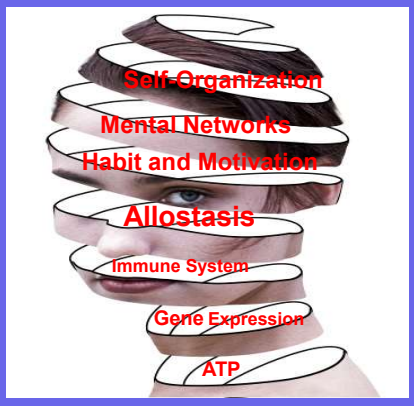
BUSTING BURNOUT AND CHRONIC STRESS:

THE WHOLE BODY SELF-CARE APPROACH



John B. Arden, PhD, ABPP

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Today's Agenda

- * Prevalence of burnout
  * Compassion fatigue
  * Bad Habits
  * Planting SEEDS
  * The Social Factor
  * The Exercise Factor
  * The Education Factor
  * The Diet Factor
  * The Sleep Factor

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Prevalence of Job Stress

- 42% of employees think their coworkers need help with stress.
- 29% of employees put themselves in the highest category of stress.
- WHO estimates that only 5-10% of the workers in developing countries have access to adequate occupational health services

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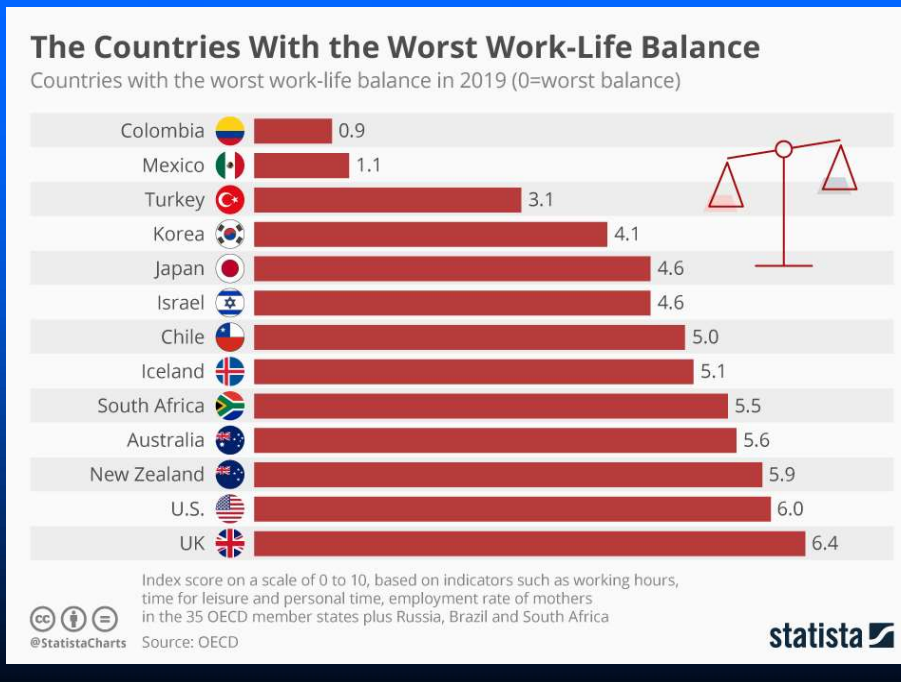

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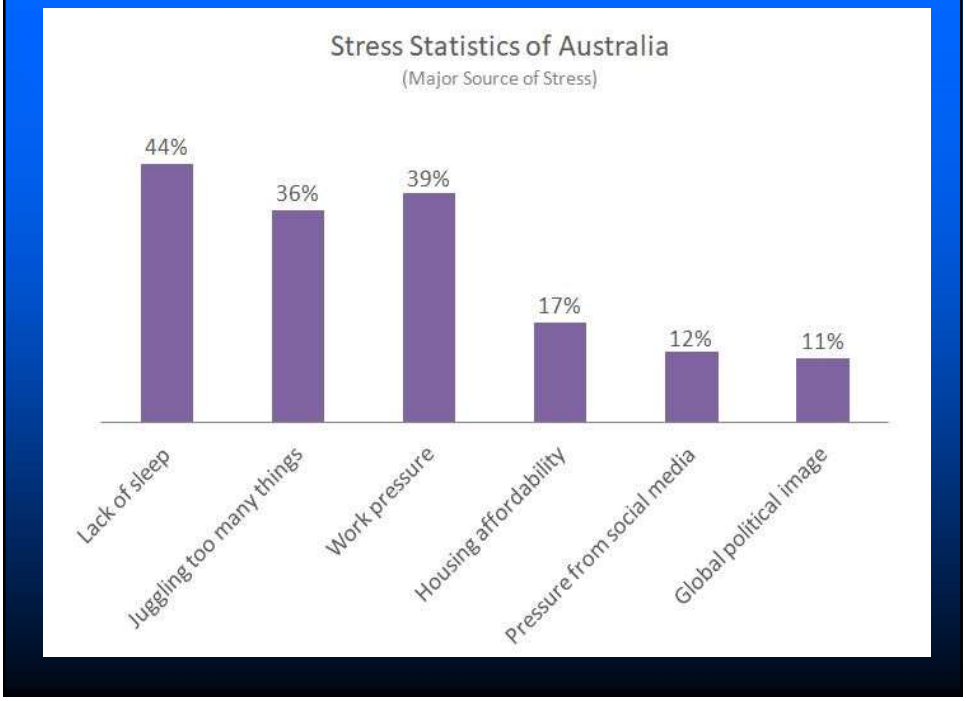

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Prevelance of Job Stress

- Over half of all Australian workers agree that increasing change and complexity at work are leading to job dissatisfaction and high levels of stress at work.
- 1 in 5 Australian employees report that they have taken time off work due to feeling mentally unwell in the past 12 months.
  - Among those who have taken off work--46% consider their **workplace** mentally unhealthy..

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Physical Symptoms

-Insomnia
-Fatigue
-Frequent colds
-Indigestion
-Nervous stomach
-Shortness of Breath
-Headaches
-Back pain
-Loss of appetite
-Overeating
-Tense shoulders
-Diarrhea

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Psychological Symptoms

- -Pessimism
- -Forgetfulness
- -Boredom
- -Indecision
- -Impatience
- -Rigid thinking
- -Depression
- -Anxiety
- -Illogic
- -Apathy
- -Loneliness
- -Feeling hopeless
- -Wanting to escape

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Behavioral Symptoms

- -Irritability
- -Bossiness
- -Accident prone
- -Social isolation
- -Aggressiveness
- -Restlessness
- -Defensiveness
- -Suspiciousness
- -Poor hygiene
- -No sense of humor
- -Easily upset
- -Poor work
- -Absenteeism

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Job Stress and Depression

- Difficulty making decisions
- Feeling like everyone is against you
- Bleak attitude about the future
- Bored with everything
- Former hobbies bring no pleasure
- Suicidal thoughts

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Job Stress and Depression

- Insomnia or hypersomnia
- Feeling hopeless or worthless
- Irritability
- Rapid weight loss
- Low appetite
- Feeling like “going away”
- Social isolation

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Burnout among Therapists

- **A 2016 report from the BPS found that 70% of psychotherapists found their job stressful**
  - **20% considering that they have a long-term chronic condition**
  - **46% reported depression.**
- **American survey found 61% of psychologists clinically depressed**
  - **29% with suicidal thoughts**

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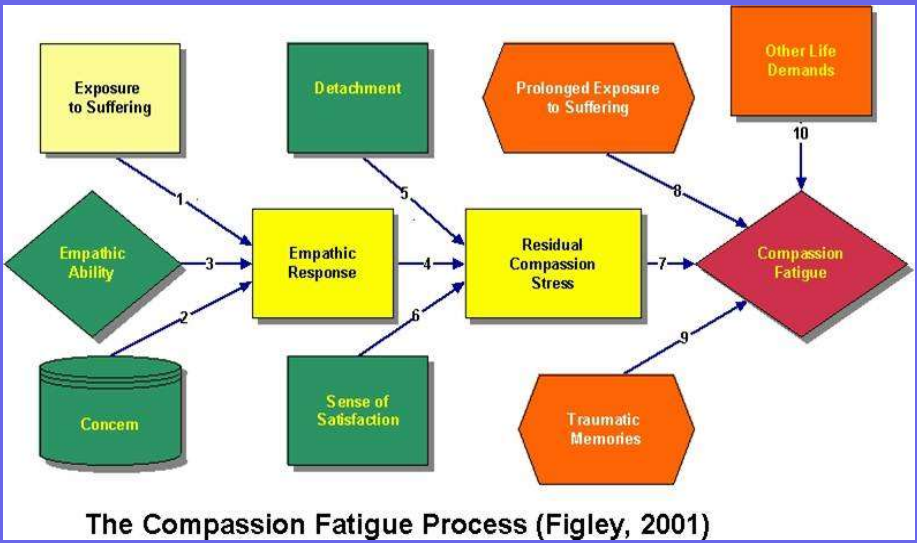
Compassion Fatigue



The Compassion Fatigue Process (Figley, 2001)

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Symptoms of Compassion Fatigue

- Diminished sense of well-being
- Sleep disturbances
- Emotional intensity increases
- Cognitive ability decreases
- Behavior and judgment impaired
- Social isolation
- Depression and PTSD (potentiate)
- Loss of self-worth and morale
- Identity and worldview deflated
- Sense of safety, trust, and loss of sense of control
- Loss of hope and meaning=existential despair
- Anger toward perpetrators or causal events

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Dysfunctional Self-Care

- Substance Abuse
  - Alcohol
  - Marijuana
- Poor Self-Care
  - Comfort Food
  - Isolation
  - Physical Inactivity

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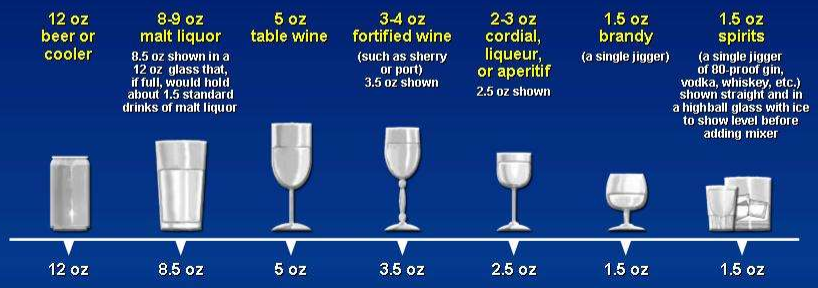
Defining the "Standard Drink"

- A **standard drink** = 14 g ethanol
  - 12 oz of regular beer or cooler (5% alcohol)
  - 5 oz of table wine (12% alcohol)
  - 1.5 oz of hard liquor (40% alcohol, 80 proof)
  - The average person metabolizes about 1 standard drink per hour



Source: National Institute on Alcohol Abuse and Alcoholism. Bethesda, Md: NIAAA; 2004. NIH Publication No. 04-3769.

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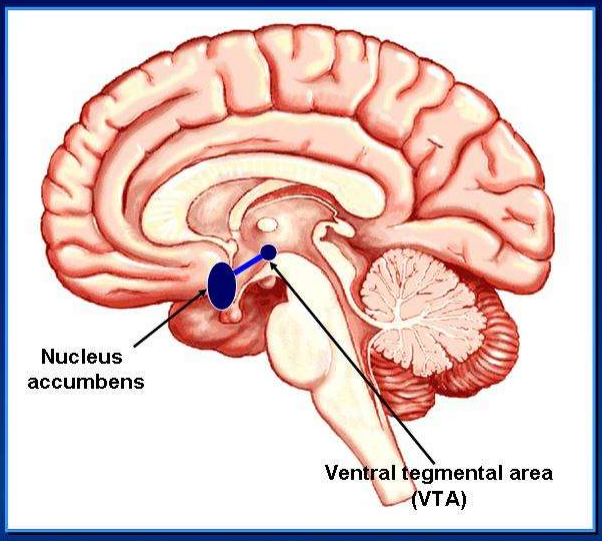
Brain Reward Pathways



- The VTA-nucleus accumbens pathway is activated by all drugs of dependence including alcohol
- This pathway is important not only in drug dependence, but also in essential physiological behaviors such as eating, drinking, sleeping, and sex

Source: Messing RO. In: Harrison's Principles of Internal Medicine. 2001:2557-2561.

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Effects of Acute Alcohol on Other Neural Circuits

GABA and Glutamate Systems

- Increases the effects of GABA, the major inhibitory neurotransmitter in the brain
- Inhibits the effects of glutamate, the major excitatory neurotransmitter in the brain
- Contributes to decreased anxiety and increased sedation during acute alcohol intake

GABA = gamma-aminobutyric acid.

Source: Littleton J. *Alcohol Health Res World*. 1998;22:13-24.

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Effects of Alcohol on Neural Circuits

Glutamate System

Administration of Alcohol

Acute Alcohol Effect
- Inhibits NMDA receptors
- **Effect:** ↓ anxiety, ↑ sedation

Chronic Alcohol Use

Alcohol Free
CNS Equilibrium

Adaptation
- ↑ # and/or function of NMDA receptors on neurons
- Balances acute alcohol effect
- **Effect:** tolerance, dependence

Withdrawal
- Increased glutamatergic activity
- **Effect:** - *Acute:* dysphoria, hallucinations
  - *Post-acute:* sleep/mood disturbances

Removal of Alcohol

Source: Littleton J. *Alcohol Health Res World.* 1998;22:13-24.

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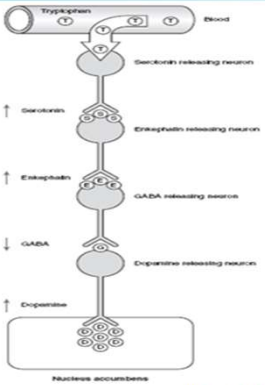
Inhibiting the Inhibiter: The Function Enkephalin

To inhibit the release of neurotransmitters
Inhibit GABA (because they share receptor sites)
Because GABA brake is off—more DA and NE



The reward cascade. Serotonin neurons stimulate the release of enkephalin, which in turn inhibits the release of GABA (gamma-aminobutyric acid) in the *limbic system*. As GABA decreases we can expect the release of dopamine to increase. In other words, the enkephalin has inhibited the inhibitor (GABA).

cognella

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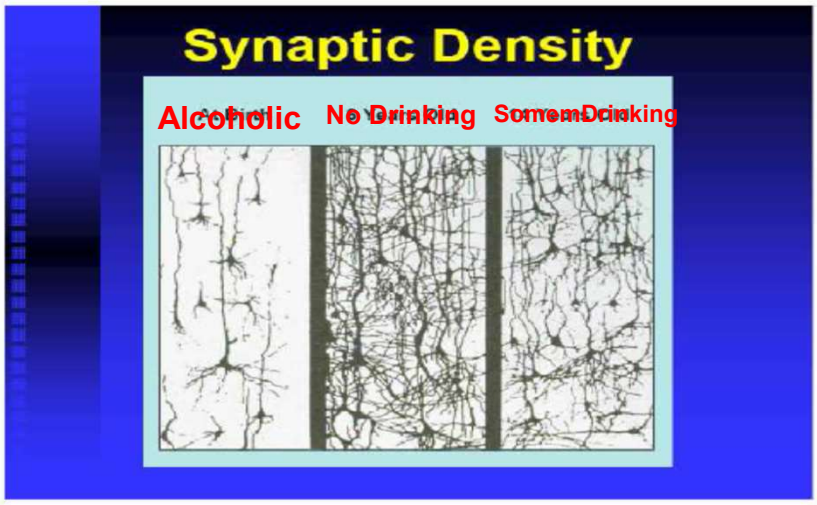
Alcohol damages dendrites and white matter, reducing message traffic between neurons and transmission speed.



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Cognition and Alcohol

Drinking on a regular basis -- cognitive deficits such as:

- ↓performance on tests of visual and spatial perception
- ↓visual and spatial learning ability
- ↓ ability to make fine motor movements
- ↓ adaptive abilities
- ↓ short-term memory
- ↓ non-verbal abstract learning
- ↓ abstract thinking ability
- ↓ conceptual thinking ability

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Alcohol, Mood and Sleep

- **Alcohol contributes to the following problems as much as several days to weeks after drinking:**
  - **↑stress and anxiety**
    - **↓ GABA—panic attacks common**
  - **↑depression**
    - **↓ serotonin and DA**
  - **Alcohol-related insomnia (mid sleep cycle awakening).**
    - **↓ deep sleep (Stage 4)**
    - **↓ REM sleep.**

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Synaptic Homeostasis

- Alcohol blocks glutamate from binding to NMDA receptors
  - While temporary enhancing GABA
- Sustained use creates more NMDA receptors to compensate
  - Also neurons release more glutamate
- Because excessive GABA activity—neurons decrease GABA
  - With NMDA receptors hypersensitive and GABA receptors dulled
  - i.e. Tolerance and withdrawal factors worsen
  - People drink to feel less “crappy”

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Alcoholism and Meth Abuse

- ↓ DA receptors
- Decrease response to natural rewards
- PFC hypoactive
- ↑ drug and alcohol responses to associative cues

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Alcoholism: Reward Deficit Disorder

- After reward system is over-activated
  - ↓ D2 receptors
  - Less opportunity to anticipate and feel pleasure
- Negative emotional state with dependence
  - Activates “anti-reward system” (Koob)
  - ↑ HPA axis
- Together with dulled reward system
  - ↑ anxiety and dysphoria
  - ↑ impulsive and relapse potential

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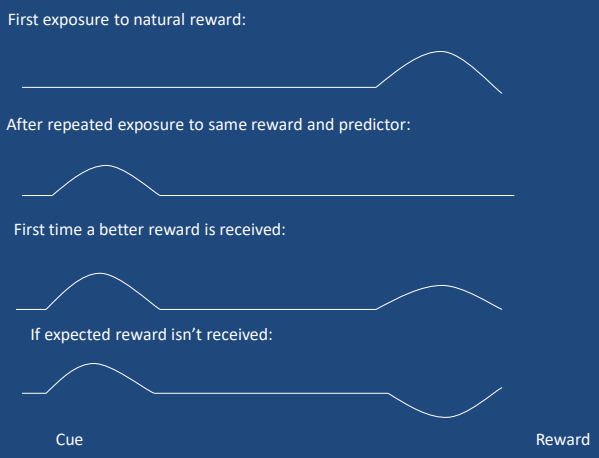
Dopamine Firing: **From Wanting without Liking**

- Incentive—sensization
- In the beginning it feels good then overtime it doesn't
- Maintenance use—to feel relief from feeling bad



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Wanting vs. Liking

- Wanting—dopamine
- Liking—opioids
  - Sometimes you get wanting without liking
- Dopamine firing like a Geiger counter approaching a radiation source
- D1 receptors direct to the BG –mindless habit
- D2 receptors indirect—grow with a wide variety of positive experiences

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The "White Knuckle" Paradox

- "Just say no" produces working memory load, increasing the activity in the anterior cingulate cortex to monitor and assess errors in learned behaviors.
- Addiction can cause trouble activating the anterior cingulate cortex.
  - This is why many recovery programs incorporate contingency planning and relapse prevention so that problem solving ahead of time can minimize working memory load.

