Brain-Based Therapy
Teaching Neuroscience in Psychotherapy

John B. Arden, PhD

The Time is Changing

“We must recollect that all of our provisional ideas in psychology will presumably one day be based on an organic substructure.”

---Sigmund Freud

“The act of will activates neural circuits”

---William James

1890

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

---Eric Kandel

Now
Agenda

1. Psychotherapy Research
2. Neuroscience
3. Nurtured Nature
4. Memory
5. Nutritional Neuroscience

Agenda

Auto-Stress Disorders
6. GAD
7. Panic
8. PTSD
9. OCD
10. Depression
The Cartesian era
- Plethora of theoretical "schools - no grounding - brainless
  - Eysenck etc.

Pax Medica
- The DSM III
- SSRI cousins
- Evidenced-based treatment
- The medicalization of psychotherapy
**Pax Medica: Side Effects**

Medications removed psychology from psychiatry and moved psychology toward the medical model

- *Patients* receive *treatment*
- *Problems* became *DSM diagnoses*
  - *Therapists* became *clinicians*
- “Clinically Speaking!”
- “Medical Necessity”

**Cracks in the Empire**

A re-analysis of studies of antidepressant effectiveness revealed that while all 38 positive studies were published, only one of the 40 negative studies made it into print

Positive studies *12 times more* likely to be published than studies finding negative results
**Serotonin Hypothesis Revisited**

- Reducing tryptophan from the diet (Delgado, 2000)
  - Didn’t effect healthy people w/o a family hx of depression
  - One third of healthy people with a family hx of depression got more depressed (what about the other two thirds?)
  - Two thirds of people tx with SSRIs got more depressed in 5 hours!
  - The drug Trianeptine reduces depressive symptoms but it also reduces serotonin levels (Fuchs, 2002)

---

**Pax Medica: Side Effects**

50 to 60% of clinically depressed people improve on SSRIs or TCAs (Quitkin, 2000)

A meta-analysis of the placebo studies found 42 to 47% efficacy (Arnold, et al., 2005)

That’s just 10% less than antidepressants!

What about the percentage of antidepressant subjects actually experienced a placebo effect?

In a re-analysis of the data from a landmark 1985 NIMH depression study, the best performing psychiatrist got better outcomes with placebos than the worst-performing psychiatrist got with imipramine. (McKay et al, 2006)
Biopsychosocial Synthesis

NEUROSCIENCE

PSYCHOLOGICAL THEORIES

EVIDENCE-BASED PRACTICE

THERAPEUTIC ALLIANCE

The BASE of BBT

Brain

Alliance

Systems

Evidence-Based Practice
“The Benefits of Psychotherapy” --Finally!
(Smith, Glass and Miller, 1980)

- Evidence-Based Practices
- Outcome Management
  - How does therapy work, anyway?

Outcome Studies

- 43% of patients recover without therapy
- Therapists are poor judges, not just of the outcome of a complete therapy, but even of a single session
- We overvalue our own competence and undervalue that of our colleagues:
  - 80% of the therapists consider themselves “better than the average”
  - Psychotherapy can produce enduring adverse effects
Psychotherapy Research

Factors affecting outcome
- **Common factors:** 40%
- **Patient factors:** 40%
- **Therapist factors:** 15%
- **Technique:** 5%

Psychotherapy and the Brain

Direct, observable links between successful CBT/IPT and brain changes

- Reduced amygdalar activity in:
  - phobics (Straube et al., 2006)
  - panickers (Prasko et al., 2004)
  - social phobics (Furmark et al., 2002)

- Increased ACC activation in PTSD clients (Felmingham et al., 2007)

- Increased hippocampal activity in depressives (Goldapple et al., 2004)

- Decreased caudate activity in OCD (Baxter et al., 1992)
Brain-Based Therapy

• Discriminates between what is therapeutic and what’s not
• Includes techniques consistent with how the brain works
• Relies on the therapist’s alliance with the client
• Employs common denominator methods of psychodynamic therapy, CBT, DBT, ACT, IPT, mindfulness, etc.

Brain-Based Therapy

• BBT changes how we think about the relationship and change:
  – Need a “Safe emergency.”
  – Experience *creates* brain biology
  – Brain biology effects experience (e.g. depression)
The Five Healthy Brain Factors

- Social
- Exercise
- Education
- Diet
- Sleep
- S.E.E.D.S.

Frontal Lobes: & Brain Evolution

- Human evolution is the story of growth & increased complexity of the cortex and PFC
  - Humans: 30%
  - Chimps: 12%
  - Dogs 6%
  - Cats 3%
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”

DLPFC and the OFC

Dorsolateral Prefrontal Cortex

Orbital Prefrontal 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

Client Education

• The more advanced part of your brain can neutralize irrational anxiety generated by the primitive parts of your brain.

• And that is what you will learn from therapy.
Practical Neuroscience

- Affect asymmetry
- Neuroplasticity
  - Neurogenesis
  - Default mode network
- Social Brain networks
- Nutritional Neuroscience
  - Psychoneuroimmunology

Affect Asymmetry

**Set points**

**LEFT FRONTAL LOBE**
- Positive emotions
- Approach behaviors
- Labeling thoughts and feelings and
  - Developing new narratives (helps to alleviate anxiety and depression)

**RIGHT FRONTAL LOBE**
- Negative emotions
- Withdrawal behaviors
  - Feeling overwhelmed

Alexithymic pts. have smaller right ACCs
larger right ACCs--more fearfulness and worry (Ganesh, et al, 2004)
**Left PFC:**

- Suppressing Sadness
- Activating Positive Emotions

**Client Education**

- When you are overwhelmed with anxiety or depression it is best to shift from the big picture to the small, and do something that approaches a goal in a piecemeal, incremental manner.
**Left PFC:**

**Activation & Approach Behaviors**
(curiosity; assertion)

**Right PFC:**

**Activating Behavioral Inhibition**

Associated With negative Emotions
Activity in the default mode network

Sheline Y I et al. (2009)

DMN Variations

- Increases when DLPFC is not engaged:
  - Stressed, bored, no novelty, or tired
- Malfunctions in the DMN:
  - Schizophrenia—defective mPFC—impaired self reflection—not sure where thoughts come from
  - Depression—obsessive ruminations over negative experiences
- Meta-awareness for creativity (notice that they are doing it) —needed for sense of self
Client Education

• It’s natural and normal to fade off and reflect every once in awhile.

• Try to make these periods useful by reflecting on ideas and impressions about what just occurred or positive and creative thoughts.

Neuroplasticity

• Donald Hebb (1904-1980)
  - Brought lab rats home for his kids to play with
  - Back at the lab they learned more quickly than cage-bound rats
  - They had developed bigger, heavier brains
  - “Neurons that fire together, wire together.”
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)

100 Billion Neurons with 10,000 Synaptic Connections
Neuroplasticity

- Increases in:
  - synaptic efficacy
  - receptor density
    - Up-regulating their activity
    - Glial cell availability
    - Changes in the shape and structure of synapses
Client Education

• Your brain is not hardwired but soft-wired.

• Our job together is to rewire your brain so that you no longer suffer from anxiety and depression.
Optimally—repetition of a stimulus ↓ the amount of glutamate necessary to make the next transmission

i.e. lowers the threshold & strengthens the connection (LTP) via a glutamate receptor called n-methyl-D-aspartate (NMDA)
Client Education

- Though you feel like you’re not ready to take the first step, actually it is not feeling ready that provides the brain chemistry necessary to rewire your brain.

