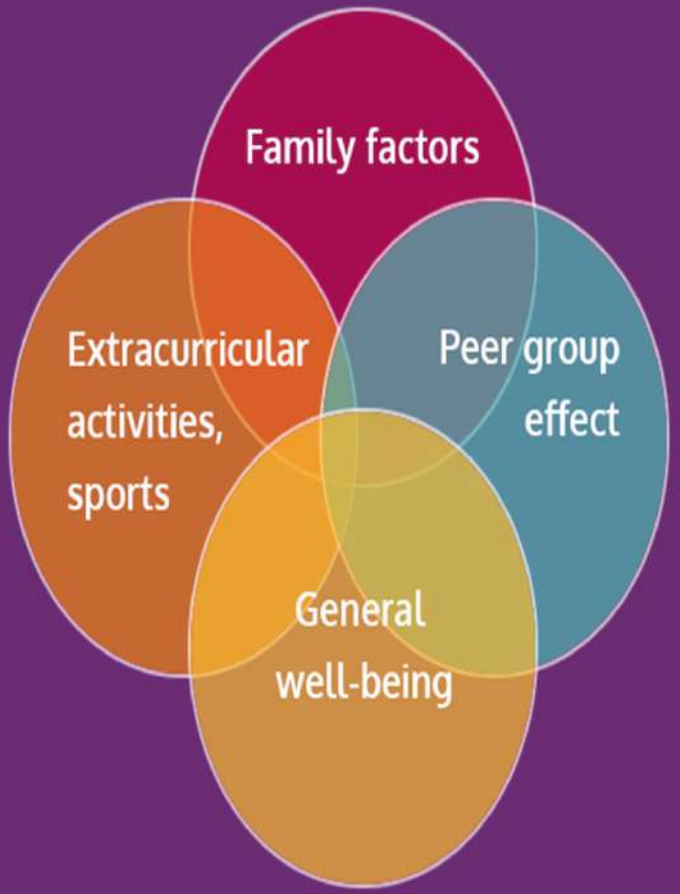
Observe & accept

Interoceptive exposure with acceptance of internal cues

Situational exposure to achieve life values and goals