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The Increase Potency of THC

- **THC: 2-3% in 60's**
- **After Vietnam war ~ 8%**
- **By 1983 10-15%**
- **Today: Some MJ 20% to > 25% THC**

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Marijuana

- 2 endogenous cannabinoid (CB) receptors:
  - Anadamide (Sanskrit for bliss)
  - 2-archidonyl-glycerol (2-AG)
- Anadamide inhibits the release of glutamate and acetycholine within the cortex and the hippocampus
  - Impairing the formation of memory
- The CB receptors enhance the release of DA
- Stimulation of the CB receptors in the hypothalamus underlies the "munchies"

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Virtual Novelty

- **Familiar foods taste fantastic**
- **Senses are not actually improved by THC, but the brain is tricked into thinking this is new and exciting . . .**

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Cannabis

- Endogenous cannabinoids—the first described was anandamide – “Ananda” Sanskrit for bliss
- Two types of cannabinoid receptors CB1 and CB2:
  - CB1: receptors in the brain
  - CB2: receptors in the body
- Two types of cannabinoids THC and CBD:
- THC: partial agonist (activates receptors)
- CBD: antagonists (prevents activity by anandamide and THC
  - CBD counteracts some of the effects of THC

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Retrograde Messaging

- Since endocannabiniods are made and released as needed
  - Not stored in vesicles
- Once released they defuse backwards on the presynaptic cells
  - They do not send their own message instead modify the message of the other neurotransmitters by decreasing their release
  - In this way the postsynaptic cell adjust the signals from the presynaptic neurons

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Chronic MJ Use:

- **Tolerance: Receptor Site Degradation**
- **Receptor sites immediately dwindle.**
- **Overstimulation: suck receptor sites into the cell.**
- **Then: receptor sites dismantled**
- **Can reduce 90 % of receptor sites.**
- **Life becomes boring**
- **Difficult to learn from negative experiences.**

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Long-Term use of Marijuana

On 9 standard neuropsychological tests that assess attention, memory, and executive functioning:

- Impaired Learning
- Impaired Retention
- Impaired Retrieval

Impairments endure beyond the period of intoxication and are worse with increasing years of regular cannabis use

Solowij et al., *JAMA*, Vol. 287, No. 9, pp. 1123-31, Mar 6, 2002

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MJ: Addiction & Withdrawal Sx**

- **Peak Symptoms 2 – 6 days into withdrawal. Duration for most symptoms is 5 – 21 days.**

- **Craving**
- **Anger/Irritability/Aggression**
- **Sleep Disturbances**
- **Increased dream sleep including "strange dreams"**
- **Nervousness/anxiety**
- **Decreased appetite or weight loss**
- **Concentration Problems**
- **Restlessness**
- **Aches, Pains and Chills**
- **Sweating**

****Withdrawal from heavy marijuana use (25 days/month) is about as harsh as withdrawal from nicotine addiction (10 cigarettes daily) A within-subject comparison of withdrawal symptoms during abstinence from cannabis, tobacco, and both substances Drug and Alcohol Dependence Volume 92, Issues 1-3, 1 January 2008, 48-54 ,**

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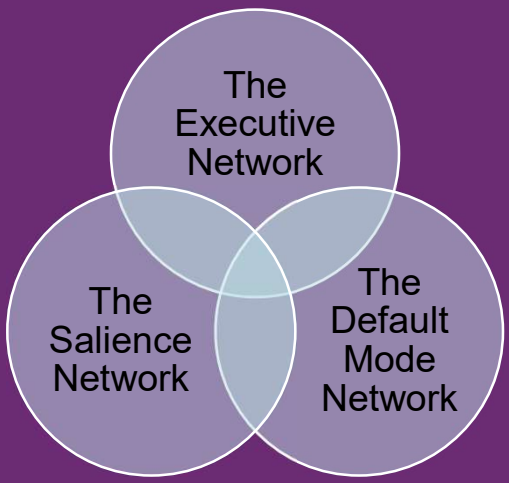
Balancing the Mental Networks



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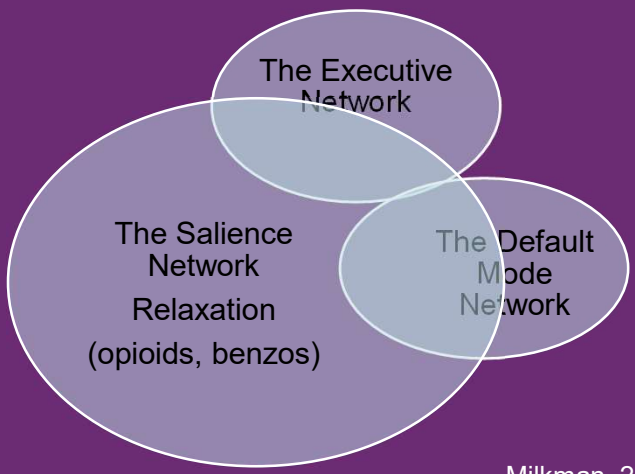
Styles of Coping Pharmacological Defenses



Milkman, 2019

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Styles of Coping
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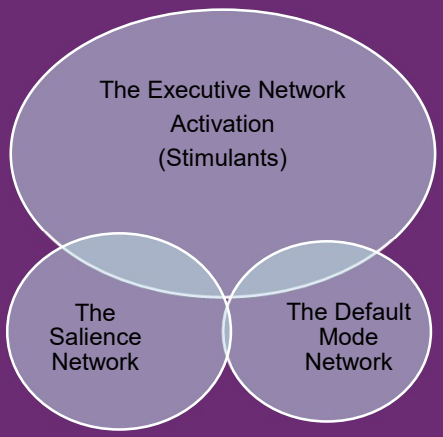

Milkman, 2019

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Styles of Coping
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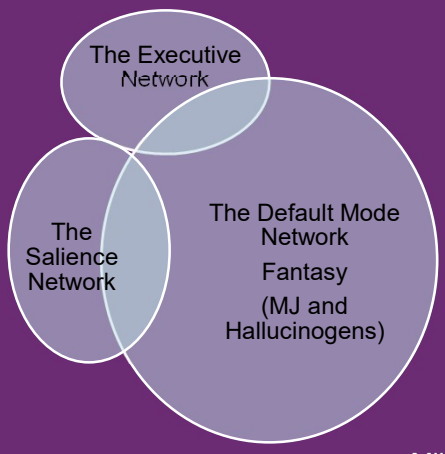

Milkman, 2019

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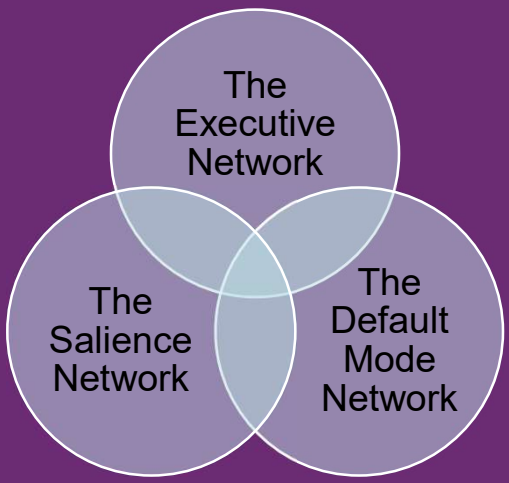
Balancing the Mental Networks



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H.A.L.T.

- **Hunger** can be physical or emotional need. Understanding the need to eat is fairly straightforward. ----not just to eat, but to eat well.
- **Anger** is a normal, healthy emotion to experience. Take time to understand what is causing your anger, and know how to properly express it.
- **Loneliness** can occur when we are by ourselves or when surrounded by many people. We isolate ourselves when we don't feel like others can understand us, withdrawing into ourselves out of fear or doubt.
- **Tiredness** takes a toll on our bodies, mind, and spirit. When our days are filled with busyness it is easy to ignore how tired we become. However, running on low energy compromises our ability to think and our capacity to cope.

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The Middle Path

- Normally, when dopamine binds to D2 dopamine receptors, the receptors change shape and cannot send another signal until they go through a recycling process.
  - The receptor is taken inside the neuron and chemically treated so that it can return to a functional state. This recycling process is messy, with the loss of some receptors in the process. If loss of receptors outpaces the rate at which the neuron makes new ones, D2 dopamine receptor levels will decline.
  - Moderate- size rewards stimulate moderate dopamine release, and a relatively small portion of the receptors go through this recycling process, leaving a large population of D2 dopamine receptors available to put on the indirect pathway brakes.
  - In contrast, drug use surges dopamine release to the extreme; with overwhelming dopamine release the D2 dopamine receptor population becomes depleted. The person becomes less able to put the brakes on habits. In recovery those receptors come back over a period of weeks and month

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Principles of Motivational Interviewing

Motivational interviewing is founded on 4 basic principles:

- **Express empathy**
- **Develop discrepancy**
- **Roll with resistance**
- **Support self-efficacy**

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OARS

The OARS are the skills that can be used by interviewers to help move clients through the process of change.

Open-ended questions
Affirmation
Reflective listening
Summarising

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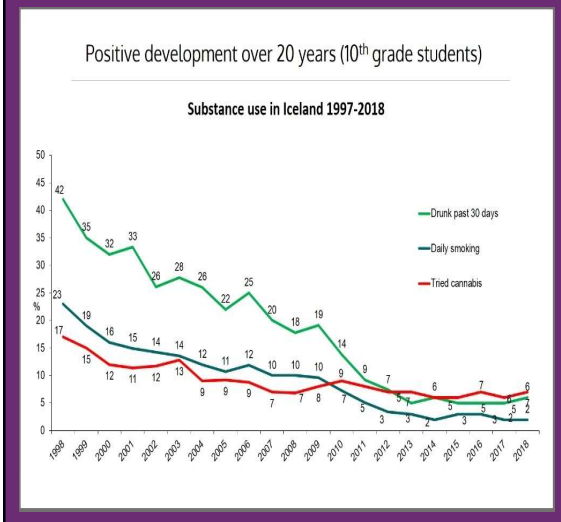
The Iceland Project



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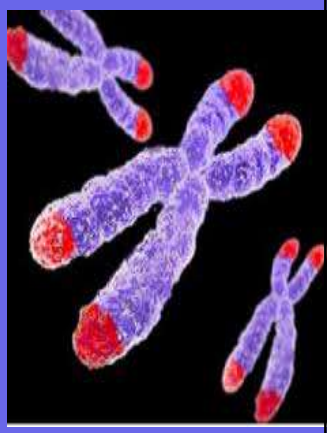
Factors that Impair DNA and Cells

- When cells divide
- Telomeres shorten
- Gene expression changes
- Impairs cellular repair
- Recycling of cells slows
- Errors accumulate
- Cells fail
- Cells die



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Energy Production

- ↑ food intake + Oxygen = ATP (energy)
  - But with ↓ exercise no demand for ATP
  - And with regular oxygen ↑ free radical
- Not enough antioxidants available
  - Oxidation of lipids
  - Electron flow stops
  - More free radicals attack mtDNA
  - Cells fail to produce ATP and die

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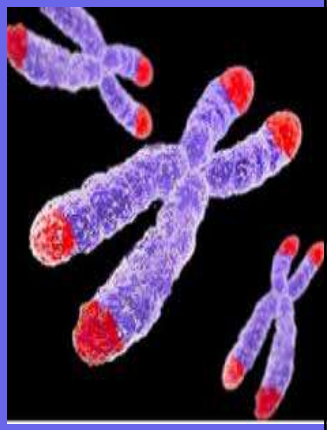
Factors that Shorten Telemeres

- Aging
- Cardiovascular disease
- 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**



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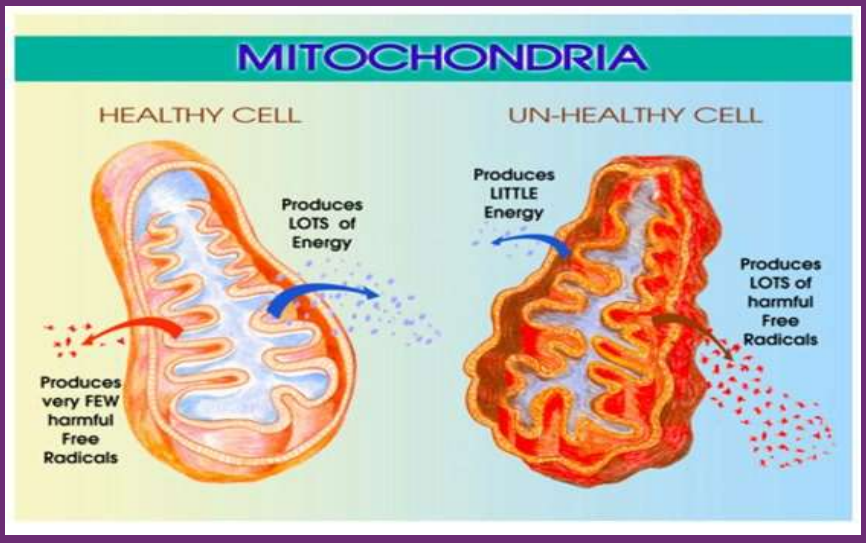
Free Radicals



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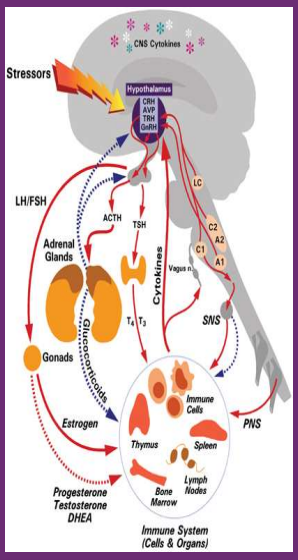
The Brain Controls the Stress Pathways

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



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Stress

Activation of corticotropin releasing hormone (CRH):

- **Contributes to delayed gastric emptying**
- **Increased colonic activity**
- **Functional bowel disease (IBS)**
- **Increase in gut permeability**
- **Leaky gut – antigens leaking out**
- **Toxic liver overload**
- **Systemic disease**

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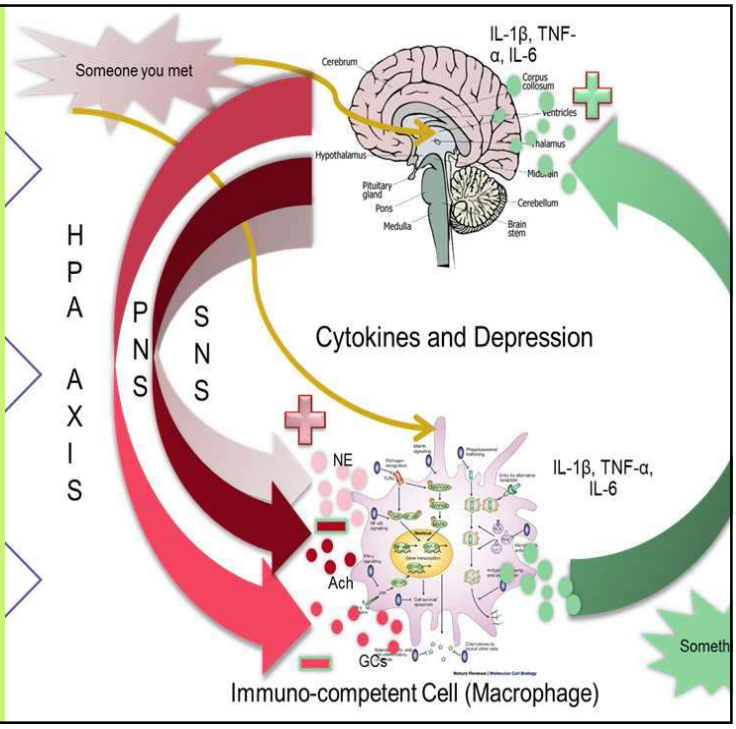
- Bad Diet
  - Simple carbs
  - Transfatty acids
  - Saturated fats
  - Food allergies
  - Bad oils
  - High dairy
  - High gluten
- No exercise
- Chronic illnesses
- Autoimmune disorders
- Chronic pain
- Chronic stress
- Being overweight
  - Apple shape
- Leaky gut



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➢PICs cause a depression-like Sickness Behavior

- Stress can increase PICs levels
- High PICs can lower the concentration of serotonin and DA
  - –Cognitive dysfunction, anxiety, fearfulness, depression, thoughts about suicide
- "Sickness behavior"---fatigue, social withdrawal, and immobility--depression (Hickie and Lloyd 1995).