Don’t wait to feel ready!
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)

Examples of Neuroplasticity

- Musicians using specific fingers to play their instruments showed enlarged areas of their somatosensory strips associated with those fingers. (Panlev, 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)
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

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
Compensatory Neuroplasticity

Client Education

- Rewiring your brain to change bad habits into good habits requires that you endure the confusing experience of feeling worse before you feel better.

- To feel better on a regular basis you must ride through the brief period of feeling worse.
Brain Environments

Enriched Environment

Impoverished Environment

“The Brain in box”

BBT & Neurodynamics

• Improving affect regulation
  – “self”-organization

• Look for periods of flux (readiness for change)

• A disturbing thought or anxious feeling can trigger a ripple effect, leading to a change of plans
BBT Strives to:

• Induce repeated states (weak attractors)
  • (i.e. positive moods)
• Repeat often enough so they become traits – (or strong attractors)

LTP vs. LTD—Long-Term Depression
• Cells that fire out of sync lose their link
• Separating the emotion and the cognition

A Mnemonic “Recipe” for Rewiring the Brain

Focus: Turn on your PFC
Effort: Establish a habit
Effortlessness: It will eventually become easier but not permanent
Determination: Stay in practice to keep it going
Client Education

- To rewire your brain, you will need to do some things you don’t feel like doing…
- Moderate anxiety is a good thing….it helps neuroplasticity
- “Don’t worry, I’ll be there with you as your partner.”

Brain Derived Neurotropic Factor

- BDNF plays a crucial role in reinforcing neuroplasticity and neurogenesis. It helps:
  - Consolidate the connections between neurons. VS. LTD
  - 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
Factors that Decrease Neurogenesis
- Aging
- Chronically high cortisol
- Chronic stress
- Recurrent depression
- Marijuana
- Obesity

Factors that Increase Neurogenesis
- Exercise
- Fasting
- Fewer calories consumed
- Food content --(Omega—3)
- Antidepressants?
You can grow new neurons in the area of your brain that gives you the capacity for memory. The first steps include maintaining a healthy diet, aerobic and cognitive exercise.

- Bonding/Attachment
- Cognitive capacity
- Affect Regulation
- Safety
- Mental and physical health
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)
- Anxiety (Cohen, 2004)
- Natural killer cells (Kiecolt-Glaser, et al., 1984)
- Slows cognitive decline (Bassuk, et al 1999)
- Improves sleep (Cohen, 2004)
- Improves depression (Russell & Cutrona, 1991)

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)
Systems of the Social Brain

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

Social Brain and the PSN

- Neurochemistry includes:
  - Oxytocin
    - Turns down cortisol
  - Central Parasympathetic Nerves
    - “Smart” Vagus Nerve
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.

Vagal Brake

• Higher vagal tone correlates with:
  – Self-Soothing capacity
  – Quality of caretaking and attachment
  – More reliable autonomic responses
  – The range and control of emotional states

• Lower vagal tone correlates with:
  -- Anxiety
  – Impulse Control problems
  – Hyperactivity, Attention deficit and distractibility
  – Avoidant & Disorganized Attachment
  – Irritability
• Dorsal vagal complex extends down into abdominal organs (i.e. heart)
  – A mechanism to slow heartbeat
  • Oxytocin and Acetylcholine
  • When brake is off:
  • ↑ heart rate (feels like a state of emergency)
  • ↑ allostatic load
**Mirror Neurons**

- Gives us the ability to anticipate others’ intentions
- Helps us respond sympathetically and empathically to others
- Mirror systems are found in circuits for:
  - Motor
  - Affect
  - Social contagion (e.g., yawning)

**Facial Expressions**

<table>
<thead>
<tr>
<th>Left Hemisphere</th>
<th>Right Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls expression on the lower right side of face</td>
<td>Controls expression on the lower left side of face</td>
</tr>
<tr>
<td>• Is NOT adept at reading facial emotion expression (e.g. alexithymics)</td>
<td>• Is adept at reading facial emotion expression</td>
</tr>
</tbody>
</table>
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

D Smiles

• Guillaume Duchenne (1806-1875) identified the orbicularis oculi muscles around the eyes

• Non-D smiles, possibly masking negative states and are more likely to be asymmetrical

• D smiles -- L-PFC activation

• Non-D smiles -- R-PFC activation (Ekman, et al, 1996)
Feedforward Expressions

• Therapists can model and influence the patient’s facial expressions and mood via feedforward and feedback:
  – 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)

Client Education

• Your brain has been endowed with circuits that thrive on positive social interactions.
• When they are not activated your health suffers.
Successful psychotherapy requires neuroplasticity
- States to traits
- Keep brain bias toward PFC and hippocampal vs. amygdala learning states
  - Affect regulation -- “self”-organization
- Bumping the set point
- Making the DMN useful

Close and Trusting Relationships (Secure Attachment)
- Activation of Moderate States of Arousal (Challenge)
- Activation of Affect and Cognition (Multimodal)
- Co-Construction of New Narrative (reconsolidating memories)
The Therapeutic Brain

• Polyvagal System—Social engagement system—the parasympathetic NS
• Mirror neurons and spindle cells—increasing empathy and emotional intuition
• Theory of Mind—Intersubjectivity
• Facial Expressions—enhancing mood
• Outcome Management—monitoring the relationship

Primed for Attachment

• Infants are born “premature” and develop:
  − Attachment schema
  − Self Identity
  − Self-esteem/”Love-ability”

Affect regulation
  − Fear modulation/Approach-avoidance behavior
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)

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 -- diminished left hippocampal development (Howe, Roth, & Cicchetti, 2006).
Still Face and Visual Cliff

- **Visual Cliff paradigm** (Source, 1985)
  - Mother shows fear – child won’t cross
  - Mother smiles 80% will cross
- **Still Face paradigm** (Tronick, Cohn, Field)
  - 9 months old no longer approach novel toys—imagination shuts down
  - s/he becomes agitated and distressed

Amygdala activation adults vs. children

- The amygdala involved in disambiguation of social situation—helps an individual disregard irrelevant information
- Fearful faces provoke more amygdala activity in adults than children
- Neutral faces (ie. Still Face Paradigm) provoke more amygdala activity in children than adults
  
  (Tottenham, et al., 2009 for review)
- With maturation: neutral faces and ambiguity are tolerated due to increased cortical processing
  
  (Casey, et al., 2003)
Infants of depressed mothers

- Display more aversion and helplessness, and vocalize less
- Higher heart rates, decreased vagal tone, and more developmental delays at 12 months of age (Field, 2005)
- Maternal depression during the first two years of a child’s life is the best predictor of cortisol production in children at age 7 (Ashman, et al., 2002)

Intergenerational Transmission

Infants of depressed mothers have:

- Over-active right frontal lobes
- Under-active left frontal lobes
- Lower levels of DA and 5-HT
- Higher levels of stress hormones (Field et al., 1998)
- Treating the mother’s depression contributes to the child’s improvement
D.W. Winnicott

• Analysand of Melanie Klein
• Good-enough parenting
• The holding environment
• Impingements mirroring
• transitional object

“Good Enough” Parents

− Perfect isn’t good enough
− High levels of affective matching correlate with insecure attachment
− Low levels also correlate with insecurity
− Moderate matching is optimum
Good-enough parenting and frustration tolerance

• If the baby is matched by instantaneous soothing s/he will not develop the PNS and the brakes to the SNS and HPA axis
• Good enough parenting factors in time before the baby is soothed
  – To anticipate being soothed and activate the parasympathetic nervous system
  – builds in frustration tolerance

