Eating disorders are biologically based brain illnesses influenced by environmental and psychological factors

**Bio-Psychosocial Model of Eating Disorders**

- **Biology**
  - Dieting/Food exposure
  - Genetics
  - Neurochemistry: Serotonin, Dopamine, Opioid, GABA
  - Neurobiology: Temperament, Traits
- **Environmental Factors**
  - Weight/appearance pressures
  - Media messages
  - Weight comments/teasing
- **Psychological Factors**
  - Stressors/suicide
  - Transitions
  - Identity/self-image
  - Trauma
  - Anxiety, depression
  - Substance use

**What Leads to an Eating Disorder Doesn’t Always Maintain It**

- **Risk factors** predispose some people
  - Genetics/Neurobiology
  - Trauma
  - Social influences (e.g., thinness ideal, weight teasing)
- **Precipitating factors** trigger risk factors
  - Dieting or significantly changing the way one eats
  - Stressful life events/transitions
- **Maintenance factors** take over
  - Biological changes that occur as a result of the eating disorder behaviors
  - Psychological factors that are connected to the eating disorder behaviors influence repetitive behaviors
But why do only some people get eating disorders?

- Many people diet/restrict/limit eating/overeat
- Many people have environmental and psychological risk factors
- Relatively few develop an ED
- Are there susceptibility factors that make some people vulnerable to dieting, weight loss, overeating?
- “Where” are these factors?
- How are they “triggered”?

Quick Neurobiology 101
Brain Components and Functions

- Prefrontal Cortex: Primarily responsible for orchestrating thoughts and behaviors based on internal values and rules. It is involved with complex behavior planning, expression of personality and interaction in the world.
- Anterior cingulate: Involved with higher level brain functions, including anticipating reward, making decisions, impulse control and emotion regulation.
- Insula: Plays a diverse role in sensory integration/processing, consciousness, emotion, and body homeostasis, including functions of perception, motor control, self-awareness, cognitive functioning, and interpersonal experience. May play a role in integration of emotion and thought.
- Amygdala: Part of what is called the emotional brain, this part of the brain is where the body responds to emotions, memories and fear.
- Hippocampus: This portion of the brain is used for learning memory, namely changing temporary memories into permanent memories which can be stored within the brain. It also helps people analyze and remember spatial relationships, so body movements are accurate.
- Brain Stem: Frequently referred to as the simplest and earliest part of the brain, brain stem is the home of the basic physiological functions of the body, including heartbeat, blood pressure and breathing.
- Spinal Cord: Functions to transmit signals from the brain to the rest of the body and back, serving as a conduit for sensory information, motor information, and coordinating reflexes.

Easy Model of the Brain

Systems Determining Food and Eating Regulation

- Brain down: Feeding behavior is mediated by a network of interacting neural circuits that include numerous areas of the brain, including the prefrontal cortex, anterior cingulate, insula, and amygdala
  - Neurochemicals such as gaba, opioids, and dopamine in the brain influence our experience of eating
- Gut up: The intestines send feedback to the brain via the vagal nerve to the central nervous system
  - Gut microbiome are likely significantly involved in creation of neurochemical messages back to the brain
Feeding behavior is mediated by a network of interacting neural circuits that include the hypothalamus, the dorsolateral prefrontal cortex (DLPFC), amygdala, striatum and the midbrain (Berthoud, 2011).

But it's not all top down: Bottom up regulation - Gut Involvement
“Melancholic microbes”: a link between gut microbiota and depression?

The Basics: Our Friends, the Microbiota, how they get there and what they eat

- Infant guts are populated by maternal bacteria and what they ingest after birth
- The average adult has 4.4 pounds of bacteria in their gut working hard to:
  - manufacture vitamins and essential compounds
  - build and stimulate the immune system
  - regulate digestion
  - contribute substrates that are believed to impact mood, appetite, weight, health
- Probiotics are the bacteria that we ingest
- Prebiotics are the indigestible stuff we ingest, mostly fiber and some starches that feed the bacteria living in the gut

What impact can the products of nutrition and the microbiome have in the brain?

Substrates (neurochemicals) of liking and wanting inform our understanding of why people keep eating even when not satisfied and how reward might be exaggerated or scant

- ‘Liking’: Response to the pleasure of reward
  - “Pleasures are mere sensations as they enter the brain, and brain systems must actively paint the pleasure onto sensation to generate a ‘liking’ reaction -- as a sort of pleasure gloss or varnish.” Kent Berridge, U Michigan
  - Neural substrates involved: Gaba and opioid systems
- ‘Wanting’: appetite and motivate systems; component of reward, but not pleasure
  - Neural substrate involved: Dopamine
What Do We See in the Brain Regarding Changes in Feeding Behavior in AN, BN, & BED?