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Rewiring the Brain

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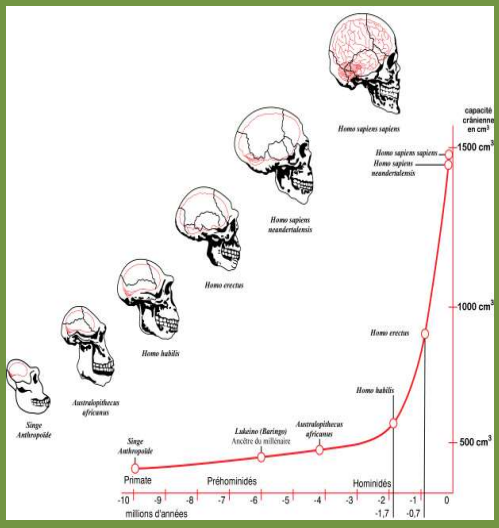
Introducing the Brain's Brain

- **Human evolution is the story of growth & increased complexity of the cortex**

- **PFC- 20% of the human brain is comprised of the frontal lobes**
  (FYI - 3.5% of the cat's brain is in the frontal lobe)



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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;

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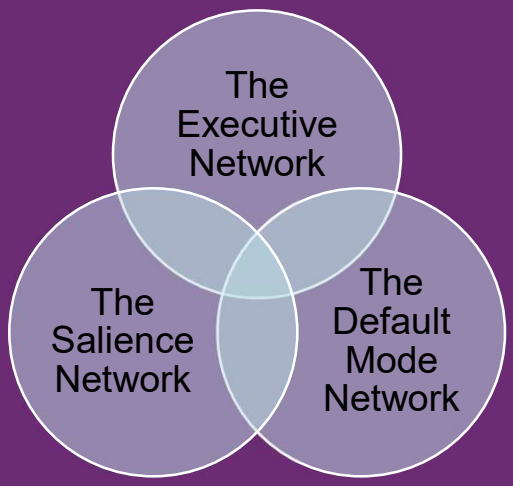
Balancing the Mental Networks



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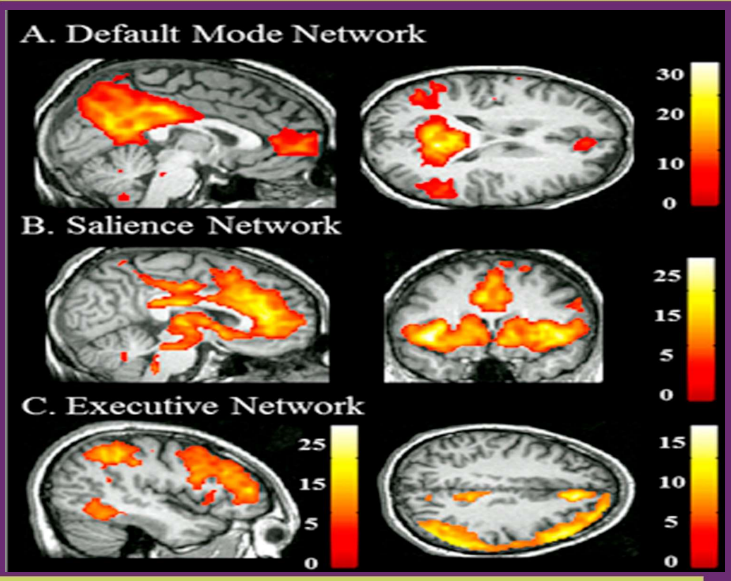
The Mental Networks



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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

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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

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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

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The Pre-frontal Cortex

- The "Executive" brain –CEO-- control center
- Motor pre-frontal lobes are last to myelinate – e.g., teenagers
  - Identity
  - Insight
  - Sense of Self
  - OFC part of the "limbic system"

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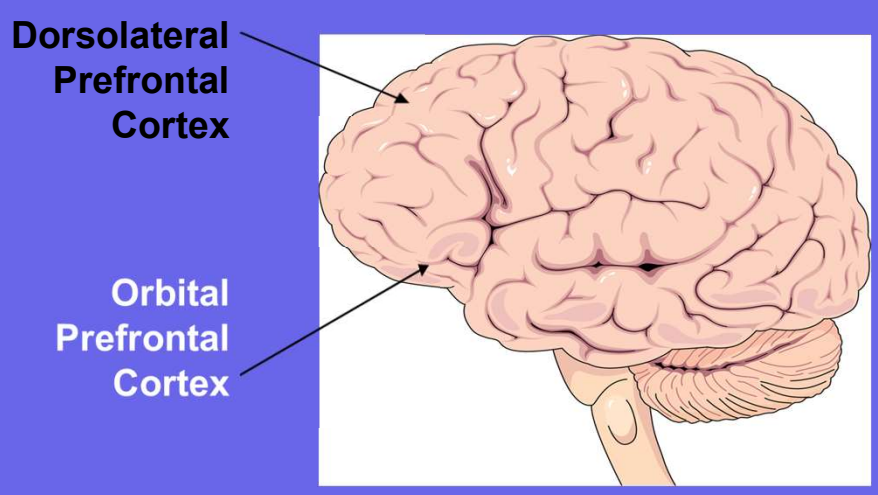
DLPFC and the OFC



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Pre-Frontal Cortex

- Dorsolateral pre-frontal cortex (DLPFC)---working memory: 7, plus or minus 2, …….or 20-30 seconds of information
- Orbital frontal cortex (OFC)
  - Social brain
  - Affect regulator
  - Empathy
  - Attachment, warmth, and love
  - Connections with limbic area, i.e., amygdala
  - Phineas Gage

67

Phineas was no longer Phineas

68

Functional Differences

- RH novelty
  - RH more global—long myelinated axons linking distant regions
  - RH early stages in learning
  - RH more likely to arrive at novel solutions
- LH routinization
  - LH activates once learned
  - LH more likely to arrive at know solutions

69

Affect Asymmetry

Set points

Left Hemisphere

Positive emotions
Approach behaviors
Feeling engaged

Right Hemisphere

Negative emotions
Withdrawal and Avoidance
Feeling overwhelmed

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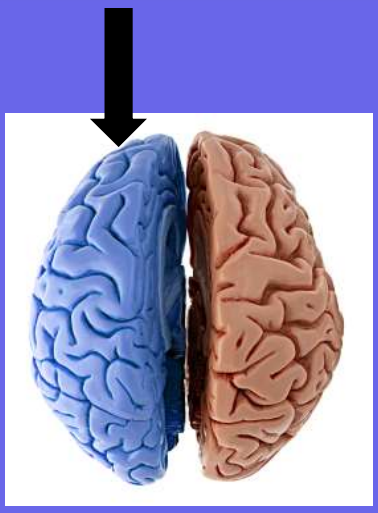
Left PFC:

Suppressing Sadness

Activating Positive Emotions

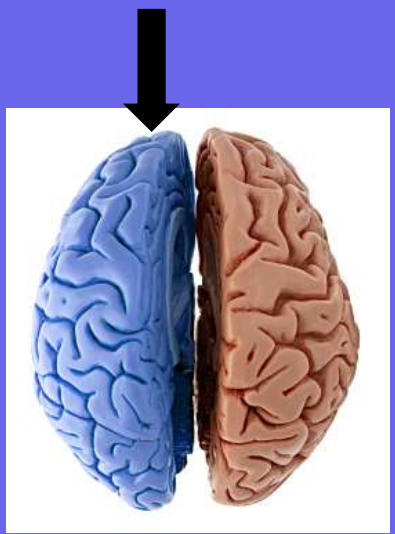


71

Left PFC:

Activation & Approach Behaviors

(curiosity; assertion)

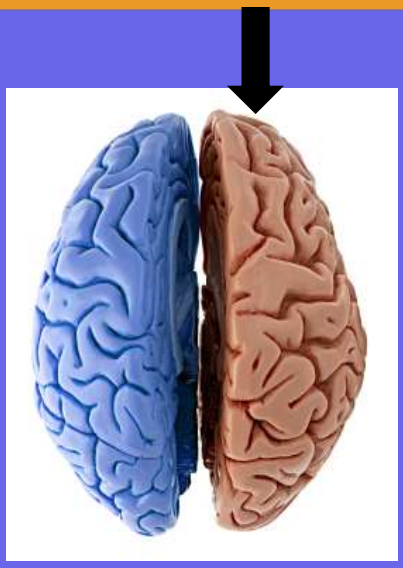


72

Right PFC:

Activating Behavioral Inhibition

Associated With negative Emotions



73

Neuroplasticity

- *Neuroplasticity* is a general term that describes changes in the brain as you experience and learn (Buonomano & Merzenich, 1998)
- Neuroplasticity involves many changes to the brain including:
  - New synaptic connections
  - Strengthening of connections through LTP
  - The growth of new dendrites (dendritogenesis)
  - Neurogenesis (the growth of new neurons)

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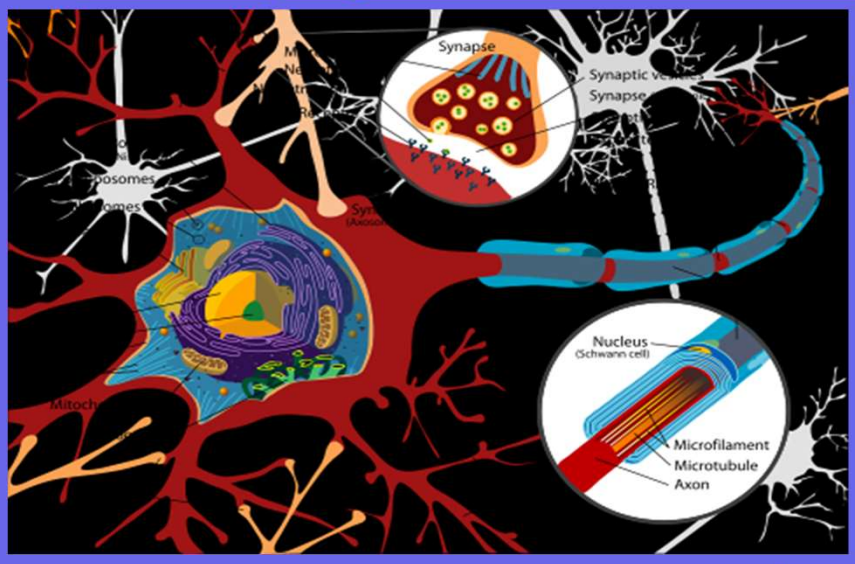
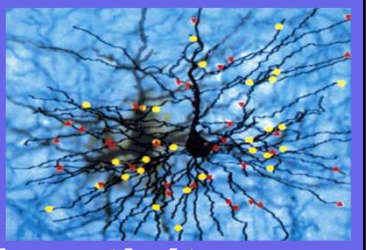
100 Billion Neurons with 10,000 Synaptic Connections



75

Neuroplasticity

- Increases in:
  - synaptic efficacy
  - receptor density



  - Up-regulating their activity
  - Glial cell availability
  - Changes in the shape and structure of synapses

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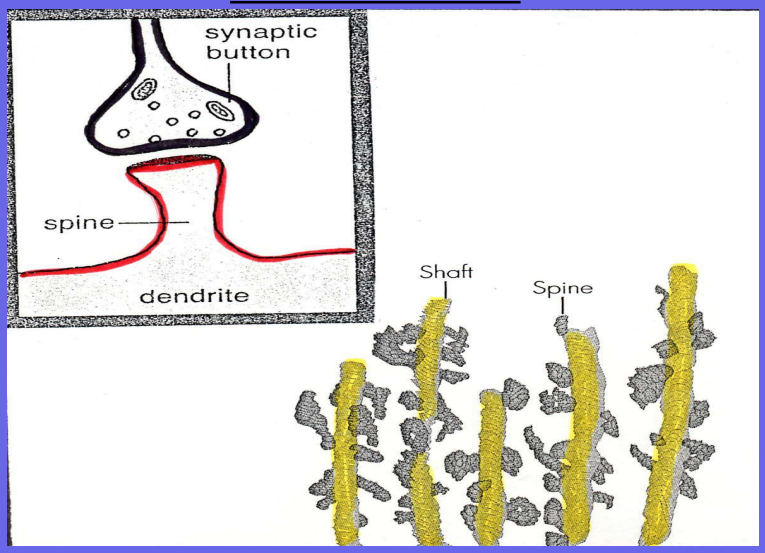
DENDRITE SPINES & SYNAPSES



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Examples of Neuroplasticity

- London cabdrivers - larger right posterior hippocampus. The longer they were on the job, the larger the size of their hippocampus. (Maguire, et al, 2000)
- Adults who juggled three balls for 3 months increased grey matter in the midtemporal area and left posterior intraparietal sulcus. - 3 months of little or no juggling, -- grey matter decreased and approached baseline values. (Draginski, et al, 2003)

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Examples of Neuroplasticity

- Musicians using specific fingers to play their instruments showed enlarged areas of their somatosensory strips associated with those fingers. (Pantev, et al, 2001)
- Blind Braille readers showed enlarged cortical areas associated with their reading finger compared to blind non-Braille readers and to sighted people. (Pascul-Leone & Torres, 1993)

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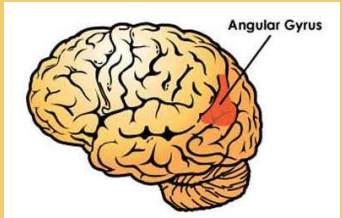
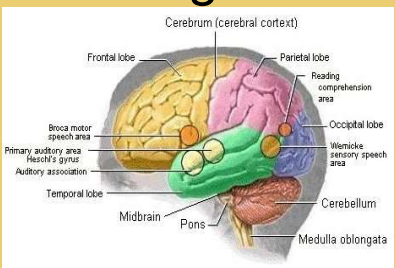
Neuroplasticity Examples

- Bilingual people have a larger angular gyrus (Green, et. al. 2007)
- Professional musicians have a Heschl's gyrus -2xs larger than non-musicians





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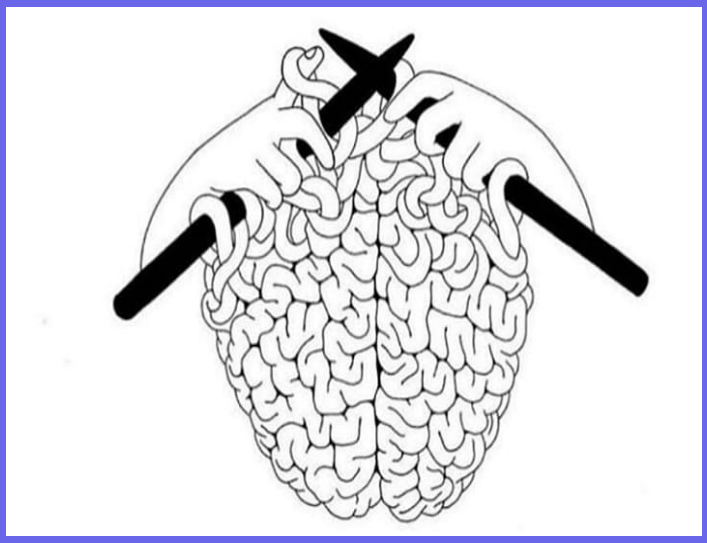
Mind/Brain Causality



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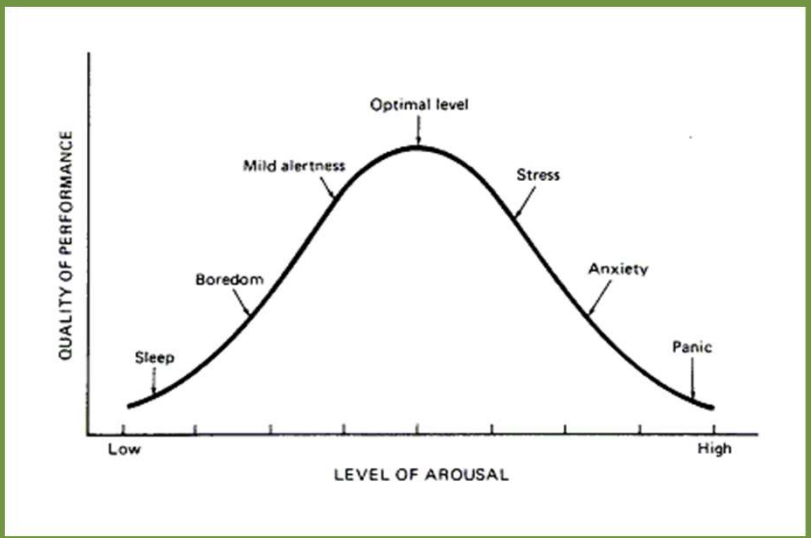
Yerkes Dodson arousal curve



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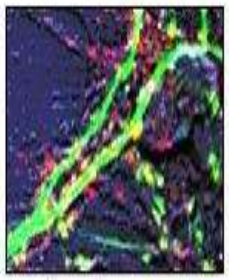
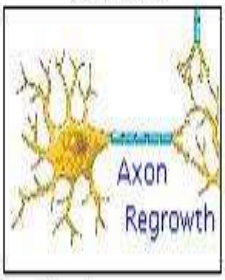
Examples of Neuroplasticity

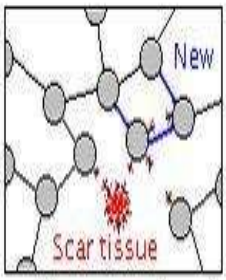
Figure (iii)



a – Actual new synapse



b – Simple new synapse



c – New connections in Neural Network

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Increasing Neuroplasticity

- Tasks are of sufficient difficulty
  - Increased difficulty as you master each level
- Sufficient intensity
  - A few learning sessions each day
  - At least 3 learning sessions each week
  - Done for several weeks
- Like body building
  - Lift more than you can easily
  - 3 reps of 10
  - 3 xs per week
  - Several weeks

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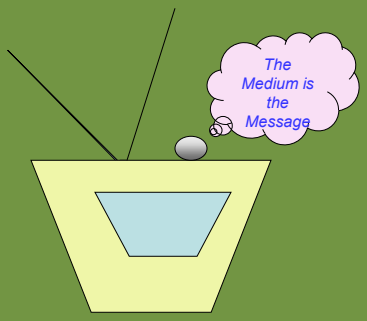
Brain Environments