John Bowlby (1907 – 1990)

• Supervised by M. Klein
• Safe haven
• Attachment figures
  figure for safety.
  “Like a thermostat”
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

ISS/Maternal Behaviors

<table>
<thead>
<tr>
<th>Child Categorization</th>
<th>Maternal Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure</td>
<td>emotionally available,</td>
</tr>
<tr>
<td></td>
<td>perceptive &amp; effective</td>
</tr>
<tr>
<td>Avoidant</td>
<td>distant &amp; rejecting</td>
</tr>
<tr>
<td>Anxious/Ambivalent</td>
<td>inconsistent availability</td>
</tr>
<tr>
<td>Disorganized</td>
<td>conflictual behavior</td>
</tr>
</tbody>
</table>
Ethnic Attachment Styles

- Northern Germany—a preponderance of *Avoidant* patterns of attachment. It is not uncommon for parents to leave their babies unattended or outside of supermarkets. (Grossman, et al., 1981)

- In Japan—a preponderance of *Ambivalent* and hard to sooth infants. Mothers and babies are rarely separated. Babysitting is rare and when it occurs is generally with grandparents. (Miyake, et al, 1985).

- Among Kibbutzim in Israel babies have been reported to become *anxious* by the entry of strangers in attachment testing situations. Strangers, therefore, are distrusted. (Saarni, et al, 1980).

Correspondence between Child & Adult Attachment Categories

**Child (ISS)**
- secure
- avoidant
- ambivalent
- disorganized

**Adult (AAI)**
- free/autonomous
- dismissing
- preoccupied
- unresolved
Aging and the Cortex

- Loss of gray and white matter in:
  - the DLPFC, temporal lobes and hippocampus
- Ventricles and Sulci gaps get larger
- The PFC-- ages more quickly then other cortical areas (Burke & Barnes, 2006)
  - Declines more quickly in the R-PFC
    - Beginning in the 4th decade of life
    - More pronounced in the 5th decade of life
  - LH atrophy begins in the 6th decade

Reverse aging: Woody Allen

- "In my next life I want to live my life backwards.
- You start out dead and get that out of the way.
- Then you wake up in an old people's home feeling better every day.
- You get kicked out for being too healthy, go collect your pension, and then, when you start work, you get a gold watch and a party on your first day.
- You work for 40 years until you're young enough to enjoy your retirement.
- You party, drink alcohol, and are generally promiscuous, and then you are ready for high school.
- You go to primary school, you become a kid, you play, you have no responsibilities, you become a baby, and then...
- You spend your last 9 months floating peacefully in luxurious spa-like conditions with central heating and room service on tap, larger quarters every day, and then voila...
- You finish off as an orgasm!"
Shift in Approach

- Teaching people about their brains boosts confidence in therapy and externalizes the problem
- Encourages the alliance and discourages resistance
- Brings what you do together into perspective

The ACE Study

- Examined the health effects of ACE’s throughout the lifespan among 17,421 members of Kaiser Permanente in San Diego county

- What are Adverse Childhood Experience?
  - Childhood abuse and neglect
  - Growing up with domestic violence, substance abuse, parental discord, crime, or mental illness in the home
The ACE Score and a History of Lifetime Depression

The ACE Score and Drug Addiction
The ACE Score and the Risk of Coronary Heart Disease
ACE Score and HIV Risks

ACE Score
- 0
- 1
- 2
- 3
- 4 or more

Percent With Health Problem (%)

Adoption of Health-risk Behaviors
- Social, Emotional, & Cognitive Impairment
- Early Death
- Disease, Disability and Social Problems
- Adverse Childhood Experiences

Death
• 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 Epidemic

Obesity Trends* Among U.S. Adults
BRFSS, 1990, 2000, 2010
(*BMI ≥30, or about 30 lbs. overweight for 5'4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Belly fat

Belly fat generates inflammation by releasing proinflammatory cytokines
- Lowers BDNF
- ↑ risk of dementia
- If you’re going to gain weight, go for the pear not the apple shape

Client Education

If you have extra weight, hope for the pear not the apple shape. Better yet, lose the body fat for the sake of your brain.

Fat cells leak out toxins that go to the brain causing inflammation, clouding thinking, and increasing depression.
Obesity-Associated Adipose Tissue Inflammation

Obesity, Inflammation, and Diabetes

- Fat cells secrete IL-6
- IL-6 can induce insulin resistance
  Higher IL-6 may predict diabetes type 2
Metabolic Syndrome

Apple shape:
- men waist ≥ 40 inches
- women waist ≥ 35 inches

• Triglyceride ≥ 150 mg/dl (milligrams per deciliter)
• Low HDL ≤ 50 mg/dl
• BP of ≥ 130/85
• Elevated fasting blood glucose ≥ 100 mg/dl

Pre-diabetes

• Occurs when blood glucose levels higher than normal but not yet high enough for dx of diabetes
• Dept of Health estimates 1 in 4 adults (57 million)
• Most develop type 2 diabetes in 10 years unless:
  – Lose 5 to 7 % of body weight
  – Make major changes to diet
  – Increase exercise diet
Gut Bacteria

- 90% of bacteria in the colon
- F/B ratio:
  - Firmicutes
    - Fat loving—increases fat absorption
    - Efficient at extracting calories from carbs
    - Turns on genes that increase the risk for obesity, diabetes, and CVD
  - Bacteroidetes
    - More dominant in lean people

Break a Fast

Skipping Breakfast contributes to:
- ↓ problem solving
- ↓ working memory
- ↓ attention
- ↓ concentration
- ↓ energy
- ↑ Mood swings
- ↑ depression
- ↑ stress reactivity
- ↑ anxiety
Deficiencies of B Vitamins

<table>
<thead>
<tr>
<th>Low B-1</th>
<th>Low B-2</th>
<th>Low B-6</th>
<th>Low B-12</th>
<th>Folic Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Decreased Alertness</td>
<td>*Trembling</td>
<td>*Nervousness</td>
<td>*Mental slowness</td>
<td>*Memory problems</td>
</tr>
<tr>
<td>*fatigue</td>
<td>*Sluggish</td>
<td>*Irritable</td>
<td>*Confusion</td>
<td>*Irritable</td>
</tr>
<tr>
<td>*Emotional Instability</td>
<td>*Tension</td>
<td>*Depression</td>
<td>*Psychosis</td>
<td>*Mental sluggishness</td>
</tr>
<tr>
<td>*Decreased reaction</td>
<td>*Eye problems</td>
<td>*Muscle weakness</td>
<td>*Stammering</td>
<td></td>
</tr>
<tr>
<td>time</td>
<td>*Stress</td>
<td>*Headaches</td>
<td>*Limb weakness</td>
<td></td>
</tr>
</tbody>
</table>

*Decreased alertness
*Fatigue
*Emotional instability
*Decreased reaction time

*Increased alertness
*Energetic
*Clear thinking
*Increased reaction time

Alertness
Fatigue
Emotional instability
Decreased reaction time

*Decreased mental alertness
*Fatigue
*Emotional instability
*Decreased reaction time

Mental alertness
Mental fatigue
Mental emotional instability
Decreased mental reaction time

Deficiencies of EFAs

Stress can have a destructive effect on EFAs including:

Inadequate replacement of lost fatty acids

Destruction (rancidity) of long-chain fatty acids in the brain can contribute to depression (Hibbeln, 1995)

Symptoms include:

- Dandruff
- Dry skin
- Dry, unmanageable hair
- Brittle, easily frayed nails
- Excessive thirst
- Depression
- Cognitive fog and memory problems
- Dry eyes
- Weakness
- Frequent infections
- Poor wound healing
- Learning problems
- Attention problems
Amino Acids