The Iceland Project





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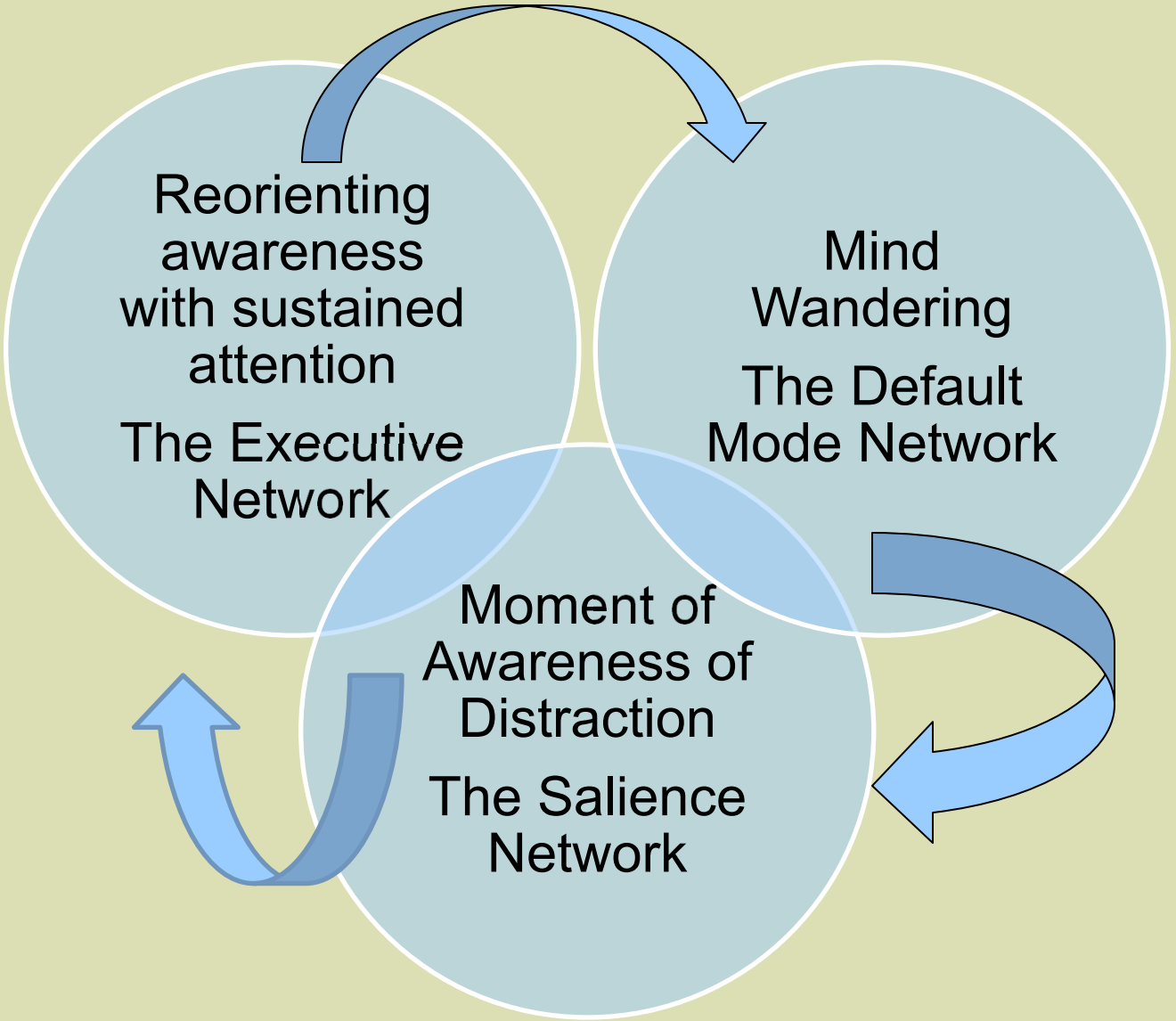
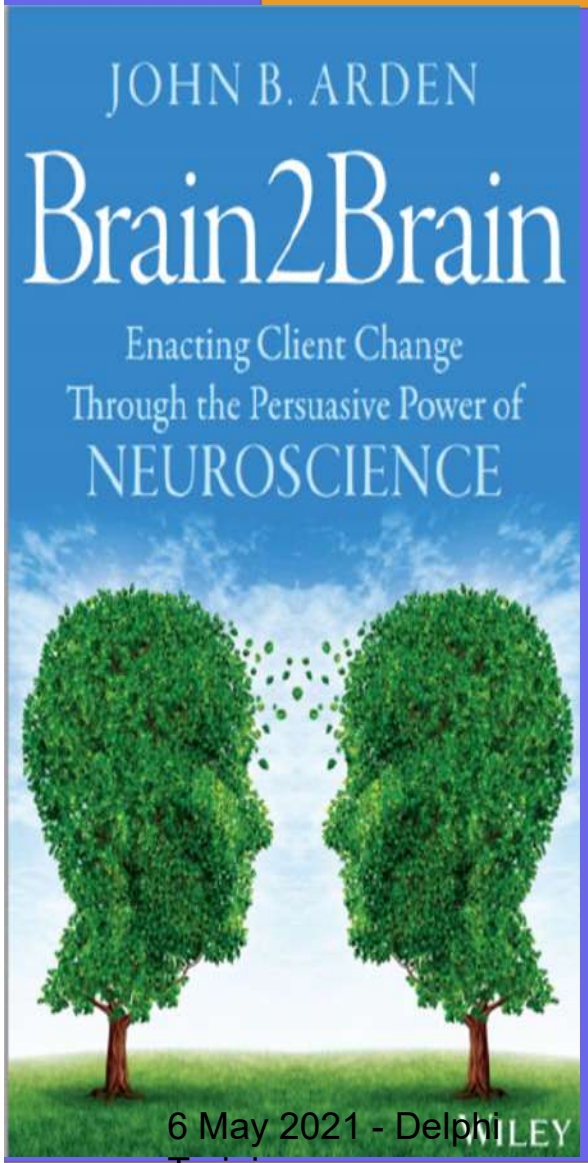