Enriched Environment

Impoverished Environment



"Your Brain on TV"

85

Rewiring the Brain Requires

- Induce repeated states
  - (i.e. positive moods)
- Repeat often enough so they become traits

86

A Mnemonic "Recipe" for Rewiring the Brain

Focus: Turn on you PFC

Effort: Establish a habit

Effortlessness: It will eventually become easier but not permanent

Determination: Stay in practice to keep it going

87

Brain Derived Neurotropic Factor

- BDNF plays a crucial role in reinforcing neuroplasticity and neurogenesis.
- BDNF is like Miracle Grow to help:
  - Consolidate the connections between neurons.
  - Turn on the nucleus basalis to focus attention, deciding what's important for neuroplasticity
  - Promotes the growth of myelin to make your neurons fire more efficiently
  - Acts on stem cells in the hippocampus to grow into new neurons

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Factors that Decrease Neurogenesis

Aging

Chronically high cortisol

Chronic stress

Recurrent depression

Marijuana

Obesity

89

Factors that Increase Neurogenesis

- **Exercise**
- **Fasting**
- **Fewer calories consumed**
- **Type of food content (Omega—3)**
- **Profound new experiences**

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Brain intro Summary

- **The Brain's Brain**
- **The Default Mode Network**
- **Brains can be rewired**
- **New neurons can be generated**
- **The two hemispheres and emotion**

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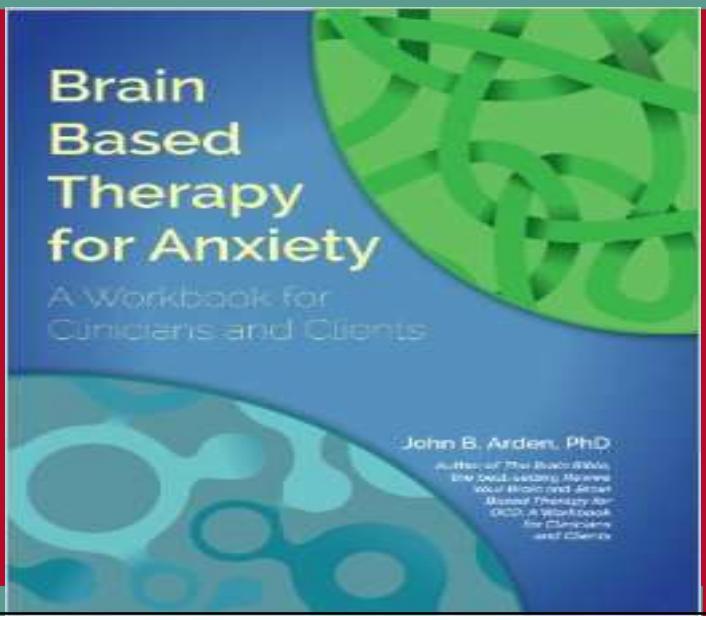
Anxiety



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Medical and Drug Related Factors that Mimic Anxiety

- Neurological: complex partial seizures, head injuries
- Pulmonary: Asthma, hyperventilation, COPD, lung cancer
- Various meds, drugs, and alcohol in withdrawal
- Endocrinological: Hyperthyroidism etc.
- Cardio: MVP, high blood pressure,
- Toxins such s hydrocarbons, mercury, and carbon dioxide
- Deficiencies in magnesium, Vitamin B-12, potassium, and calcium

93

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).

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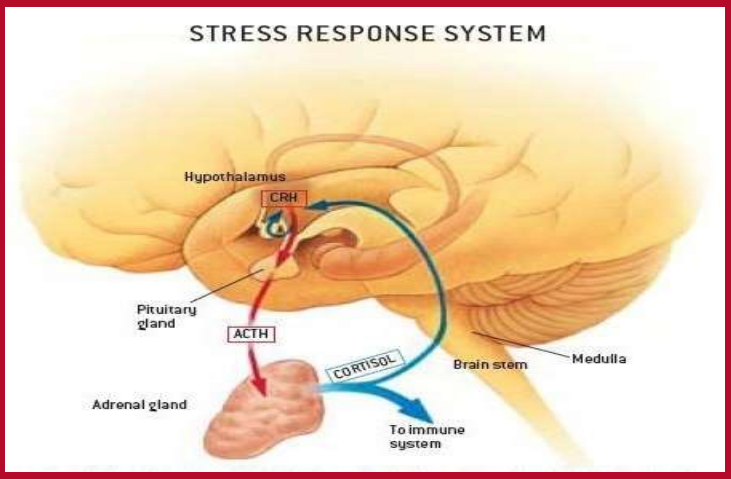
Sympathetic ANS and Neuroendocrine Systems



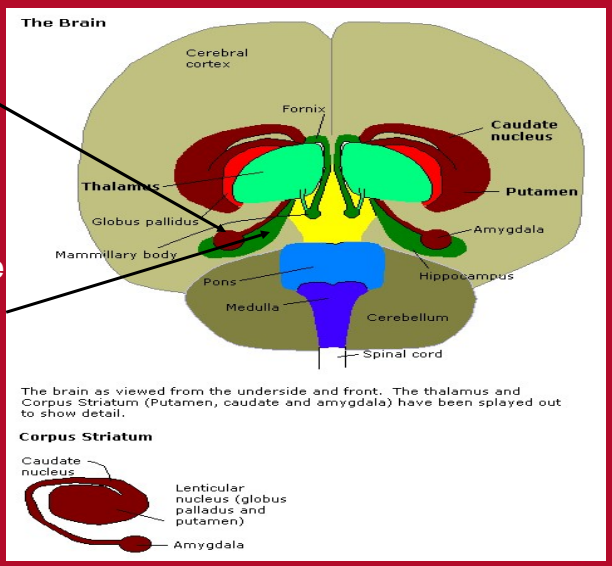
Locus Coeruleus (LC) source of NE which has extensive projections throughout the brain and can trigger the HPA axis (Aston-Jones, et al., 1994).

95

The Seahorse and the Almond

Amygdala *turns up* the HPA axis and sympathetic NS

Hippocampus *turns down* the HPA but may get saturated with too much cortisol and the thermostat can break



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Cytokines

- Proteins released by immune cells that act on target cells to regulate immunity
  - Proinflammatory (IL-1, IL-6, TNFά) *coordinates* inflammatory responses
  - Anti-inflammatory (IL-10) *controls* proinflammatory responses.

97

Hypocortisol vs. Hypercortisol Activity

- Chronic stress (especially uncontrollable) alters the cortisol system
- Early on there can be *higher* cortisol
  - Can lead to agitated depression
  - Kills white blood cells
  - Metabolic syndrome
- More distant traumas may result in an inadequate cortisol response
  - Autoimmune disease
  - Inflammation
  - depression

98

Dysregulation of the HPA axis

- Adrenaline and NE increases PICs
- PICs increase HPA axis
- Excessive CRH and low ATCH results in:
  - Low cortisol= high PICs
  - High PICs increase depression
    - Suicide victims—higher IL-6, TNFά and lower IL-2

99

Physiology of GAD

- Less parasympathetic more sympathetic-- reduced vagal tone
- Bed nucleus of the stria terminalis (BNST)
  - Free-floating anxiety
- Amygdala—an intolerance for ambiguity
  - Anxious individuals select more threatening interpretations of ambiguous stimuli (e.g., Mathews & Mackintosh, 2000)

100

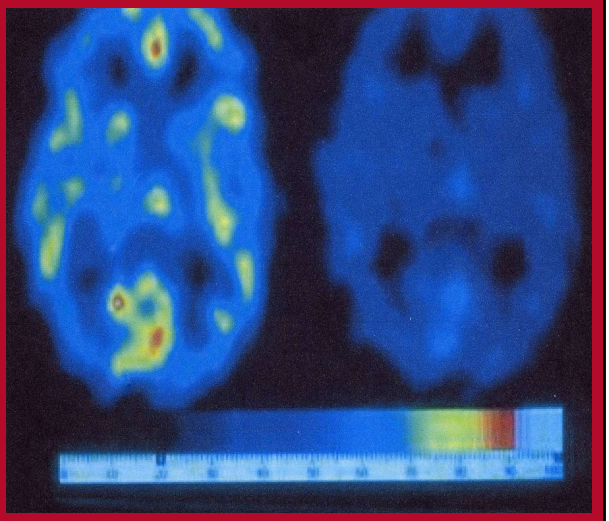
Hyperventilation 1 ½ minutes
Vaso-constriction: too little CO2

↑ Oxygen

↓↓ CO2

respiratory alkalosis

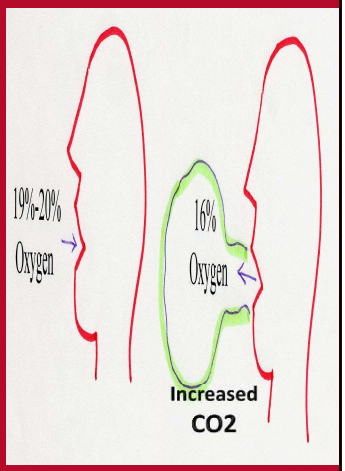
causes vasoconstriction in the brain



101

Breathing and Over-Breathing

- Most people breathe 9 to 16 breaths per minute. Panic attacks - 27 breaths
- Over-breathing pulls in too much oxygen forces down the carbon dioxide level in the blood stream.
- Carbon dioxide helps maintain the critical acid base (pH) level in blood. Lower pH level causes nerve cells become more excitable and people associate the feelings with a panic attack.

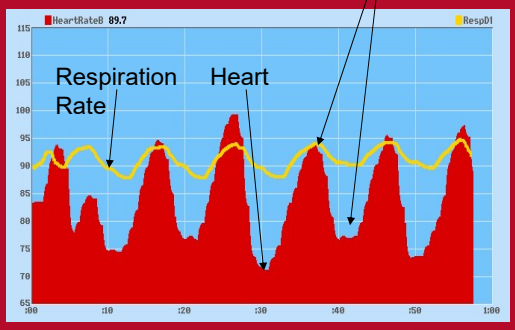


102

Variability is healthy

Notice how heart rate increases with inhale. Heart rate decreases with exhale. This pattern shows high vagal tone (high PSNS activity) and a high amount of heart rate variability.

Peak/valley differences = vagal tone ***when respiration is in normal range***



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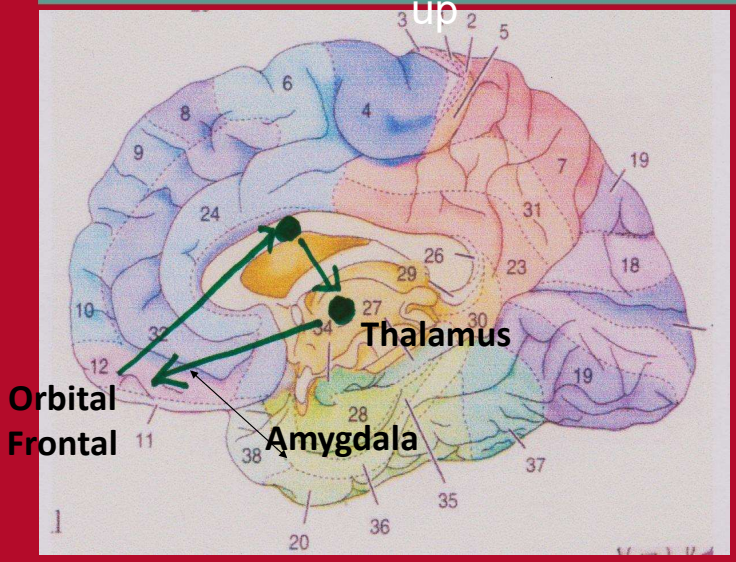
Activating the PNS

- **Diaphragmatic Breathing**
- **Stretching**
- **Yoga**
- **Meditation**
- **Cuddling**
- **Orgasm**
- **Pulling the Kegel**

104

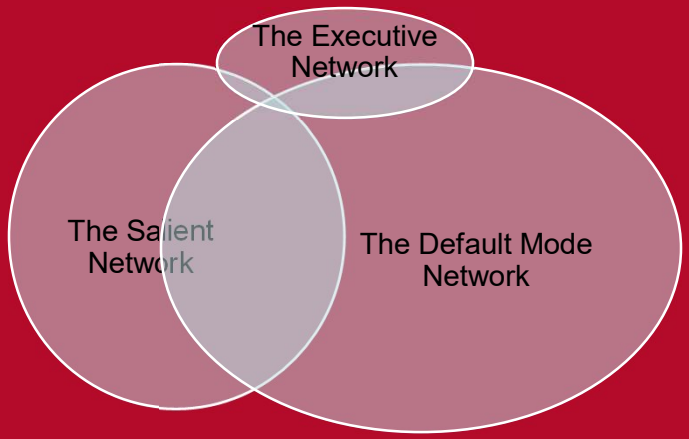
Worry Loop attempts dampen autonomic arousal only to crank it back up



105

Worry as Cognitive Avoidance

- **Excessive DMN ruminations with little Executive Network**



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CBT vs. Metacognitive Models

(ACT, DBT, MBCBT, etc.)

CBT	MC Models
Rationale=control	Rationale=relinquish control
Cognitive restructuring	Thought Diffusion
Breathing retraining	Observe & accept
Interoceptive exposure to lessen fear & avoidance	Interoceptive exposure with acceptance of internal cues
Situational exposure to lessen fear fear and avoidance	Situational exposure to achieve life values and goals

107

Avoidance: the Polarizer

- **Over-Sensitizing the Amygdala**
  - **Forms of Avoidance**
    - **»Escape behaviors**
    - **»Avoidant behaviors**
    - **»Procrastinating**
    - **»Safety behaviors**

108

Why avoidance is hard to resist

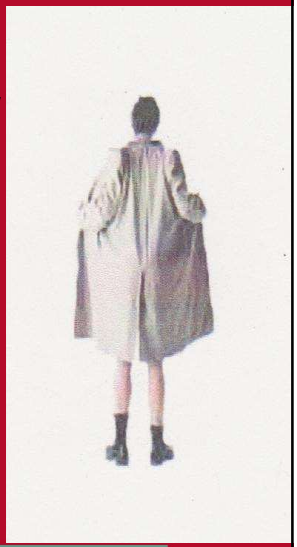
- It works to reduce fear over the short term
- The more you avoid the harder it is to resist repeating --they become habits
- There is a superficial logic to avoidance, --- "Why wouldn't I avoid something that makes me anxious?"
- You get some secondary gain from it like extra care because people around you feel sympathy

109

Deceptively Simple but so Complex Exposure Techniques

Beta- endorphin is co-released along with ACTH but is momentarily blocked by ACTH at the common receptor sites.

The therapeutic effects from exposure in part result from beta-endorphin anxiolytic effects 20 minutes after the exposure



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Critical Aspects of Exposure

1. To maximize violation of expectancies
2. To multiple feared conditioned stimuli individually and in concert
3. Occasionally reinforcing a CS with an UCS
4. Removal of safety signals or safety behaviors
5. Stimulus variability
6. Retrieval skills in other contexts that are transferable for real life situations
7. Multiple contexts

111

Slow Track—Allostasis

- ***Automatic thoughts*—fast track impulse—interrupt with curiosity and time**
- ***Assumptions*—from pessimism to incremental optimism**
  - **"I'm working on it and can tolerate distress"**
- ***Core beliefs*—existential self descriptor**
  - **"I'm a survivor."**

- **Global/Passive (R-PFC) vs. Detail/Action (L-PFC)**

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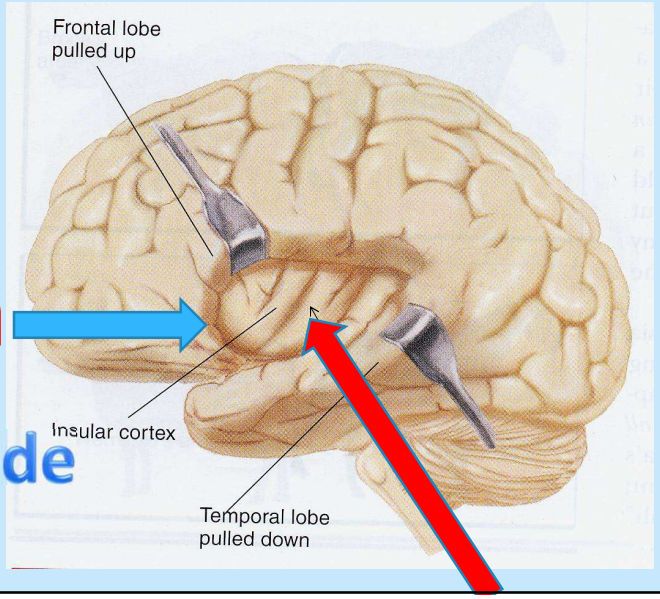
Client Education

- Sensations from your own body should not be the cause for alarm.
- Don't let your body be the boy who cried wolf.

113

Interoceptive Feedback



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Client Education

- Do you have shortness of breath, rapid heartbeat, sweating, headaches, or nausea?
- Each one of these are normal body sensations. It's when you overreact to them you may tumble into a panic attack.
- Befriend your own body sensations.