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>Neurotransmitter</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-Tryptophan</td>
<td>Serotonin</td>
<td>Improves sleep and calmness and mood</td>
</tr>
<tr>
<td>L-Glutamine</td>
<td>GABA</td>
<td>Decreases tension and irritability</td>
</tr>
<tr>
<td>L-Phenylalanine</td>
<td>Dopamine</td>
<td>Reduces anger and increases feelings of pleasure</td>
</tr>
<tr>
<td>L-Phenylalanine</td>
<td>Norepinephrine</td>
<td>Increases energy, feelings of pleasure, and memory</td>
</tr>
</tbody>
</table>

Glycation (excess glucose)

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

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

**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
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
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. proinflammatory cytokines
The Inverted U

Area of Optimal Stress

Low Stress
Boredom
Depression

Performance,
Happiness,
Health

High Stress
Anxiety

Stress Level

Working Memory

Prefrontal cortex

Intraparietal sulcus

Globus pallidus
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 information
  • 2,600 deaths and 330,000 injuries each year in the US via cell phones and driving

Habit vs. WM and Explicit Memory
Grocery Store Effect

• While driving home from work you forget to stop at the store
  – This minor error in memory is evidence of two competing parts of the brain, one for habits, the other involved in holding information
  – Driving home from work is a habit, done on autopilot – the striatum
  – Stopping at the store holding information and acting on it
The Habit Circuits

- Striatum
- Basal ganglia
- Thalamus
- Amygdala

Two LT Memory Systems

**Implicit**
- Non-declarative
  - Procedural
  - Emotional
  - Generalized
  - Classical conditioning
  - Amygdala and BG-driven

**Explicit**
- Declarative
  - Episodic
  - Autobiographical
  - Semantic
  - Context Specific
  - Hippocampus-driven
AMYGDALA

• Fear Conditioning
• Emotional Valance
• Generalized
• Cortisol Heightened
• Sensitivity
• (Hypervigilence)
• Matures Early
• “Little Albert”
• “LSMFT”

HIPPOCAMPUS

• Many Cortisol Receptors
• Context Specific
• Heightened Cortisol leads to atrophy
• Matures Later
  • Vs. Infantile Amnesia
  • “H.M.”

Implicit Memory System

Explicit Memory System
Client Education

- The part of your brain that codes in information to long-term memory does not go online at least until age 3 or 4.

- This means you cannot go back to capture accurate memories that were never encoded.

Amygdala and Hippocampus

- Amygdala contributes to emotional amplification of explicit memories

- Explicit memories can be state-based (e.g., when we are depressed, we remember depressing events)

- When the amygdala and hippocampus are activated together memories are more robust and durable

  - Make what you want the client to remember emotionally relevant
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”

The Slow Circuit to the Amygdala

- Sensory info goes to the Thalamus through the Cortex and Hippocampus to the Amygdala
- Limitations:
  - Worries and GAD
  - Fears and Phobias
- Benefits:
  - Tames the Amygdala
  - With exposure, New Thinking (cortex)
- “Top down”
Client Education

• Anxiety occurs when your fast track is on too often and your slow track needs to speed up.
• Let’s work together to slow down your fast track and speed up your slow track.

Flashbulb Memories

• A particular type, not class
• During emotional peaks, NE dramatically sensitizes synapses
  –Primes neurons by increasing their sensitivity
Negative Memories

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

Positive Emotion and Memory

• During positive experience we may want to “take it all in” — widens the frame
• Recalling positive memories — “reminiscence bump” with increased positive memories

* (Bertsen & Rubin, 2012)
Memory Consolidation

• Consolidation takes place over of time—from hours to years (McGaugh, 2004)

• Emotional effects of consolidation are often not detectible immediately after the event, but evolve gradually and are labile and vulnerable to disruption.

• NE and cortisol effects which began during the event continue to modulate the consolidation of the memory trace after the event (Haman, 2009)

Client Education

• Every time you recall a memory you change it by the context, mood, and vantage point of the present moment.
• 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!

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
Memory Giants

- Homeric Bards
- Talmudic Scholars
- Muslim Scholars
- West African griots: genealogies
- Thomas Aquinas: dictated the Summa Theologica (3100 pp) from memory
- Akira Haraguchi, age 60, recited Pi to 100,000 decimal places from memory in 16 hours in 2006

Client Education

- Your brain is not like a computer, coding every program used or website visited.
- Your memories change in response to new experiences. That’s what therapy does.
**Memory (summary)**

- Attention is critical to the coding of new memory
- A moderate degree of anxiety works best to facilitate neuroplasticity and new memory
- Make information to be remembered meaningful and emotionally relevant
- Memories are reconsolidated every time they are recalled within the context of the present moment—this is a main factor in therapy

---

**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).
Client Education

• Just as your car needs shock absorbers for bumpy roads, so too can you develop the durability to adapt to daily challenges.

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).
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.

---

Client Education

- The thermostat for stress in your brain needs to be reset.
- You can reset it by deciding that the feelings that you are having represent excitement for a challenge not anxiety about danger.
Allostatic Load

- ↑ cortisol in the evening ↓ sleep
- Sleep deprivation ↑ cortisol and glucose in the evening
- ↓ vagal tone
- R-PFC overactivity ↑ cortisol and NE
  - ↓ Natural Killer cell activity

• 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
Applications

Autostress Disorders
- Generalized Anxiety Disorder
- Panic
- PTSD
- OCD
- Depression
Medical and Drug Related Factors that Mimic Anxiety

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

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)
Balancing the ANS

Activating the PNS

- Diaphragmatic Breathing: Stretch
- Yoga
- Meditation
- Cuddling
- Orgasm
- Pulling the Kegel
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.

Client Education

• Your breathing speed and your heart rate are interconnected.

• As you learn to breathe more slowly and deeply your heart rate will slow, allowing you to enjoy a calm and clear frame of mind.

• Deep diaphragmatic breathing allows your lungs to fill to capacity. Emphasize the exhale.
Hypocapnic Alkalosis

- The excessive dissipation of carbon dioxide leads to hypocapnic alkalosis, making blood more alkaline and less acidic. This leads to the following:
  
  » Vascular constriction, resulting in less blood and less oxygen released to the tissues and the extremities.
  
  » The paradox is that though too much oxygen is inhaled, less is available to the tissues.

- Symptoms:
  
  – cerebral vasoconstriction, which leads to dizziness, light-headedness, racing thoughts, feelings of unreality,
  
  – peripheral vasoconstriction, which leads to tingling in the extremities.

Jane’s Song

B—Breathing, sympathetic arousal

A—Anxious attachment to anxious mother, father codependent

S—GAD, need for parasympathetic activation

E—Breathing exercises with song Silent Night, REAL mnemonic
**GAD -- Cognitive features**

- **Attention**
  - slow to disengage from negative stimuli
  - attentional resources allocated to threat

- **Judgment**
  - overestimate negative outcome to a neutral stimulus
  - judge negative events that are self referent as being more likely to occur than positive events (Butler & Mathews, 1983, 1987)

**GAD -- Cognitive features**

- **Meta cognitions -- beliefs about worry**
  - “Worrying helps me cope.”
  - “If I worry I can prevent bad things from happening.”
    - or
  - “My worries are uncontrollable.”
  - “Worrying is harmful.”
    - or
  - “I feel anxious, so there must be a reason why.”
Worry Loop attempts dampen autonomic arousal only to crank it back up.