References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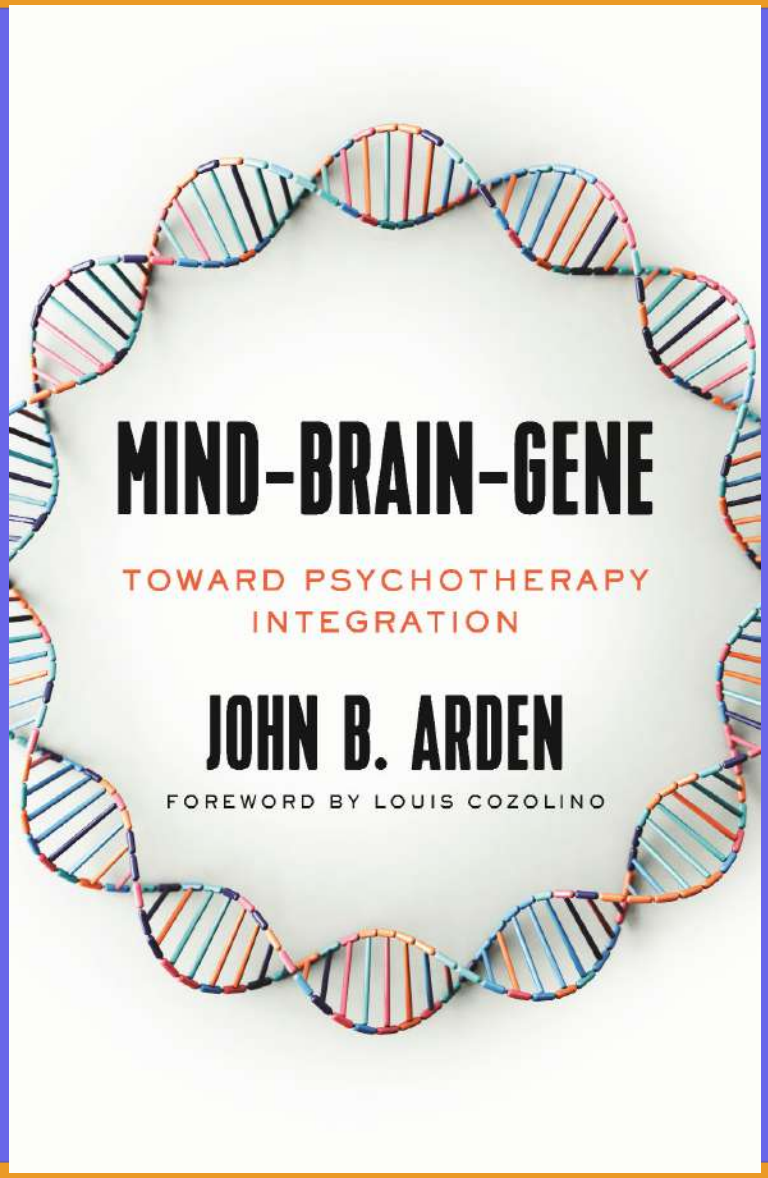
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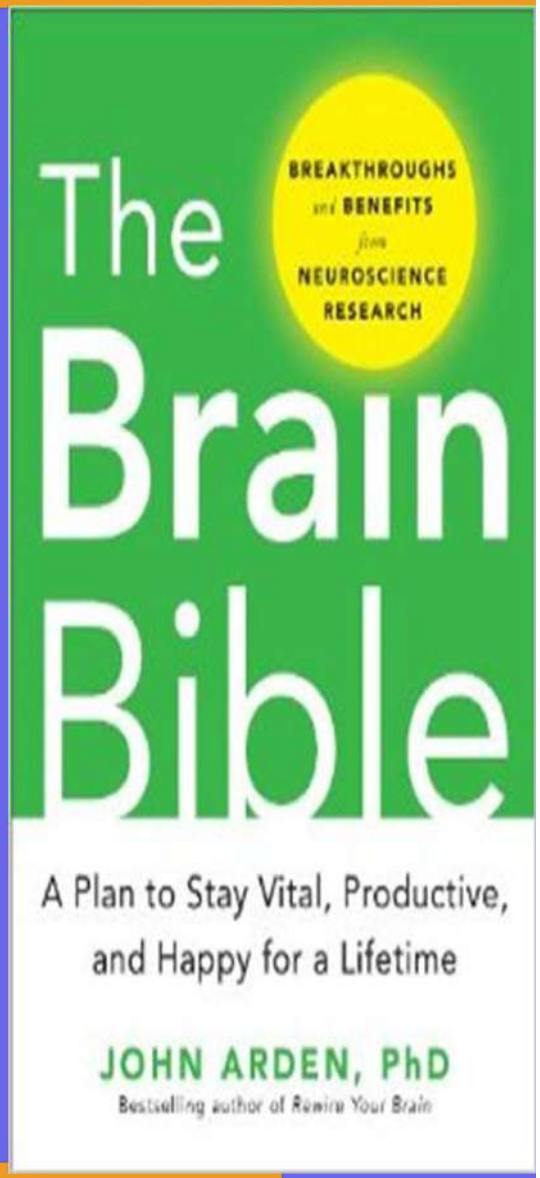
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