115

Interoceptive Exposure +

- **Swallowing quickly--- to cause a lump in the throat**
- **Tensing the body--- leading to chest constriction**
- **Standing up quickly from lying on the floor---to cause dizziness.**
- **Staring at one spot---to increase the feeling of being trapped**

116

BBT and Panic Disorder

- Desensitizing the Amygdala—Avoiding avoidance
- Interceptive exposure exercises—Embracing body sensations
- Speeding up the slow track—Getting the L-PFC and L-Anterior Insula cortex involved

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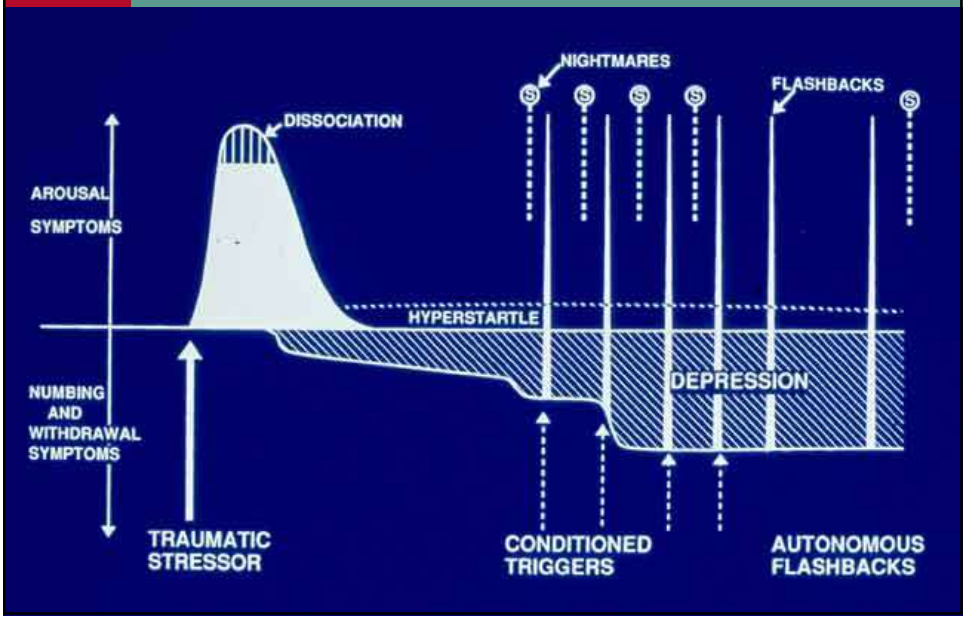
Time Sequence



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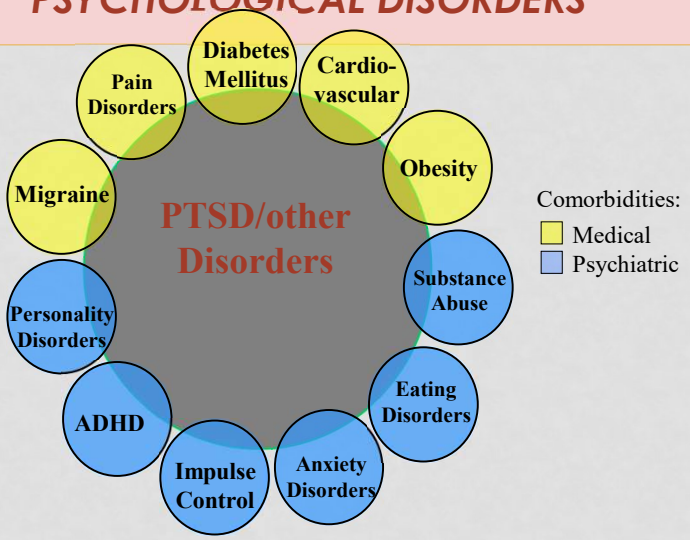
THE RULE NOT THE EXCEPTION
THE MULTIDIMENSIONALITY OF NEURO-PSYCHOLOGICAL DISORDERS



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The Five Risiliency Factors

- Social
- Exercise
- Education
- Diet
- Sleep

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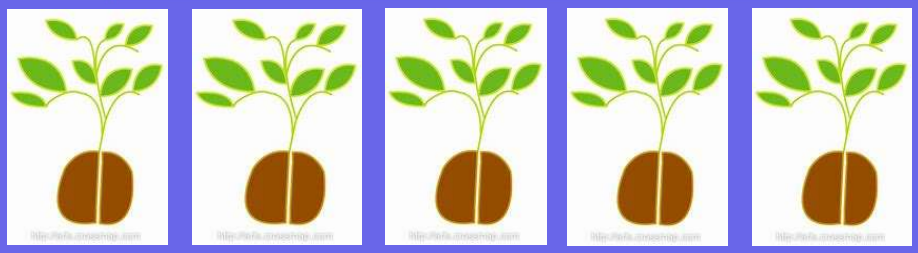
It is an evolutionary imperative to nurture our SEEDS



Socialise
Calms nervous system
↑ Oxytocin (feel comforted)
↓ Cortisol (less stressed)
↑ Sense of connection
↑ Problem solving
↑ Attention
↑ Humour and fun
↑ Boost in immunity
↑ cognitive flexibility

Exercise
Calms nervous system
↑ Serotonin & Dopamine
↑ GABA (calm)
↑ Energy levels
↑ Growth new brain cells
↑ Sleep
↑ Alertness and thinking
↑ Attention
↑ Chance to socialise
↑ Cardiovascular strength
↑ Physical strength
↑ Flexibility & endurance

Education
↑ Brain power
↑ Serotonin & Dopamine
↑ Growth of new brain cells
↑ Thinking ability
↑ Working memory
↑ Challenge to learn
↑ Novelty – try new things
↑ Social connection
↑ Interest in life
↑ Ability to focus
↑ Sense of achievement

Diet
Calms nervous system
↑Brain chemistry
↑ Brain clarity
↑ Mood
↑ Sleep
↑ Energy
↑ Alertness
↑ Concentration
↑ Ability to focus

Sleep
↑ Hippocampus activity
↑ Memory
↑ Brain cell growth
↑ Serotonin
↑ Immune system
↑ Mood
↑ Energy
↑ Alertness
↑ Concentration

All have a positive effect on Telomers

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SEEDS
Social Medicine

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Regulatory Networks of the Social Brain

- Bonding/Attachment
- Affiliation
- Fear Regulation
- Affect Regulation
- Safety

123

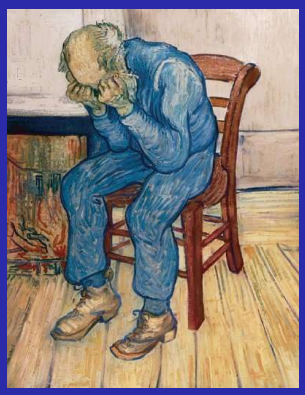
The Effects of Social Medicine

- ↓ 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)

124

Loneliness

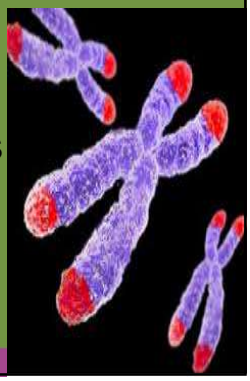
- **In Portugal 1000 people 65> assessed:**
  - **Loneliness was the single most important predictor of depression** (Paul, et al, 2006)
- **In London 2600 people 65>**
  - **More than 15% were at risk for social isolation and depression** (Illife et al., 2007)



125

Cell Aging: Telomeres Length

- "Psychobiomarker": Linked to social status, perceived stress, depression, predictive of mortality (Epel, 2009, Current Directions)
- •Telomeres: non-coding sequences capping ends, serving as a
- "senescence clock" (Blackburn, 1978)
- •Telomerase: enzyme that prevents telomere shortening, promotes cell resilience.



- Psychobiomarker": Linked to social status, perceived stress,
- depression, predictive of mortality (Epel, 2009, Current Directions)

126

Hungry Systems of the Social Brain

- Brain Structures
  - Orbital Frontal Cortex (OFC)
  - Amygdala
  - Insula
  - Cingulate
  - Mirror Neurons
  - Spindle Cells
  - Facial expression modules

127

Systems of the Social Brain

- Neurotransmitter systems include:
  - Oxytocin
  - Dopamine
- Central Parasympathetic Nerve
  - "Smart" Vagus Nerve

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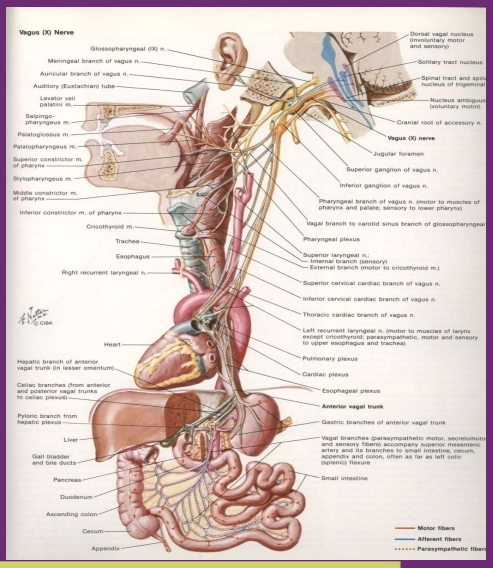
The Vagus Nerve System

- 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.



129

Mirror Neurons

- **Helps us respond sympathetically and empathically to others**
- **Gives us the ability to anticipate others' intentions**
- **Mirror systems are found in:**
  - **Motor**
  - **Affect**
  - **Cognition Theory of Mind (ToM)**
  - **Social contagion (e.g., yawning)**

130

Facial Expressions

Left Hemisphere	Right Hemisphere
• Controls expression on the right side of face	• Controls expression on the left side of face
• Is NOT adept at reading facial emotion expression (e.g. alexithymics)	• Is adept at reading facial emotion expression

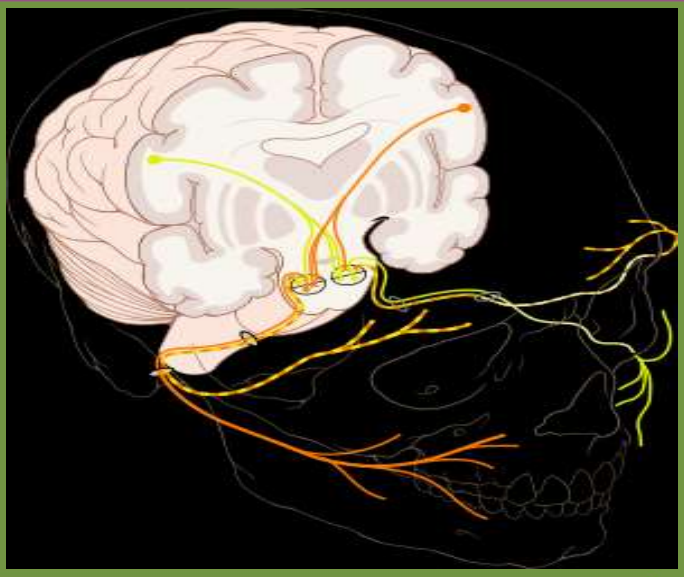
131

Facial Expressions

- We view objects and faces with different systems
- Facial-reading systems --amygdala, fusiform gyrus, and supertemporal gyrus (Gauthier, et al, 2000)
- Reading of faces when faces are right-side up, but not when faces are upside-down (Kilts, et al, 2003)
- When we view faces upside-down, we view them as objects, unable to read their emotional content
- ASD patients read faces as if they were viewing objects

132

Facial Muscles and Nerves



133

Facial Expressions

- People can model and influence the person's facial expressions and mood via the mirror neuron system
- Feedback system:
  - Contracting muscles on the right side activates LH and positive emotions
  - Contracting muscles on the left side activates RH and negative bias--e.g., a "smirk" (Schiff, et al, 1992)

134

D Smiles

- Guillaume Duchenne (1806-1875) identified the activity of the orbicularis oculi muscle
- Non-D smiles possibly masking negative states and more likely to be asymmetrical
- D smiles -- L-PFC activation
- Non-D smiles -- R-PFC activation (Ekman, et al, 1996)

135

Laughter is Good Medicine

- Improves cognitive function (Fry, 1992)
- Exercises and relaxes the muscles (Kuhn, 1994)
- Increases heart rate and blood pressure (Pearce, 2004)
- Decreases cortisol levels (Berk, et al, 1988)
- Increases natural killer cell activity (Takahashi, et al, 2001)
- Altering gene expression (Hayashi, et al, 2006)
- Stimulates the dopamine reward system (Mobbs, et al, 2003)
- Increased longevity (Yoder & Haude, 1995)

136

Psychological Boost of Humor

- ↓ **Anxiety** (Yovetich, et al, 1990)
- ↓ **Stress** (Wooten, 1996)
- ↓ **Depression** (Deaner & McConatha, 1993)
- ↑ **Self esteem** (Martin, etal, 1993)
- ↑ **Energy and hope** (Bellert, 1989)
- ↑ **A sense of empowerment** (Wooten, 1996)

137

Social Summary

- Social brain networks need activation
- Health related costs without activation
- Neurochemistry of social connection
- Non conscious facial expressions
- The emotional and cognitive costs of loneliness
- Social medicine for stress reduction

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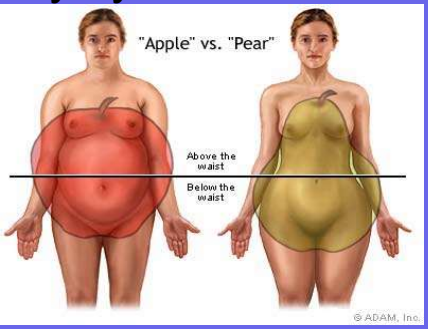
Belly fat

Belly fat generates inflammation by releasing pro-inflammatory cytokines

- Lowers BDNF
- ↑ risk of dementia
- If you're going
  to gain weight
  go for the pear not the apple shape



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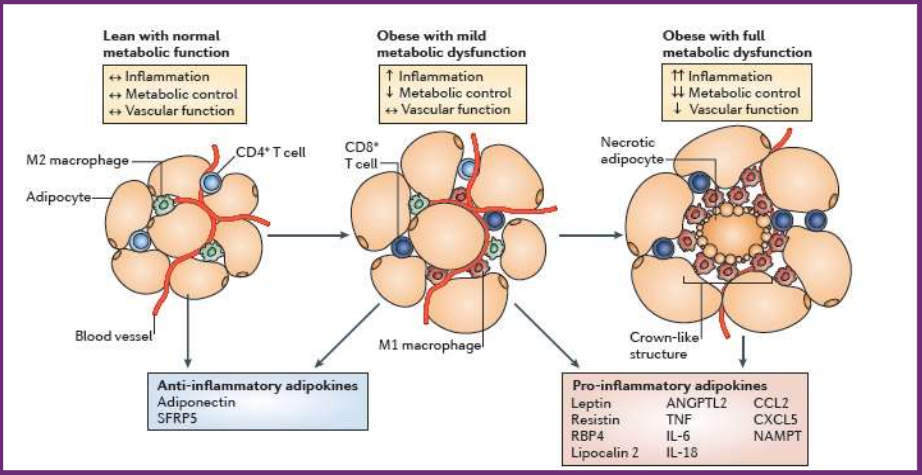
Obesity-Associated Adipose Tissue Inflammation



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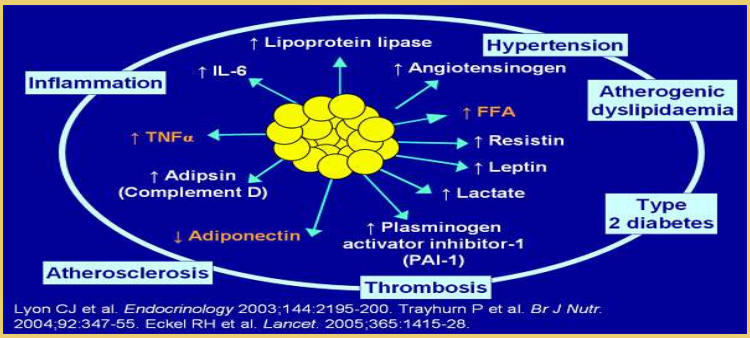
Obesity, Inflammation, and Diabetes

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

Higher IL-6 may predict diabetes type 2

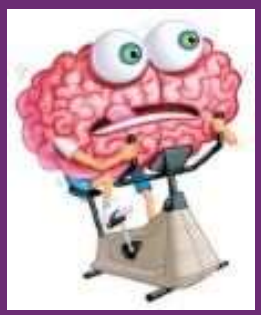


Lyon CJ et al. *Endocrinology* 2003;144:2195-200. Trayhurn P et al. *Br J Nutr.* 2004;92:347-55. Eckel RH et al. *Lancet.* 2005;365:1415-28.

141

Exercise Optimizes

- **Mood**
  - **–↑ neurotransmitters**
    - **»Serotonin**
    - **»Dopamine**
    - **»norepinephrine**
  - **–physical health**



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Exercise Optimizes

- Cognition
  - –alertness
  - –attention
  - –motivation
  - –cognitive flexibility

143

Exercise Optimizes

- Neurogenesis
  - –new neurons in the hippocampus
- Neuroplasticity
  - –↑ BDNF

144

During Exercise

- After glycogen is spent—runner/hiker will “hit the wall”
  - Then the primary fuel is fat (but it moves burns more slowly
- At this point shifting to sustained low intensity workout will burn fat

145

Exercise – Movement Medicine

- Uses up ATP
  - ↓ build up of electrons in the ETC
- ↑ mitochondria in each cell
  - More energy available
- Modify gene expression ↑ BDNF

146

Exercise: mitochondria recycling loop

- Disposes of the unhealthy so that those that survive can dominate by:
  - Reactive oxygen species (ROS) trigger mitophagy (killing off damaged mitochondria) and:
  - Mitochondrial biogenesis (the generation of new mitochondria).

147

Exercise and the Brain

Mechanism	Impact
Gene Expression	Neuroplasticity (Cottman & Blanchard, 2002)
Brain Derived Neurotrophic Factor (BDNF)	Neurogenesis & Neuroplasticity (Adlard, et al, 2005)
Insulin-like Growth Factor (IGF-1)	Energy Utilization (Carro, et al 200)
Nerve Growth Factor	Enhanced Neuroplasticity (Neeper, et al, 1996)
Vascular Endothelial Growth factor (VEGF)	Capillary Health (Fabel, et al, 2003)

148

Exercise Improves Sleep

Exercise improves sleep quality and normalizes circadian rhythms.

- increases slow wave sleep and total rest time
- decreases the amount of time to fall asleep
- decreases the amount of time spent in non-restorative sleep.