Interrupting the Worry Loop
Cognitive Exposure Exercises

• For fears of personal inadequacy take risks and survive mistakes
  – Admit a personal mistake to someone
  – Express an opinion on a subject with limited knowledge
  – Complete a task in less than perfect fashion
  – Make a decision without reassurance

CBT vs. Metacognitive Models

<table>
<thead>
<tr>
<th>CBT</th>
<th>MC Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale=control</td>
<td>Rationale=relinquish control</td>
</tr>
<tr>
<td>Cognitive restructuring</td>
<td>Thought Diffusion</td>
</tr>
<tr>
<td>Breathing retraining</td>
<td>Observe &amp; accept</td>
</tr>
<tr>
<td>Interoceptive exposure to lessen fear &amp; avoidance</td>
<td>Interoceptive exposure with acceptance of internal cues</td>
</tr>
<tr>
<td>Situational exposure to lessen fear and avoidance</td>
<td>Situational exposure to achieve life values and goals</td>
</tr>
</tbody>
</table>
REAL not GAD

“R” is for relaxation, including deep breathing, stretching, self hypnosis, mediation, and prayer to activate your parasympathetic nervous system and increase vagal tone.

“E” is for exposure such as in scheduling an hour of worry time, allowing focused exposure to all your worries, and giving your higher brain a chance to work on developing the capability of dealing with the ambiguities inherent to life.

“A” is for acceptance. Since there is no ultimate certainty with much of life, acceptance of uncertainties allows worries to fade into the texture of normal living.

“L” is for labeling. When you have an anxious thought you can label it as just “an anxious thought,” thereby detaching from the feeling of anxiety.

Deborah’s Worry Loop

B—OFC hijacked by amygdala
A—Critical gambling father, worrying mother
S—GAD, need for ambiguity acceptance
E—Exposure to ambiguity especially to boring part of one hour worry time, until there is no energy anymore, REAL mnemonic
Neurodynamics of Anxiety

• Two routes to the amygdala, the fast and slow

• Right frontal bias in general for anxiety disorders

• Under-activation of the left frontal lobes and in Broca’s area explains why some people feel “speechless” when they’re scared (Rauch et al., 1997)

Slow Track—Leaning Forward

– *Automatic thoughts*—fast track impulse—interrupt with curiosity and time

– *Assumptions*—from pessimism to incremental optimism
  • “I’m working on it.”

– *Core beliefs*—existential self descriptor
  • “I’m a survivor.”

• Global/Passive (R-PFC) vs. Detail/Action (L-PFC)
Shifting Perspective to Speed Up the Slow Track

• Labeling thoughts—"That is an anxiety provoking thought" vs. "This makes me anxious!"—R-vmPFC

• Externalizing—"What would another person in this situation say and how is s/he right?"

• Temporal Distance—"How will I sensibly view this situation in six months?"

• Humor—"What is funny about this?"

• Wisdom—"How can I grow from this?"

Avoidance: the Polarizer

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

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.
There are a variety of interoceptive exercises including:

- Running in place--- to increase heart rate and hyperventilation
- Holding your breath--- to simulate sensations of suffocation
- Spinning--- leading to dizziness
- Hyperventilation or breathing through a straw---leading to light-headedness

- 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
**Exercise and Anxiety**

- Since fight/flight is meant for action exercise provides the method to feelings – take action.

- Exercise:
  - Reduces muscle tension
  - Builds brain resources (neuroplasticity and neurogenesis)
  - Increases GABA and serotonin
  - Interoceptive exposure
  - Improves resilience – self-mastery

**BBT and Panic Disorder**

- Desensitizing the Amygdala—Avoiding avoidance
- Interceptive exposure exercises—Embracing body sensations
- Speeding up the slow track—Getting the pre-frontal cortex involved
“B” is for body. When you feel your heart race or breathe too fast just ride it out. Say, “I can befriend my own body!

“E” is for exposure. Through interceptive exposure exercises you can regain tolerance to body sensations. Say, “this is not a heart attack but just my own body sensations that I’ve felt many times before.”

“A” is for the amygdala. With its fast and slow tracks. “I can learn to slow down my fast track and speed up my slow track.”

“T” is for thinking. To speed up your slow track, remind yourself that what you think is happening has a dramatic effect on what you feel is happening.

Post Traumatic Stress Disorder
Chronic, severe, inescapable

- War Zones
- Rape
- Child abuse
- Elder abuse
- Domestic violence
- POWs and refugees

Risk Factors for PTSD

- Greater distress before/after the trauma
- Poverty and low socioeconomic status
- Previous or current psychiatric disorder and poor affect regulation
- Family discord and/or insecure attachment
- Cognitive disengagement at the time of the trauma and dissociation involving depersonalization and derealization
  - Especially with early and repeated trauma
Time Sequence

Neurochemical Dysregulations

- Decreased serotonin
- Hypocortisol
- Increased cortisol
- Increased proinflammatory cytokines
- Decreased opioids
- Decreased GABA
- Decreased BDNF
PTSD Neurodynamic Aspects

- ↑ amygdala—general false positives for threat
- ↓ mPFC especially the ACC (reduced neurointegration and cortical volumes) \( \text{(De Bellis, et. al., 2000)} \) (inadequate top down inhibition of the amygdala)
- ↓ hippocampus (cortisol, excitotoxity, blocking of neurogenesis)

Window of Tolerance

Arousal Capacity "window of tolerance"
Trauma Responses are Autonomically Driven

Hyperarousal-Related Symptoms:
High activation resulting in impulsivity, risk-taking, poor judgment
Chronic hypervigilance, post-traumatic paranoia, chronic dread
Intrusive emotions and images, flashbacks, nightmares, racing thoughts
Obsessive thoughts and behavior, cognitive schemas focused on worthlessness and dread

Hyperarousal

"Window of Tolerance"*
Optimal Arousal Zone

Hypoarousal

Hypoarousal-Related Symptoms: Flat affect, numb, feels dead or empty, "not there"
Cognitively dissociated, slowed thinking process
Cognitive schemas focused on hopelessness

Possible Neurochemical Vulnerability of PTSD

• ↑ NE post trauma may predict PTSD (Yehuda, et al., 1998)
• ↑ cortisol in the evening not in the morning
• ↑ proinflammatory cytokines post trauma
  – The secretion of IL-6 inflammatory cytokines can be triggered by B-adrenergic receptors with ↑ NE
  – Inflammation can occur post trauma via CRH/substance P-histamine axis with ↑ cortisol and IL-6 (Elenkov, et al., 2005)
Cortisol Cascade Model

- Stress causes over-production of cortisol
- Excessive cortisol causes dendrites in the hippocampus to shrivel up (Sapolsky, 1996)
  - PTSD patients with smaller hippocampi (Bremner, 1999)
- This feedforward loop leads to heightened reactivity of amygdala
- The hippocampus is essential for turning off HPA axis and damage to it leads to even more cortisol release as time passes

Hippocampal atrophy
Memory Reconsolidation

• Every time a memory is retrieved the underlying memory trace becomes once again fragile
• The memory trace goes through another period of consolidation
• Beta-adrenergic antagonists (i.e. propranolol) blocks reconsolidation of implicit fear-based memories by indirectly influencing protein synthesis in the amygdala (Debiec & LeDoux, 2004)

PTSD and Memory

• People with PTSD typically remember that the traumatic event occurred
• But describe blank periods, gaps, between vague details
• Recollection for details are often unclear, and disorganized (Harvey & Bryant, 1999)
Research on PTSD Treatments

- Institute of Medicine (IOM) 2007 Review
  - Thorough review of psychotherapy research for PTSD (requested by the VA)
- Treatments not found to have clear empirical support:
  - EMDR, group therapy, hypnotherapy, eclectic, CBT alone….
- Exceptions: review found strong efficacy of exposure:
  - Prolonged Exposure (PE)
  - Cognitive Processing Therapy (CPT)

Exposure

- Imaginal exposure (trauma memory)
  - Exposes client to memory of the trauma in structured, controlled way
  - Trauma exposure helps client in two ways:
    - Helps reduce anxiety associated with trauma memory (via extinction of conditioned fear)
    - Helps client organize memory into coherent narrative (calms overactive amygdala)
  - Generally need minimum of 12 sessions (CBT, PE, CPT)
    - CBT approach starts with psychoeducation, anxiety management, and coping skills
    - Minimum 4-6 imaginal exposure sessions (temp. increase of anxiety and re-experiencing symptoms)
    - Cognitive processing of trauma memory & associated meaning (beliefs)
- Situational exposure (CBT & PE)
  - targets avoidance of trauma-related situations (and agoraphobic avoidance)
- Interoceptive exposure
  - Targets “fear of fear” or somatic phobia (treatment for panic disorder)
Exposure

• An activity that provokes or triggers memories of the traumatic event:
  – Repeated or extended (prolonged) to objectively harmless but feared stimulus
  – For at least 20 minutes allows enough time to habituate and enough time to recoup with sufficient support
  – Also allows for the release of BE release
  – Start low—go slow
  
  Goal—for traumatic memories to lose their power
  – a disparity between what a client is feeling (i.e. fear) and the objective reality that there is nothing to fear in

PTSD Treatment

– Increased size and activity of DLPFC
– Increased size and activity of the hippocampus
– Decreased activity of the amygdala
– SNS activity within the window of adaptive elevation
– Decreased PICs
– Recalibrated HPA
### Affective Regulation of Condition Emotional Response (CERS)

- The skill of perceiving, labeling, and accepting emotion
- Identifying and modifying thoughts that exacerbate emotions
- Practical action—act in concert with values
- Insight into why/how the emotions are coming up
- Titrate the exposure within the window of Tolerance with the middle of the inverse “U”
  - Highest affect in the middle of the session then calm at the intensity curve at the end

### Activation

- Conditioned Emotional Responses (CERs e.g. fear, sadness, or horror)
- CERs are critical to trauma processing to extinguish emotional-cognitive associations to a given trauma memory must be:
  - Activated
  - Not reinforced
  - Counter-conditioned

  **Cells that fire out of sync lose their link—LTD**
Delaying tension reduction behaviors

• “Urge surfing”—ride it out, they are only temporary
• Hold off long enough to defuse the power
• The upsetting feeling will eventually become tolerable
• Don’t try to change the feeling but change your relationship to it.

Dual Processing Theory

• Limitations of the “fear network” theory – doesn’t account for implicit memory:
  – Verbally accessible memories (VAMs) on the conscious memory level. VAMs can be accessed in therapy through deliberate recall.
  – Situationally accessible memories (SAMs) non-conscious. SAMs are only accessible through exposure cues that activate the non-conscious network (Brewin, Dalgleish, and Joseph, 1996).
The Explicit system

- Verbally accessible memory (VAM) system—the narrative—autobiographic
  - Can be deliberately retrieved (Brewin, 2005)
  - Cortex and hippocampus
  - Past, present, and future
  - Available to verbally communicate
  - Restricted by attention and arousal
- Traumatized people use the VAM system to evaluate the trauma
  - They ask themselves “could it have been prevented?”
  - “What are the consequences….the meaning?”

The Explicit system

- VAM system memories are accompanied by “secondary emotions” (not experienced at the time of the trauma)
  - Directed at the past—i.e. regret or anger about the risks taken
  - Often involves guilt or shame over perceived failure or not preventing the event
  - Thoughts about the future—i.e. sadness at the loss of cherished plans or hopeless at the thought of not finding fulfillment
The Implicit System

- Lower level perceptual processing—too briefly apprehended to be bounded together in consciousness memory required for VAMs
  - Sights
  - Sounds
  - Physiological sensations including changes in heart rates, temp, or pain

The Implicit System

- Primary emotions—fear, horror, helplessness
- Accounts for flashbacks that can be triggered involuntary by cues related to the trauma (sight/sounds etc.)
- Not structured by verbally coded memories—therefore more extensive
- The more drawn out the trauma, the greater the tendency to experience a range of sensations and emotion
- Difficult to access in therapy
Client Education

• Though the flashbacks seem to “happen out of nowhere” they may be triggered by the same body sensations that you felt during or right after the trauma.

• Our work together will help you tolerate those sensations so that they don’t trigger flashbacks.

Explicit and Implicit interactions

• SAM—implicit memory—amygdala related to the intensity of emotions
• VAM—explicit memory—hippocampus related to context and time
• SAM flashbacks occur via the fast track to the amygdala and override the VAM system
• ↑ cortisol and catecholamines impair the VAM system and kindle the SAM
Client Education

• Every time you go through this exposure exercise it will get easier.

• The higher parts of your brain, will rewire to put the brakes on the alarm button in the lower part of your brain.

Therapeutic Explicit and Implicit Integration

• Deliberately maintaining attention on the content of flashbacks w/o avoidance--SAM memories can be encoded in the VAM system.

• The timeless qualities of the SAM images and sensations get linked with spatial and temporal context—within the safety of the therapeutic relationship

• “I’m safe now—those things that that happened to me in the past”
Converting traumatic memories into meaning

- Traumatic memories are fragmented and disorganized into “hotspots” which can spur flashbacks.
- Hotspots occur where there is maximal functioning separation between SAMs and VAMs (i.e. less integration) (Brewin, 2005).
- They need to be integrated and converted into a coherent and an organized form to reduce the risk intrusions into flashbacks (Ehlers & Clark, 2000; Conway & Playdell-Pearce, 2000).

Explicit and Implicit Integration

- The process needs to be repeated for:
  - Neuroplasticity—the inverted “U”
  - To neutralize the traumatizing quality of the SAM system
  - So that VAMs can compete with SAMs and integrate them
- The new VAM system puts the SAM system in perspective.
Orienting Response, REM, and Memory

• Somatic stimulation of the orienting response (i.e. via EMDR, EFT, acupressure etc.) involve:
  – *Shto takoe?* (Что такое? or *What is it?*)
  – Reorienting of attention -- triggered automatically when a sudden movement grabs attention or intentionally when you chose to look at an object
  – The reorienting of attention requires you to release your focus on one location so that it can shift to a new location

• The shift in attention involves:
  – The orienting response (Sokolov, 1990)
  – Induces REM like state

• Both facilitate cortical integration of memories (Stickgold, 2002)

Shifts in attention and asymmetry

• Why activate the RH when it is already overactive? How about tapping the right hand and/or foot?

• The right limb tapping method still includes:
  – reorientation response
  – attentional shift
  – grounding

• This method is portable—the client can practice on his own (neuroplasticity)
Client Education

• I’m going to ask you to direct your attention to the specific movement while at the same time you describe the traumatic event.

• This will help you reset your brain so that it will no longer be stuck in the past and you can move ahead to a positive future.