Lack of restorative sleep increases PICs and is associated with chronic disease

A single night of sleep deprivation results in higher levels of PICs

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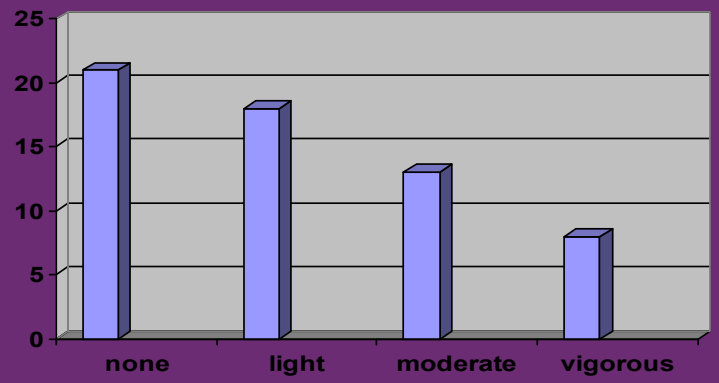
Effect on C-Reactive Protein

- **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)**



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Exercise and Depression

- Alameda County study of 8,023 tracked for 26 years
  - Those that didn't exercise were 1.5 times more likely to be depressed
- Finnish study of 3.403
  - those that exercised 2 to 3 times per week were less depressed, angry, stressed and cynical
- Dutch study of 19,288 twins and their families –
  - those that exercised were less anxious, depressed, neurotic and more socially outgoing
- Columbia University study of 8,098
  - same inverse relationship between exercise and depression

151

Exercise Summary

- Evolutionary imperative
- The dangers of belly fat
- Exercise boosts mood
- Exercise boost cognition
- Miracle grow—neurogenesis

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Working Memory Load

- As tasks become more demanding so does WM load and the potential for the stimulus driven attention system to take over.
  - ↑ WM load can occur with two or more streams of info
- 2,600 deaths and 330,000 injuries each year in the US re: cell phones and driving

153

Two LT Memory Systems

Implicit	Explicit
Non-declarative	Declarative
• Procedural • Emotional • Generalized • Classical conditioning	• Episodic • Autobiographical • Semantic • Context Specific
Amygdala and BG-driven	Hippocampus-driven

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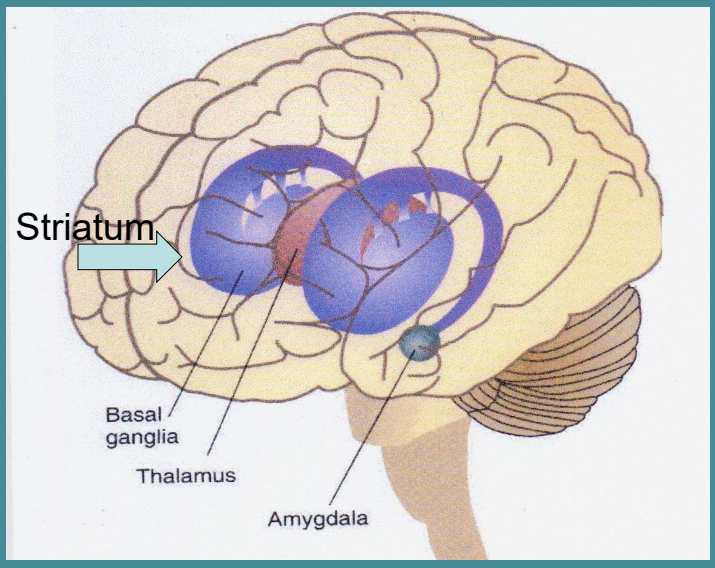
The Habit Circuits



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AMYGDALA *Implicit Memory System*	HIPPOCAMPUS *Explicit Memory System*
• Fear Conditioning • Emotional Valance • Generalized • Cortisol Heightened Sensitivity (Hypervigilence) • Matures Early • "Little Albert" • "LSMFT"	• Many Cortisol Receptors • Context Specific • Heightened Cortisol leads to atrophy • Matures Later • Infantile Amnesia • "H.M."

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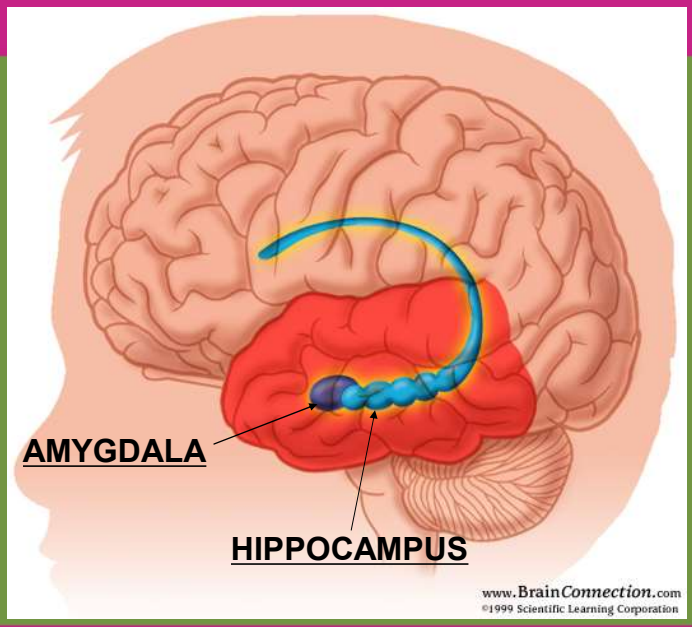

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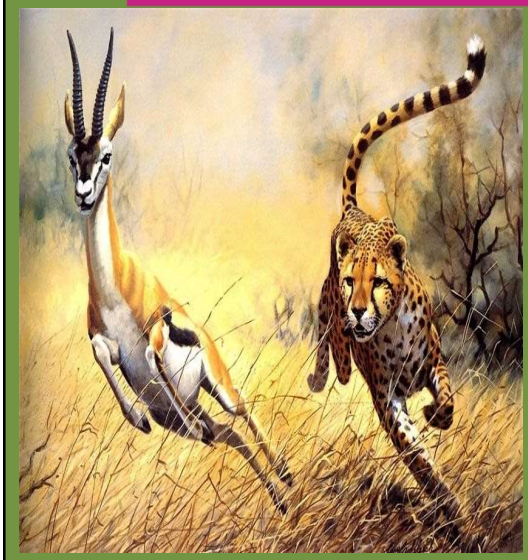
The Fast Circuit to the Amygdala



- Goes from the Thalamus directly to the Amygdala
- Fight or Flight: HPA activation
- Emotional Learning
- Fear Conditioning
- PTSD, panic, etc.
- Flashbacks
- "Bottom up"

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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"

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Negative Memories

- Fear and negative emotion narrows attention to threat:
  - **–"weapons focus"**
- Thus, less accuracy for peripheral memory of stimuli (i.e. color of the car or person's hair) more to the object of threat (gun, knife, etc.)

160

Recovered Memory Therapy? Be Careful!

- **183 claims of repressed memories of early childhood abuse:**
- **100% report torture/mutilation (no evidence)**
- **100% in therapy 3-5 years after first "memory"**
- **83% employed before therapy—37% after therapy**
- **23% lost parental custody**
- **100% estranged from families**
- **10% SI before therapy—67% after therapy!**

161

Are traumatic memories accurate?

- Generally accepted theory:
  - Central facts remembered more accurately
  - Peripheral details *inaccurate* and often fabricated in later stories
  - Not possible to distinguish repressed memory from fake memory without some form of corroborating evidence

162

Maximizing Memory

- Attention
- Emotional engagement
- Novelty
- Associations

163

Types of Mnemonics

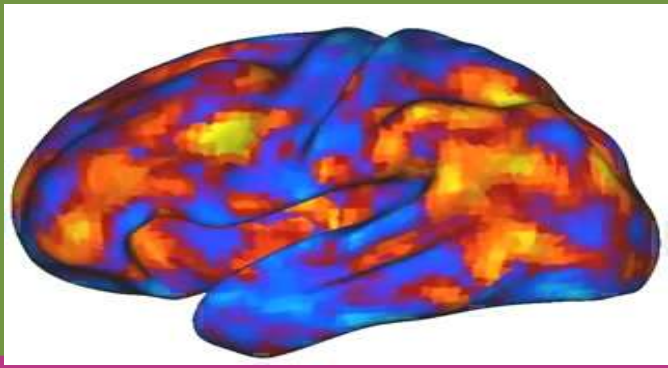
(memory improvement techniques)

- Chunking
- Rhyming
- Visualization
- Keyword
- Link
- Loci
- Pegword
- First letter technique

164

Memory and Brain Complexity

- Memory is not an exact copy—Not in one neuron or byte on a hard drive.
  - Distributed network located in multiple locations



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Memory Summary

- **Attention is critical for memory**
- **The "Inverted U**
- **Implicit and Explicit memory**
- **Fast and slow track to the amygdala**
- **Associations**
- **Emotionally involved**
- **Make it meaningful**

166

Break a Fast

Skipping Breakfast contributes to:

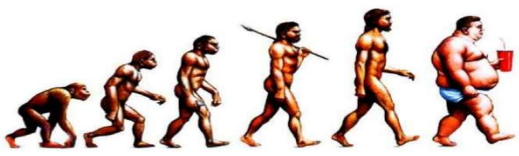
↓ problem solving
↓ working memory
↓ attention
↓ concentration
↓ energy

↑ Mood swings
↑ depression
↑ stress reactivity
↑ anxiety

167

Perils of the Western Diet

- Fructose blunts the effects of leptin which normally tells us we are "full"
  - Fructose produces uric acid
  - Increased cardiovascular disease
- Increasing risk of metabolic syndrome
- **Shrinks the left hippocampus**
- Increased blood pressure
- LDL cholesterol
- Increased stroke
- Type 2 Diabetes



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Comfort Food?

- Food rich in carbs favor the transport of tryptophan over other amino acids
  - Briefly boosts serotonin
  - Brief ↓anxiety and depression
- Then ↑ anxiety and depression

In low light environments and winter ↑ carbs

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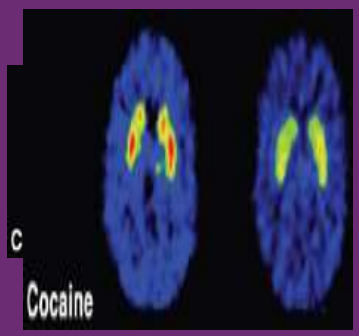
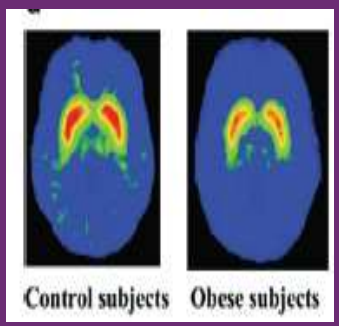
Dopamine D2 Receptors in Drug Users And Comfort Food Addiction

- Drug Addiction
- Obese

- DA D2 (Dopamine Receptors)
- In the brains of controls, drug abusers, and obese subjects





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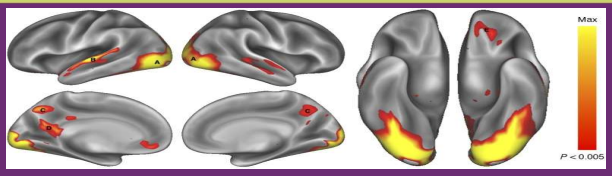
Priming Appetite and Obesity



Children can view 13 food ads per hour

The higher the BMI the greater the responsiveness to food commercials

Activity in the left OFC, Nacc, and right Insula

171

Priming Appetite for Bad Food

- Grey matter volume in two brain regions predicts selection of healthful food or tasty but unwholesome cuisine
- While the volume of grey matter in the DLPFC and the vmPFC predicts the choice of healthful food:
  - **Those people with less grey matter in these areas chose unhealthy foods**

172

Break a Fast

Skipping Breakfast contributes to:

↓ problem solving
↓ working memory
↓ attention
↓ concentration

↑ Mood swings
↑ depression
↓ energy

↑ stress reactivity
↑ anxiety

173

Hydration

- **Dehydration contributes to:**
  - **Brain cells shrivel up**
  - **Enlarging ventricles**
  - **Brains work harder with poor results**
  - **Impaired cognition**
    - » **Attention**
    - » **Forgetfulness**
    - » **Speech problems**

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Blood Sugar

- **When blood sugar drops below 50 milligrams per milliliter symptoms include:**
  - **Free-floating anxiety**
  - **Shakiness**
  - **Lightheadedness**
  - **Irritability**
  - **Rapid heartbeat**
  - **Difficulty concentrating**
  - **Memory problems**

175

Glycation (excess glucose)

- Blocks protein from moving freely
- The body's membranes become "gunked up"--slowing down neural communication
- Interferes with synaptic transmission
- Causes structural damage to the mitrochondria (the cells' energy factories)
- Lead to free radicals
- Causes inflammation.

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Glycemic load (GL) – a measure of rise in blood sugar

- The higher the GL of a food:
  - –the greater the adverse insulin effects
  - –Long-term consumption of foods with a high GL leads to a greater risk of:
    - Obesity
    - Diabetes
    - Inflammation.

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Amino Acids

Amino Acid	Neurotransmitter	Effects
L-Trytophan	Serotonin	Improves sleep and calmness and mood
L-Glutamine	GABA	Decreases tension and irritability
L-Phenylalanine	Dopamine	Reduces anger and increases feelings of pleasure
L-Phenylalanine	Noreprinephrine	Increases energy, feelings of pleasure, and memory

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The OFC and Serotonin

- Large numbers of 5-HT receptors in the OFC
- ↓ 5-HT in OFC ↓ inhibition of the amygdala
- Tryptophan depletion impairs reverse learning tasks (Robbins & Everitt, 1995)
- Reverse-learning tasks include :
  - Ability to evaluate, integrate, and act on environmental cues
  - To stop responding to something when it becomes unhealthy and shift back to something healthier

179

Deficiencies of B Vitamins

Low B-1	Low B-2	Low B-6	Low B-12	Folic Acid
*Decreased Alertness *fatigue *Emotional Instability *Decreased reaction time	*Trembling *Sluggish *Tension *Depression *Eye problems *Stress	*Nervousness *Irritable *Depression *Muscle weakness *Headaches *Muscle Tingling	*Mental slowness *Confusion *Psychosis *Stammering *Limb weakness	*Memory problems *Irritable *Mental sluggishness

180

Omega 3

- 20% of the brain is made up of essential fatty acids
  - One third of myelin
- Current American average: 130 mg
- International Recommendations: 650 mg
- Omega 3 inhibits cytokine synthesis
  - *Cytokines* are proteins, peptides (a derivative of amino acids), and glycoproteins (proteins with carbohydrates).

181

Deficiencies of EFCs

- **What symptoms of fatty acid imbalance might you look for?**
  - **Dandruff**
  - **Dry skin**
  - **Dry, unmanageable hair**
  - **Brittle, easily frayed nails**
  - **Excessive thirst**
  - **Depression**
  - **Cognitive fog and memory problems**

182

trans-fatty acids

- Formed when an vegetable oil is heated for a long time in a metal container (i.e. deep frying).
- tends to be solid at body temperature and acts like saturated fat
- trans-fatty acids makes nerve cell membranes rigid and inflexible, interfering with their functioning.

183

trans-fatty acids

- Cookies
- Doughnuts
- Potato chips
- Candy
- Mayonnaise
- Vegetable shortening
- Crackers
- Cake
- Deep-fried foods
- Cheese puffs
- Margarine

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trans-fatty acids can:

1. Be absorbed directly by the nerve membranes
- 2. Block the body's ability to make its own essential fatty acids
- 3. Alter the synthesis of neurotransmitters such as dopamine
- 4. Negatively effect the brain's blood supply
- 5. Increase bad (LDL) cholesterol while decreasing good (HDL) cholesterol

185

trans-fatty acids

6. Increase plaque in the blood vessels
7. Increase blood clots
8. Increase triglycerides, which cause the blood to be sluggish and reduces the amount of oxygen to the brain
9. Cause excess body fat, which can have a destructive effective on the brain

   i.e. cytokines

186

Fructose

- Unlike other sugars, it produces uric acid and blunts the effect of leptin, the hormone that tells the brain to stop eating.
- It flips a switch in the body, causing it to hoard fat, raise blood sugar and blood pressure.
- Can increase LPS by 40%.
  - With Firmicutes, LPS increases gut permeability and so inflammation.
- Triggers free radical products of damaged fatty acids, called isoprostanes, rising 34% just ninety minutes after consumption (↑ with AD)

187

***Advanced glycation end products* (AGEs)**

- Acts as chemical glue that attaches molecules to one another
  - Causes *cross-linking*, (like overcooked meat)
- Associated with the formation of plaque, inflammation, atherosclerosis, particularly in diabetes

188

Vitamin D

- Vitamin D receptors (VDR) are located in the cortex, hippocampus, and cerebellum:
  - deficiency common in older adults implicated in neurologic disorders.
  - deficiency associated with depression.

Associated with:

- Glial cell-derived neurotrophic factor (GDNF)
- Nerve Growth Factor (NGF)
- Brain-Derived Neurotrophic Factor (BDNF)

189

Meal Size

- Large meals stress the GI track and create adverse systemic effects:
  - Causing rapid rise in triglyerides
  - ↑ blood sugar
  - Risk factors for cardiovascular disease and diabetes

Smaller 3-4 meals per day better for memory

190

Fasting and/or Caloric Restriction

- The body increasingly relies on ketone bodies for fuel
  - (water soluble compounds produced when fatty acids are broken down for energy in the liver)
- Fewer calories mean less “fuel” (electrons) entering the ETC reducing free radical production called histone deacetylases which otherwise promote free radical damage

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Mediterranean diet

- Reduces the chances of developing type 2 diabetes by up to 23%
- 30% lower risk of heart disease and stroke
- 35% lower risk of scoring poorly on cognitive tests
- 19% reduced risk of thinking and memory problems
- Less brain shrinkage, than those with the Western diet.
  - Those who closely followed the diet showed the greatest loss of brain volume.