BBT and PTSD

• Phase 1: Psychological first aid—stabilizing ASD and preventing PTSD

• Phase 2: Integration of implicit and explicit memory systems:
  – Explicit memories (VAMs) – The conscious memory level, which can be accessed in therapy through deliberate recall.
  – Implicit memories (SAMs) – The nonconscious, which are only accessible through cues that activate the network.
  – Aided by somatic reorienting method
  – Phase 3: Posttraumatic growth—developing meaning and direction (Constructivism)
SAFE from PTSD

“S” is for stabilizing. To establish a healthy foundation for recovery.

“A” is for acceptance of what happened. No victimization on one extreme or on the other of event(s) that occurred in the past.

“F” is for future. To visualize a hopeful posttraumatic growth.

“E” is for exposure. To confront the feelings and sensations that trigger flashbacks.

Bret’s BASE

B--Increased amygdala and dampened hippocampus—Substance abuse

A--Buddy connection

S--Numbing, re-experiencing (barbecue) and avoidance

E--New Narratives—Exposure at McJack Jr’s—Posttraumatic Growth
OCD

Structures with Roles in OCD

• Striatum-- gate is left open for habit
  – caudate part serves as a gate for thoughts and emotions
  – putamen part serves as the gate movement
• Anterior Cingulate Cortex-- error detection
• Malfunctions in the action of Glutamate
• Orbital frontal cortex-- gets flooded with information and generates error messages:
  – “Better do something!” Then you engage in compulsive behaviors to “make it right.”
The Habit Brain and OCD

Cues: e.g. an emotional state, stress, fatigue, addictive cue

Ignites a Behavioral routine: previously associated with reward or relief (e.g. counting, food, sorting, bite finger nails, hair pulling, tics…)

Flooded OFC in OCD

- OFC flooded with nuisance info and tries to make sense of it
- Given its inhibitory role pts try to use it to “stop that thinking!” But that results in a paradox—“try not to think about pink elephants”
OCD: failure of top down control

Pulling Out of the OCD Circuit

- Prefrontal Cortex (DLPFC and OFC)
  - DLPFC—Breaks out of auto pilot and decides “time to do something new”
  - With help the OFC can now learn to inhibit the amygdala and the fear network
- Anterior Cingulate Cortex—error correction
- Hippocampus—provides context and what is worthy of fear
  - Remembers that you engaged in a compulsive behavior that never seems to solve the problem.
Strengthened Pathways and Improved Gating

DLPFC

Anterior Cingulate

Caudate

Top-Down Control

ORDER

• O—Observe--the OCD thoughts and behaviors.
  – DLPFC activation.
  – Attention key first step for learning something new.
  – Break out of autopilot
Client Education

• The first step in breaking the OCD habit is to observe what you are thinking and about to do, as if you are watching someone else. This will shift you out of autopilot and interrupt your OCD habit.

• For example, when you ride a bicycle as soon as you observe how you are peddling or keeping your balance, you start to wobble as if to cast doubt upon it.

ORDER

• R—Remind--By reminding that obsessing itself is the problem, not what is being obsessed about:
  – call it a symptom of the brain's OCD habit and nothing more to be concerned about.
  – “This is just OCD.
Client Education

• Remind yourself that obsessive thoughts and compulsive behaviors are simply your OCD habit. This helps to shift from the feeling that you need to do something to the knowledge that you don’t.

ORDER

• D—Doing--By doing something different than the usual OCD compulsive behaviors establishes a new practical habit. The new behavior draws attention and interest to expand upon:

  –The new habit builds a system of practical and enjoyable behaviors through neuroplasticity.
Client Education

- Every time you feel the need to do your old OCD habit do the new habit instead. Make the new on practical and enjoyable.

- By doing the new habit it branches out into other positive activities related to it.

ORDER

E—Exposure--to the situation or place that had been intolerable. Exposure allows habituation.

– Taming of the amygdala
Client Education

• When you do not engage in your old compulsive behavior, while you are exposing yourself to the situation. The discomfort will eventually pass.

ORDER

R—Response Prevention--Refraining from compulsive behaviors that contribute only to momentarily “feeling better.”

This step strengthens the inhibitory circuits
Client Education

• When you prevent yourself from engaging in your compulsive ritual note that nothing bad seems to happen other than feeling uncomfortable.

• This strengthens the top down brain networks that shut off OCD.

ORDER for OCD

O is for observing the obsessive thoughts and behaviors. The shifts you out of autopilot.

R is for reminding that yourself that the obsessive thoughts are mere symptoms of OCD.

D is for doing something practical and enjoyable rather than the usual compulsive behaviors.

E is for exposure to the situation, objects, or place that is intolerable which eventually makes it tolerable.

R is for response prevention which strengthens all your ability to shut off OCD.
Penelope’s BASE

B—Straitum’s open gate for the OCD habit – OFC gets flooded (DLPFC activation to break out of autopilot)

A—Forming an alliance based on the marital inequity

S—Conceptualizing the need to address the OCD with the felt need to clean up the disorder in her marriage.

E—Exposure Response Prevention methods with EBP and the ORDER system

Illness and Depression

• Anemia
• Mono
• Asthma
• Diabetes
• Hepatitis
• Congestive Heart Failure
• Hypothyroidism
• MS
• Obesity
• inflammation
• Medications, drugs, and alcohol
**Bottom Up**

**Medication SSRI**

8 wks treatment
Ham Score drop: 20±3 to 7±4

Primary Targets: LIMBIC
- ↓ neg mood, emotional reactivity
- ↓ body state, stress responses
- ↑ drive, motivation

---

**Top Down**

**Cognitive Behavior Therapy**

16 wks treatment
Ham Score drop: 22±3 to 6±4

Primary Targets of CBT: CORTEX
- ↑ awareness of body state reaction
- ↑ cognitive re-appraisal of stimulus/response
- ↓ self referencing, personal salience

---

Pezawas, 2005
Ongur, Price 1997
Haber, J. Neuroscience 2000

Goldapple et al. Arch Gen Psych 61:34-41, 2004
Cytokines

• Protein molecules that act as cellular messengers

• Healthy people optimally regulate and balance pro-inflammatory (PIC) and anti-inflammatory cytokines.

• Too little PIC activity -- immunodeficiency, severe infection, and even death.

• Hyper arousal of PICs can cause death, or in illness, tissue damage, or shock (Granger, et al, 2006).

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, TNFα and lower IL-2
Pro-inflammatory Cytokines

- 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).

One Condition – Many Imbalances

One Imbalance – Many Conditions
Client Education

- Feeling ill makes you act ill and if you do, the feelings of depression will increase.

Bidirectional Systems of Depression

- Mood changes (dysphoria, hopelessness, suicidality, anhedonia, anxiety)
- Circadian dysregulations (low drive, energy, appetite, sleep, libido)
- Motor deficits (slow movement, restlessness, agitation)
- Cognitive impairments (poor attention, working memory, executive functions, ruminations)
Cultivating Depression

- Pessimism
- Passivity
- Self-critical
- Apathy
- Inactivity
- Alcohol/drugs
- Dehydration
- No SEEDS

Gender Differences and Depression

- 2:1 women > men—Only Post pubescence
- Male symptoms—anger, irritability, recklessness
- Female symptoms—sadness
- 4:1—men from suicide
  “Women seek help, men die”
Gender differences and depression

- Premenopausal women respond best to SSRIs (Kornstein, 2008)
  - SSRIs work best in the presence of estrogen
- Men respond best to Wellbutrin and Tofranil – targets DA and NE
- Postmenopausal women also respond best to non 5-HT meds
- Male brains make 5-HT faster and generally have more available

Stress and Depression

- Stress and depression are closely linked
  - Amygdala turns up the HPA and the SNS
  - Hippocampus turns down the HPA but may become impaired

Up to 19% of chronically depressed pts with hippocampal atrophy

NE and CRH reduces 5-HT and + risk of depression
Stress Induced Depression

• ↓ DA, NE, and 5-HT as much as 90 minutes post stress (Irwin, 2000)

• ↓ DA is associated with psychomotor retardation

• Psychomotor retardation is associated with ↓ blood flow to the PFC

• L-PFC can inhibit negative affect ↓ amygdala activation (Davidson & Sutton, 1995)

Hemispheric Asymmetry

• Evidence from neurology—strokes
  – Left side stroke—catastrophic effect and become very depressed
  – Right side stroke—laissez-faire effect and demonstrate more acceptance and much less depression

• Relative inhibition of the left PFC and relative activation of the right PFC (Davidson, 2000).

• Left PFC associated with positive emotions, putting a positive spin on adversity, and is action oriented

• Right PFC associated with negative emotions and is passive--withdrawal oriented
Re-balancing Hemispheric Asymmetry

• Instead of putting details into context, depressed patients are overwhelmed by a global negative perspective.

• Creating a constructive and goal oriented narrative generates positive, optimistic emotions which are all products of robust left hemispheric functioning

• Behavioral activation (left PFC) is one of the principal EBPs for depression

Effort-Driven Reward Circuit

• Nucleus accumbens-striatal PFC network
  - ↓ accumbens—loss of pleasure
  - ↓ striatum—sluggishness and slow motor responses
  - ↓ PFC—poor concentration

(Lambert, 2008)
Client Education

• When depressed, if you do what you feel like doing, which is not much, you will become more depressed.

• Inactivity will fuel your depression.

Effort-Driven Reward Circuit (Lambert, 2008)

• PFC activates when you plan an activity

• Striatum activates as you do it

• Accumbens activates when you feel the pleasure of doing it

• All the above increases the sense of self control
**Effort-Driven Reward Circuit**

(Lambert, 2008)

- Kindling this circuit by activities (Behavioral Activation)
  - ↑ DA and 5-HT
  - ↑ positive feelings
  - Reap rewards of problem solving

**Therapist vs Psychiatrists in Dx**

Therapists were three times as likely as MDs to see the issue as a relationship problem

Psychiatrists dxed depression and made scant mention of relationships
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)

Client Education

- Though you may feel like withdrawing from family and friends, it will only make you more depressed.

- Activating your social brain networks are key to your physical and mental health.
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
  – inverse relationship between exercise and depression (reviewed in Ratey, 2008)

Exercise and Depression

• Ohio State study---45 minutes of walking per day/ 5 days per week (heart rate at 60% to 70% of their maximum) lowered BDI mean scores from 14.81 to 3.27 compared to no change for controls (depressed non-walkers)

• Univ. of Wisconsin – exercise (jogging) as effective as psychotherapy for moderate depression
  – After one year 90% of exercise group were no longer depressed. 50% of psychotherapy group

• Duke Univ. – found that exercise was as effective as Zoloft
  – At 6 month follow-up exercise was 50% more effective in preventing relapse
  – Combining exercise and Zoloft added no benefit re: relapse (Babyak, et. al. 2000)

• NIMH panel concluded that long-term exercise reduces moderate depression.
• Exercise is the best antidepressant that we have to offer you.

• Better than medications, better than psychotherapy, and better than both combined.

• And it is cheap and there are good side effects!

DMN (in blue). All of the other colors are overactive in people with depression.
DMN and Depression

• The DMN increases when DLPFC is not engaged:
  – Stressed, bored, no novelty, or tired
  – Obsessive ruminations over negative experiences

Ruminations fade with:
• Goal directed behaviors
• Exercise
• Social activities
• mindfulness

Client Education

• When you find yourself drifting into ruminations bring yourself back to the present moment.

• Pulling out of the rumination stew and into the now will help you climb out of the black hole of depression.
Mindfulness and Depression

Targets depression by neutralizing:
- Monotony: via attention to novelty and cultivation of curiosity
- Ruminations: via wide spectrum observation and detachment
- Thinking errors: via affective labeling
- Fixations on imperfections: via acceptance

Client Education

• When you have a depressing thought, call it just that, a depressing thought.

• This will help you put distance between the thought and the feeling.
Meta-awareness: General Concepts

Decentering – thoughts and feelings are events—not realities
Intentionality – breaking out of automatic thoughts and behaviors
Reducing Avoidance -- facing difficulties
Anti-ruminative – here and now focus not the past or future

Shifting to Meta-Cognitive Awareness

• Target depression inducing thought:
  “I’m inept, so people don’t respect me.”
Whereas:
  CBT: Change that thought
  “I need to change the thought to I am capable.”
  Meta-Cognitive Awareness: Change your relationship to the thought.
  “Ha! There goes that thought that I am inept.”
Transcendent Awareness

- Mindfulness
- Acceptance
- Forgiveness
- Gratitude
- Compassion

Principles of Therapy - Depression

- Alliance
- Perspective shifting
  - New narratives
  - Behavioral activation
  - Affect regulation
  - Social brain networks—shared compassion
  - Present focus
Brain-Based Therapy

**Up regulate**

- **The Social Brain Networks**
  - Individual psychotherapy
  - Groups
  - Expanding social supports
- **Activity Reward Circuit**
  - Behavioral activation
- **Hippocampus**
  - Exercise
  - Rebuilding a positive explicit memory system
- **Prefrontal Cortex**
  - Mindfulness
  - Goal planning and follow-through
  - Meta-awareness

**Down regulate**

- **Right hemi withdrawal tendency by:**
  - Social engagement
  - Active behavior
  - Challenging negative generalizations
  - Humor
  - Labeling moods
- **The amygdala and the HPA axis by:**
  - Exposure
  - Exercise
  - Goal directed behavior
- **The ACC by:**
  - Challenging self-criticism
Brain-Based Therapy

*Interventions that bolster under-active areas of the brain*

- **Physiology**
  - Exercise
  - Sleep hygiene
  - Diet, including Omega 3
- **Hippocampus**
  - Counter mood-congruent bias with inquiry
- **Rebalance left PFC**
  - Details
  - Active
  - Goal directed behavior
- **Activity Reward Circuit**
- **Mindfulness**
  - Quieting ruminations and monotony

Client Education

- Because many factors can contribute to your depression you’ll need to do all the things we talk about doing simultaneously to climb out of depression.
TEAM for Depression

T is for thinking to defuse negativistic thinking associated with depression.

E is for effort, to activate the approach circuits of the L-PFC and the effort driven reward circuit.

A is for accepting that the world is not perfect and the things that happen are not always good.

M is for mindfulness to focus on the present moment and novelty of each experience, gratitude, and forgiveness.

Jim’s Goat

B- Behavioral activation- L-PFC

Diet (laying of the sugar and transfats) Aerobic boosting—BDNF Light chemistry (open the curtains)

A- Trust with a kindred spirit

Social medicine

S- Depressive spiral with no meaning
Abbreviation Glossary

- 5-HT—Serotonin
- AAI—Adult Attachment Inventory
- ACTH—Adrenocorticotropin Hormone
- ACC—Anterior Cingulate Cortex
- BDNF—Brain Derived Neurotrophic Factor
- CPT—Cognitive Processing Therapy
- CRH—Corticotropin Releasing Hormone
- DA—dopamine
- DLPFC—Dorsolateral Prefrontal Cortex
- DMN—Default Mode Network
- EFCs—Essential Fatty Acids
- GABA—gamma-Aminobutyric acid

Abbreviation Glossary

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