192

Olive oil

- It contains the polyphenol hydroxytrosol --supports complexes of the mitochondrial ETC and stimulates mitochondria biogenesis (Peyrol, et al., 2017).
- Its polyphenols can protect against depression and neurogenesis by promoting the expression of NGF which helps to concentrate mitochondria at sites for axon growth in neurons (Carito, et al., 2016).

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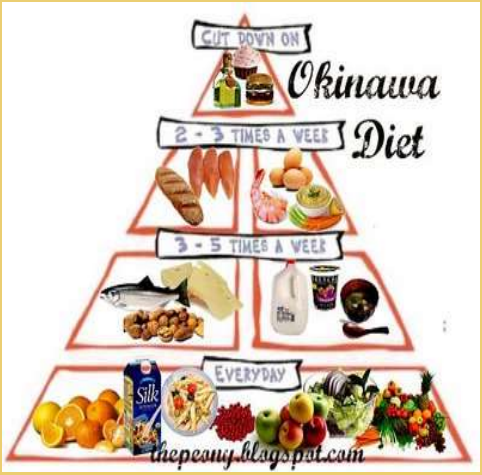
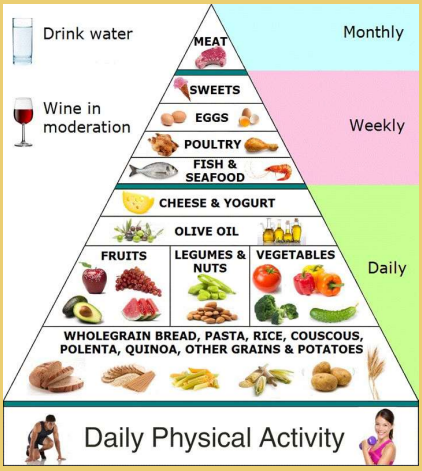
Diets styles for longevity:

Okinawan



Mediterranean



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Diet Summary

- –The importance of breakfast
- –The perils of simple carbohydrates
- –Essential fatty acids
- –Transfatty acids clogging
- –3-4 balanced meals

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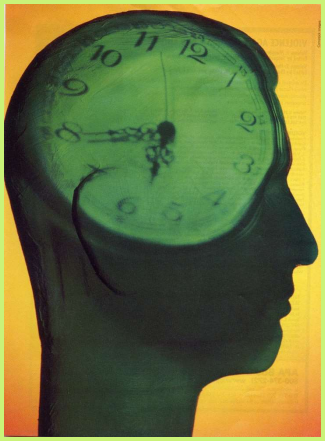
Circadian Rhythm



- Wake and asleep times
- Body temperature
- Release of specific hormones
- Regulation of the immune system
- Recalibrating the brain

196

The Importance of Sleep for the Brain

- Protein synthesis (Ding, et al, 2004)
- Synthesis and transport of cholesterol (Cirelli, 2005)
- Expression of molecules associated with synaptic plasticity (Taishi, et al, 2005)
- Increase LTP (Cirelli, 2005)
- Gene expression (Cirelli, 2005)
- Memory consolidation

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Medical Conditions - Insomnia

- Fibromyalgia
- Huntington's disease
- Kidney disease
- Hyperthyroidism
- Parkinson's disease
- Epilepsy
- Cancer
- Hypertension

198

Memory and Sleep

- REM improves implicit (procedural) learning
- Non-REM improves explicit (declarative)
- Sleeping during a retention interval leads to better memory than wakefulness: i. e. consolidation
- A single night of sleep deprivation produces a significant deficit in hippocampal activity during episodic memory encoding, resulting worse subsequent retention

199

Memory and Sleep

- Only with more than 6 hrs of sleep improved did memory improve over the 24 hrs. following a learning session (Strickgold, 2000)
- Sleep changes memory, making it more robust and resistant to interference in the coming day—stabilizing memory
- During sleep the brain dissects memories and retains only the most salient details—helps to remember aspects of a negative even
- Plays a crucial role in retaining emotional memories

200

Emotions and Sleep

- **"Never go to sleep angry" makes sense**
- **Sleep selectively enhances:**
  - **episodic memory that are emotionally salient**
  - **Emotional memories creating a long-lasting and potentially traumatic representation of distressing experiences**

201

Poor Sleep Linked to Alzheimer's

Lack of sleep or waking up several times may increase the risk of Alzheimer's disease

Getting less sleep or sleeping poorly is tied to an increase in brain levels of beta-amyloid

Older adults, (average age 76); those who said they got under five hours a night, or who slept fitfully had higher levels of beta-amyloid in the brain than those who slept over seven hours a night

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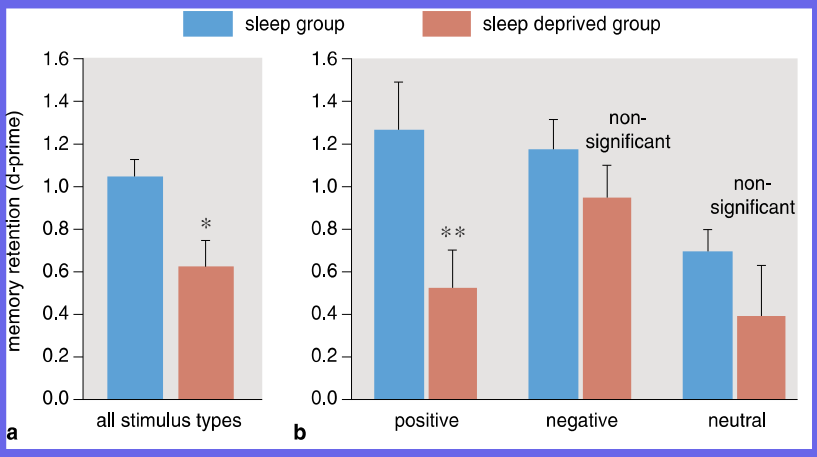
Sleep deprivation impairs memory



- 36 hours of sleep deprivation
- Word-pair test

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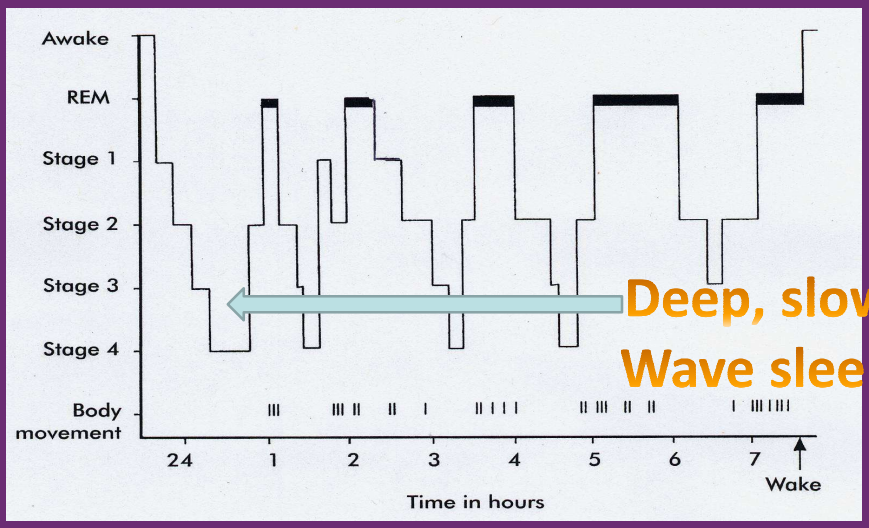
Sleep Hygiene

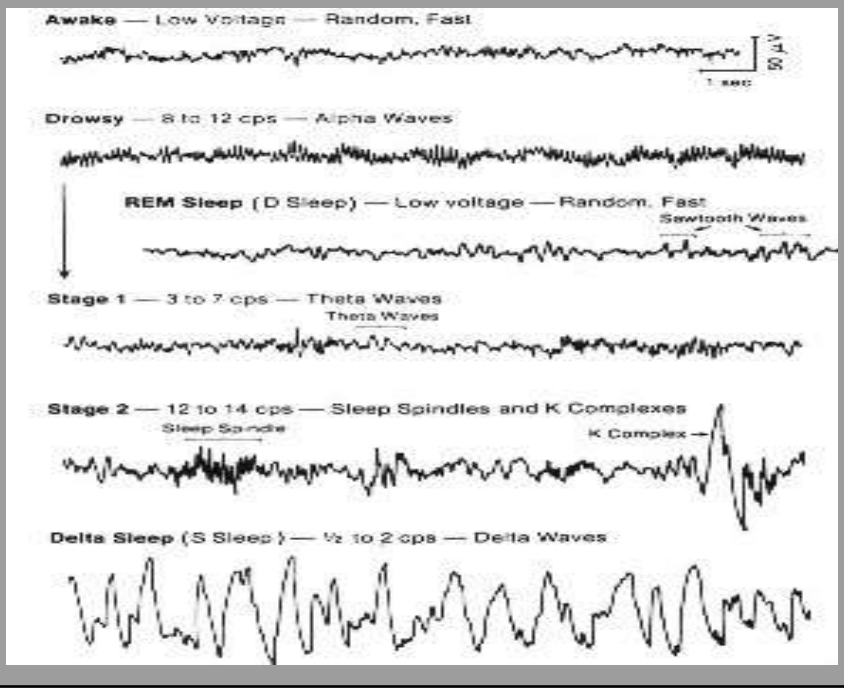
- Don't do anything in your bed other than sleep (except for sex).
  - –Do not watch television, balance your checkbook, discuss finances with your spouse, or argue in bed. Make your bed carry only one association—*sleep*.
- If you can't sleep and find yourself tossing and turning, get up and go to another room.

204

Normal Sleep Architecture



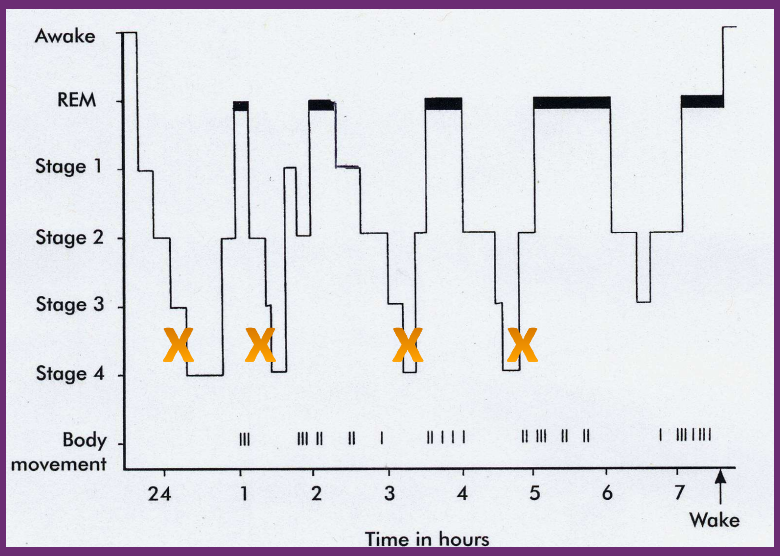
205



206

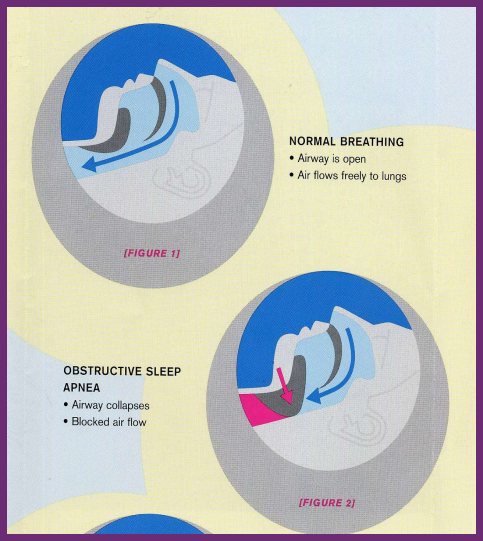
Pathologic Changes in Slow wave sleep

dep, anx, pain, apne, substance abuse



207

Obstructive Sleep Apnea Made Worse with Alcohol and Tranquilizers



208

Slow wave sleep deprivation

- **> Fatigue**
- > Increases in cortisol
- **> Inflammation**
  - **> Trouble concentrating**
  - **> Impaired emotion regulation**

Increase in negative memories

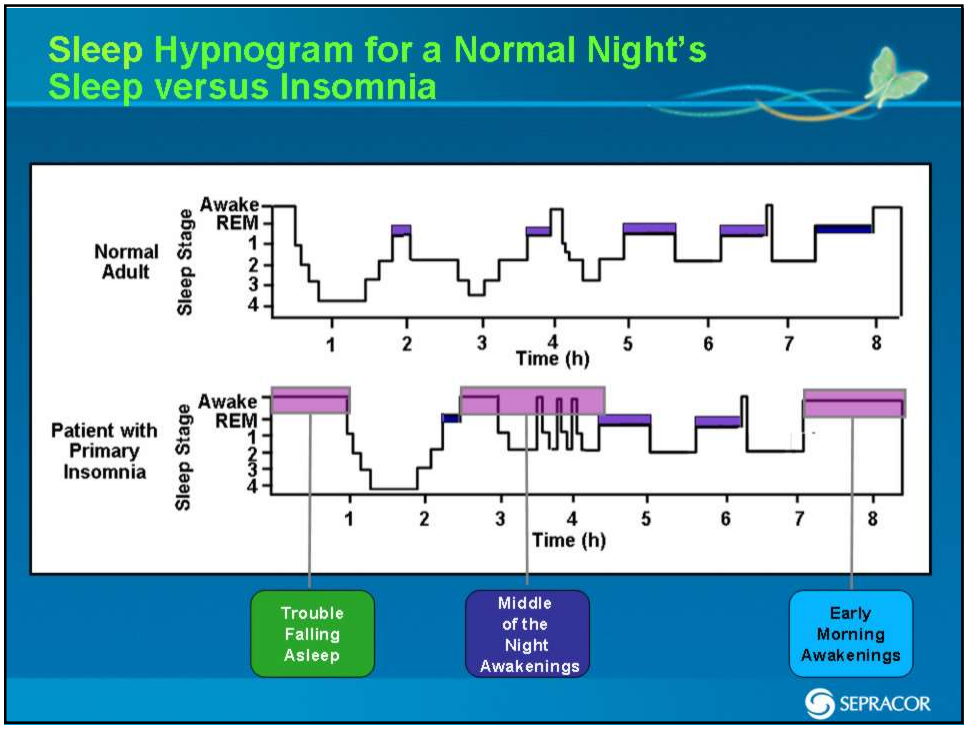
–Increase in depression

209

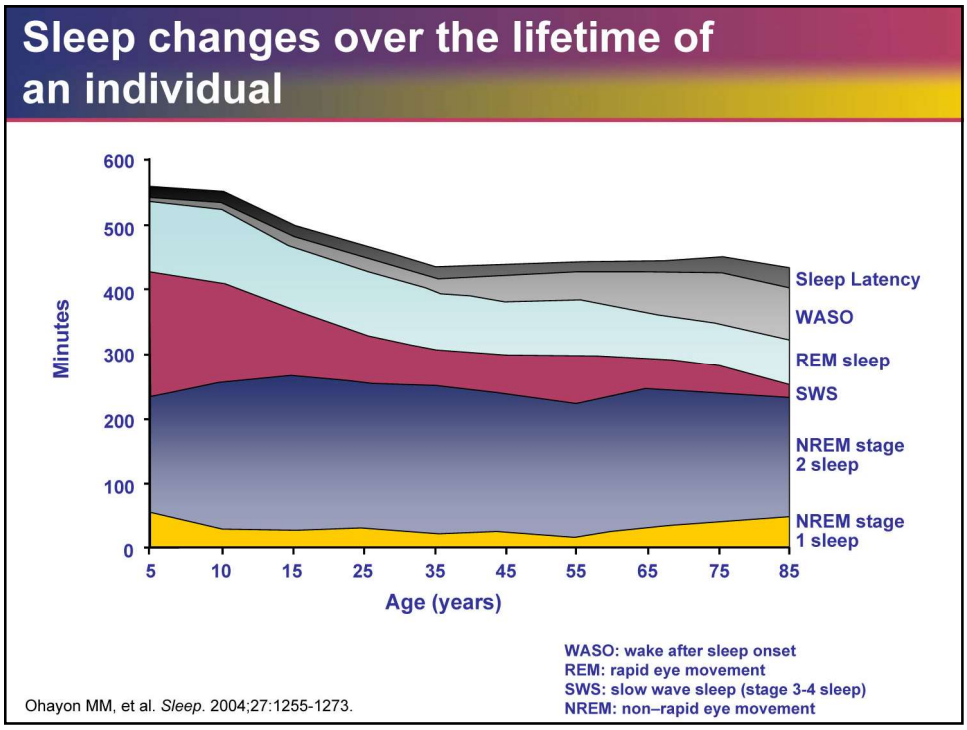
Sleep deprivation

- **↓ ability to clear glucose**
- **↓ in leptin (which normally would inhibit hunger)**
- **↑ in ghrelin (increasing hunger)**
- **↑ in weight**
- **↑ vulnerability to type 2 diabetes**

210


Sleep Hypnogram for a Normal Night's Sleep versus Insomnia
Normal Adult
Sleep Stage
Awake
REM
1
2
3
4
1 2 3 4 5 6 7 8
Time (h)
Patient with Primary Insomnia
Sleep Stage
Awake
REM
1
2
3
4
1 2 3 4 5 6 7 8
Time (h)
Trouble Falling Asleep
Middle of the Night Awakenings
Early Morning Awakenings
SEPRACOR

211


Sleep changes over the lifetime of an individual
600
500
400
300
200
100
0
Minutes
5 10 15 25 35 45 55 65 75 85
Age (years)
Sleep Latency
WASO
REM sleep
SWS
NREM stage 2 sleep
NREM stage 1 sleep
WASO: wake after sleep onset
REM: rapid eye movement
SWS: slow wave sleep (stage 3-4 sleep)
NREM: non–rapid eye movement
Ohayon MM, et al. Sleep. 2004;27:1255-1273.

212

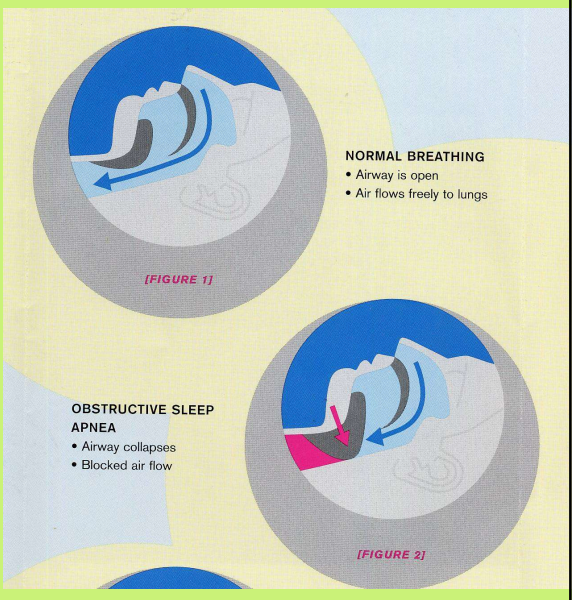
Circadian Rhythm Shifts

- Shift work--- disruption of the melatonin circadian rhythm
  - Irritability
  - Sleepiness at work
  - Sleep disruption when sleeping--hearing noise, light
  - Increase in work error and accidents
  - Carbohydrate craving
  - Weight gain
  - Susceptibility to stress

213

Obstructive Sleep Apnea

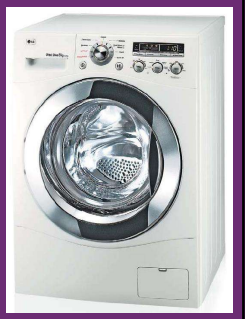
Made Worse with Alcohol and Tranquilizers



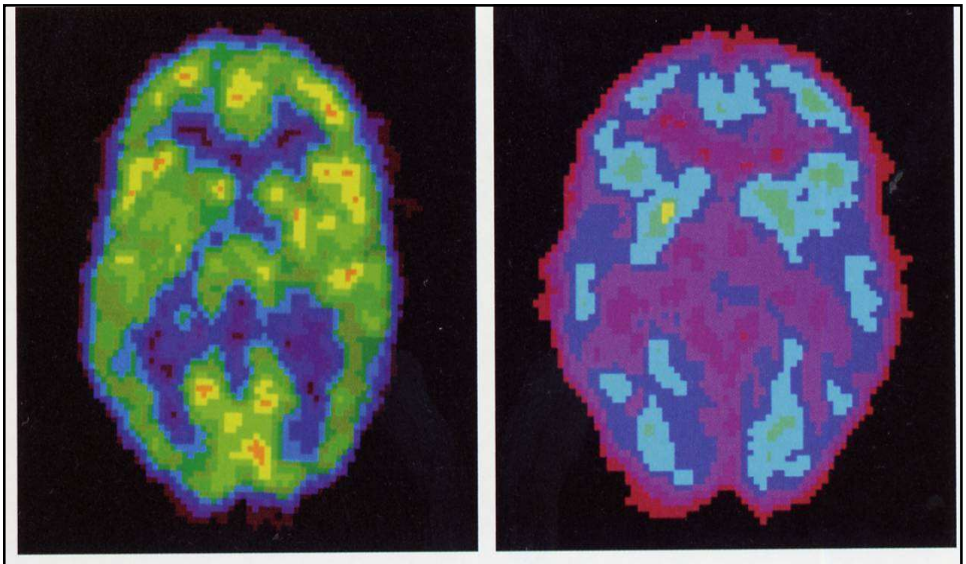
214

Brain Clearing

- "Glymphatic" system, a nod to both glial cells and its functional similarity to the lymphatic system
  - –Sleep as a dishwasher for your brain
- Sleep clears B-amyloid in the brain via increased CSF flow in interstitial space



215

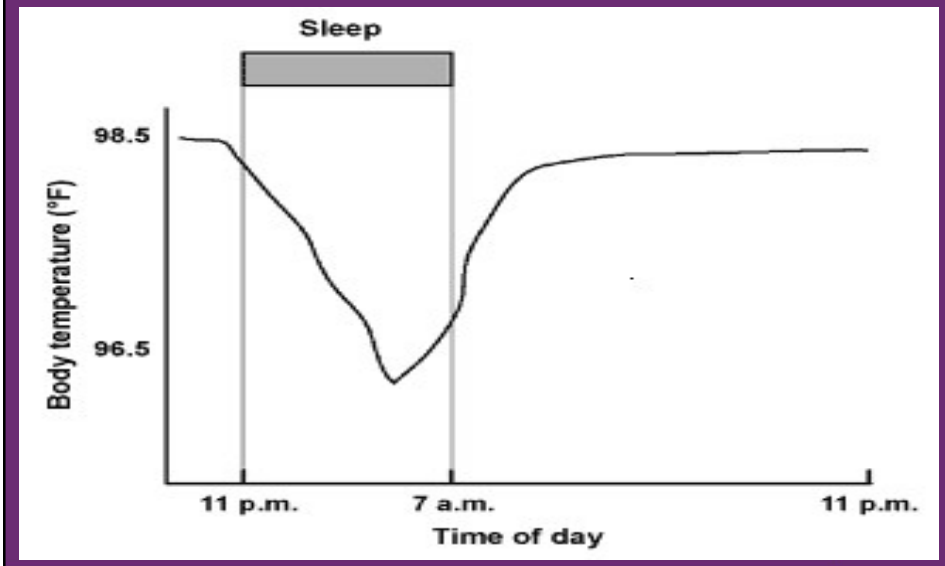


DEEP SLEEP
This PET scan shows that activity quiets down in many areas of the brain during deep sleep. The purple areas are the least active.

DRUGGED SLEEP
Most sleeping drugs induce a deeper sleep than normal. The purple areas on this PET scan show that much of the brain is inactive.

216

Body Temp and Sleep



217

Sleep Hygiene

- Cut your caffeine intake and don't drink caffeine on an empty stomach
- Force yourself 3 meals a day
- Avoid sugar

218

Sleep Hygiene

- Avoid drinking large quantities of liquid at night. This will lower the sleep threshold and cause you to wake up to urinate.
- Avoid bright light at least a few hours before going to sleep. Don't work on the computer into the late evening.

219

Sleep Hygiene

- Do all planning for the next day before you get into bed. If you think of something you need to remember get up and write it down. Tell yourself that you will postpone thinking or worrying about anything until the next day.
- Avoid all daytime naps. Think of naps as a way to steal sleep from the night time.

220

Sleep Hygiene

- Try eating a light snack with complex carbohydrates before bed. Foods rich with L-Tryptophan are advisable. Don't eat anything with sugar or salt before bed.
- Avoid protein snacks at night because protein blocks the synthesis of serotonin and as a result promote alertness.

221

Sleep Hygiene

- If you are troubled by chronic insomnia try the sleep scheduling technique.
- Try the relaxation exercises described in next chapter. These will help you go to sleep or go back to sleep if you wake up during the night.

222

Sleep Hygiene

- Don't "try too hard" to go to sleep.
  - You'll frustrate yourself, leading to a paradoxical effect, and work yourself into an anxious state of mind.
- Tell yourself "it's okay if I get just a few hours sleep tonight. I will catch up the next night."
  - This change in expectation will free you up to be able to relax. The harder you try to go to sleep the harder it will be to induce sleep.

223

"Learned" Insomnia

- "I'm not going to get to sleep tonight."
- Bed becomes an enemy—a negative cue.
- Sleep later on the weekends to compensate.
- Next night you feel as you are losing sleep.
- You try too hard to get to sleep.
- Thoughts about sleep add to daytime stress.

224

Negative Sleep Thoughts (NSTs)

- I have to get the same number of hours of sleep every night.
- There is something wrong with me.
- I will never get to sleep.
- I will be ruined tomorrow.
- I can't get my mind to turn off.

225

Defusing NSTs

- This isn't great but at least I've got my core sleep.
- If I don't get a good night sleep tonight I will tomorrow night.
- I may get back to sleep, I may not. Either way it is not the end of the world.

226

Sleep Hygiene

- Avoid drinking large quantities of liquid at night.
  - This will lower the sleep threshold and cause you to wake up to urinate.
- Avoid bright light at least a few hours before going to sleep.
  - Don't work on the computer into the late evening.

227

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228

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  - Think of naps as a way to steal sleep from the night time.

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- Avoid protein snacks at night because protein blocks the synthesis of serotonin and as a result promotes alertness.

230

Sleep Hygiene

- Exercise 3 to 6 hours before you go to bed. A brisk walk before or after dinner time is perfect.
- Avoid alcohol
- If noise bothers you use earplugs.
- Sleep scheduling technique.
- Try the relaxation exercises. These help you go to sleep or go back to sleep if you wake up during the night.

231

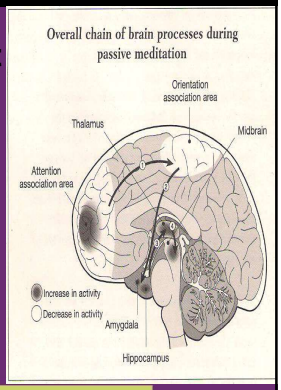
Sleep Summary

- Under 6 hours impairment
- Avoiding sleep depressors
- Negative sleep thoughts
- Body temperature
- Diet
- Exercise

232

Mindfulness and the Brain

- Long-term meditators show increased thickness of the medial prefrontal cortex and also enlargement of the right insula (Lazar, et al, 2005).
- The process of verbal labeling of affective states reduces anxiety and negative affect (Leiberman, et al, 2004)
- The middle prefrontal cortex has been associated with self observation and mindfulness meditation (Cahn and Polich, 2006).
- A shift to the left PFC which puts a positive spin on the experience (Davidson, et al., 2003).



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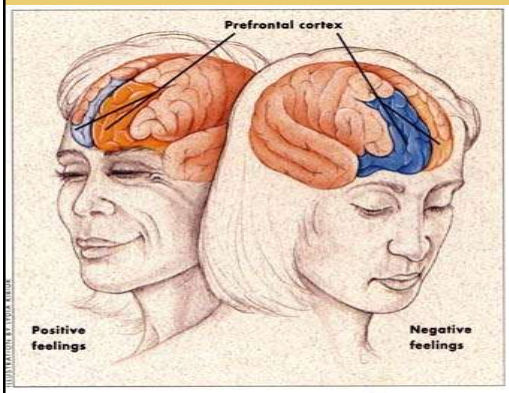
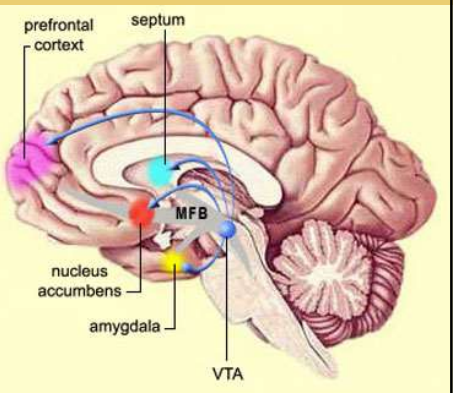
Mindfulness: Brain Changes

(Sara Lazar: Harvard, Davidson and Kabat-Zinn, 2003)

- Shifting attention activates prefrontal circuits
- Increase left PFC activation (better affect regulation)





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Mindfulness for Various Groups

- Borderline via Dialectic Behavior Therapy-DBT (Linehan, 1993)
- OCD (Baxter, et al., 1992)
- Depression (Teasdale, Sigal)
- General medical problems such as chronic pain (Kabit-Zinn, 1990).

235

Mindfulness and Open Focus

- Increases in Gama waves with meditation
- Neurofeedback
  - –Global coherence
  - –Open focus—widened

236

7 Principles Common to prayer, meditation, relaxation exercises, and hypnosis.

- 1) Breathing Rhythmically—deep, deliberate, and focused breathing allows you to slow your heart beat.
- 2) Focused attention—to the present moment can transform each experience into a rich and calm experience by turning on your brain's brain.

237

7 Principles of Relaxation

- 3) An accepting and a nonjudgmental attitude shift away from rigid expectations that helps you appreciate reality as it is, rather than what you fear it could be.
- 4) Observation—This allows you to detach from bad feelings by not denying their existence.

238

7 Principles of Relaxation

- 5) Labeling what you experience can calm your amygdala.
- 6) A quiet environment—This will give you an opportunity to learn how quiet your mind without distractions.
- 7) A relaxed posture—This can reduce tension include sitting in a relaxed posture or stretching (e.g. hybrid yoga)

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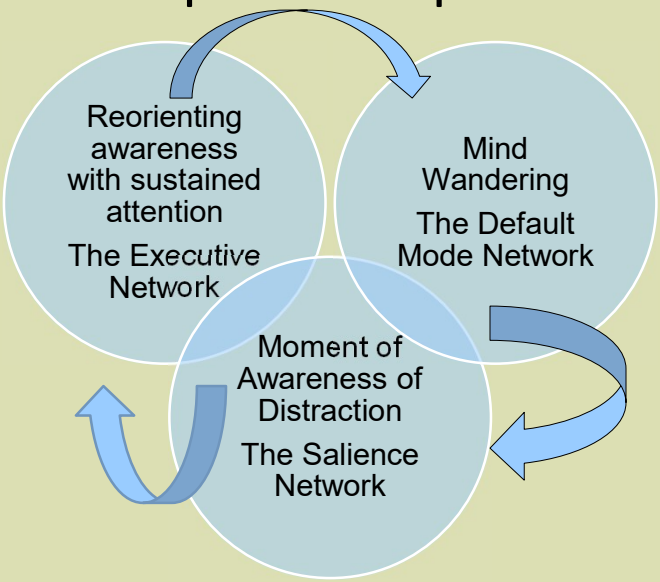
Contemplative Experiences



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Balancing the Mental Operating Networks

- The forest and trees together—not one or the other
  - A symphony—all pieces in synch
- Not passivity—instead of mindless action -- move with purpose with time
  - Mindful action—Zen is not like chopping wood. Zen *is* chopping wood.

241

Sustaining Positive Habits

- **Pleasure…often fleeting**
- **Positive habits --associated with sustained levels of well being**
  - **But during stressful times: having fun, self-nurturing and humor are the first to go**
- **Ongoing work toward a valued goal**
- **Daily contact with nature**
-

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Transcendent Awareness

- Contemplative Attention
- Mindfulness
- Acceptance
- Forgiveness
- Gratitude
- Compassion

»The 9th!

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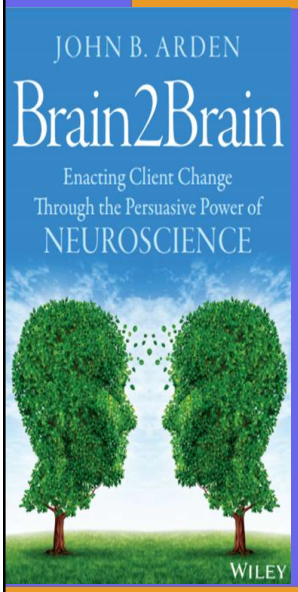
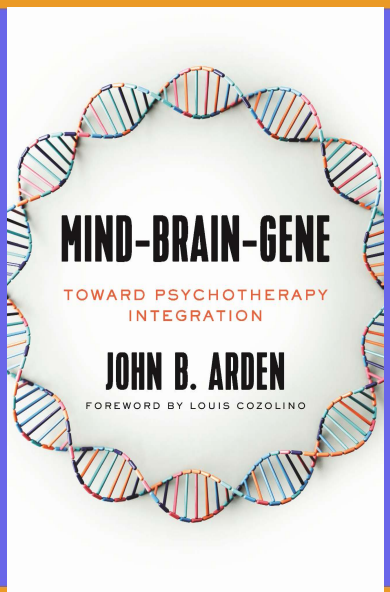
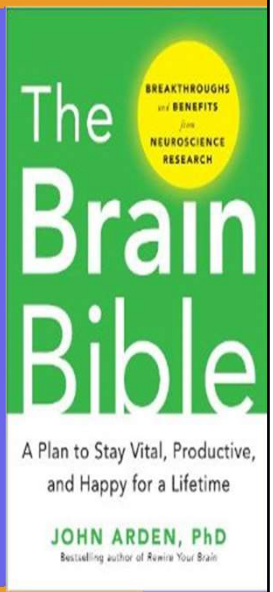
References







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Abbreviation Glossary

- AAI—Adult Attachment Inventory
- ACTH—Adrenocorticotropin Hormone
- ACC—Anterior Cingulate Cortex
- BDNF—Brain Derived Neurotrophic Factor
- CRH—Corticotropin Releasing Hormone
- DA—dopamine
- DLPFC—Dorsolateral Prefrontal Cortex
- DMN—Default Mode Network
- ISS—Infant Strange Situation
- OFC—Orbital Frontal Cortex
- NE—Norepinphrine
- NMDA—n-methyl-D-asparate receptors
- 5-HT—Serotonin

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- **NMDA—n-methyl-D-asparate receptors**
- **5-HT—Serotonin**

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Abbreviation Glossary

- **IPT—Interpersonal Therapy**
- **ISS—Infant Strange Situation**
- **lvPFC—Lateral ventral Prefrontal Cortex**
- **OFC—Orbital Frontal Cortex**
- **PE—Prolonged Exposure**
- **NE—Norepinphrine**
- **NMDA—n-methyl-D-asparate receptors**
- PICs--Proinflammatory Cytokines
- SAM—Situationally accessible memory
- TPJ—Temporal parietal junction
- VAM—Verbally accessible memory
- **VTA—Ventral tegmental area**

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