- **AN**: There exists an anxiety-reducing character to dietary restraint (Kaye, 2003; Strober, 1995; Vitousek, 1994; Steinglass, 2010)
  - Fear of eating, loss of control; food causes anxiety, not pleasure
  - Decreased sensitivity to reward, increased sensitivity to punishment (Strober, 2012; Harrison, 2011)
  - Alterations of top-down circuits diminish, yet persist after recovery (Uher, 2003; Wagner, 2007; Kaye, 2009)
  - Altered “reward” impacts drive to eat

- **BN**: Overeating is thought to relieve dysphoria and/or anxiety (Abraham, 1982; Kaye, 1986; Johnson, 1982; Smyth, 2007; Crosby, 2009; Hetzler-Matt, 2011)
  - Stress, negative mood state, affective liability trigger BP episodes; alternate between fasting and binge
  - Heightened response to taste even when fed (Ely et al., 2017)
  - Exaggerated “reward” (wanting) impacts drive to eat

- **BED**: Overeating and eating in the absence of hunger linked to emotional state (Hebebrand et al., 2014)
  - Less so exaggerated liking
  - Disinhibited eating; exaggerated wanting, minimized liking impacts drive to eat

- **What about MICROBIOME DIFFERENCES??**

If you can’t turn off the trait, can you learn to turn it down?

- **Trait – Enhanced “Alarm”** like we see in people with restricting behaviors
  - Increased anticipation of danger or error can be helpful to stay safe; “What if?” repertoire of alternative plans a good strategy when persistence, attention to detail serves to ensure thorough consideration of options
  - Achievement oriented, attention details, concerned about consequences might make for a competitive advantage in certain professions
  - Modulate attention to stimuli with rest, movement, creative outputs, mindfulness

- **Trait – Impulsivity** like we see in people with binge and/or binge/purge behaviors
  - Risk-taking behaviors can spur action, new discovery; fun, relationships
  - Increased ability to “act” rather than “anticipate” can be helpful in some situations; dangerous in others.
  - Seeking new experiences opens up new frontiers and suits some professions well
  - Modulate attention to risk with mindfulness, creativity, and planning skills to decrease negative outcomes of impulsivity and manage chaos
So given all this trait & neurobiology information, how might we use it with clients?

**Step One: Reframing Traits in Illness and Recovery**

<table>
<thead>
<tr>
<th>Eating Disorder</th>
<th>Recovery</th>
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<tbody>
<tr>
<td>Persistence</td>
<td>Commitment</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>High standards</td>
</tr>
<tr>
<td>Obsessive personality</td>
<td>Attention to detail</td>
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<tr>
<td>Drive to thinness</td>
<td>Achievement potential</td>
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<tr>
<td>Harm Avoidant</td>
<td>Keen awareness</td>
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<tr>
<td>Impulsive</td>
<td>Action oriented</td>
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<tr>
<td>Chaotic</td>
<td>Willing to try</td>
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</tbody>
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**Next Step:** Neurobiologically informed skill development

- **Target Trait to Manage:** Harm avoidant, reduced reward
- **Trait in Lived Experience:** Anticipatory anxiety
  - Tool/Skill: Centering: Pre-meal breathing and centering with a poem/meditation before meal to reduce anticipatory anxiety
  - Tool/Skill: Pre-meal routine: Particularly soothing sensory component
  - Tool/Skill: Planning meals: With lower reward, repetition and planning gets the meal in without focusing on reward
  - Tool/Skill: Meditation: Greet the day upon waking and welcome it with gratitude, silently and softly resting in bed
  - Tool/Skill: Moving meditation: Mindful walk/yoga poses in AM and PM
  - Tool/Skill: Knowing when to eat: attend to schedule and appetite impacting emotions and situations
Next Step: Neurobiologically informed skill development

• Target Trait to Manage: Impulsivity
• Trait in Lived Experience when Ill: Difficulty bringing structure
  – Tool/Skill: Planning meals: bring structure to day
  – Tool/Skill: Pre-meal routine: consult meal plan; self monitoring
  – Tool/Skill: Planning meals: with higher reward, planning helps set limits
  – Tool/Skill: Meditation: Set intention for the day. Greet the day upon waking and welcome it with gratitude, silently and softly resting in bed
  – Tool/Skill: Moving meditation: Mindful walk/yoga poses in AM and PM
  – Tool/Skill: Knowing when to eat: attend to plan of eating to help regulate emotions and situations

Summary: What’s in the Neurobiologically Informed Toolkit?

• Understanding of neurobiology of eating disorders and trait management and optimization
• Recovery support skills
• Recovery toolkit
  • What will it take to maintain peace in their relationship with food, weight, and self?
  • What do other people in their life need to know about them, i.e. what does their ‘owner’s manual’ say they need?
  • How do you live in concert with values and needs in a greater society that is not typically supportive of such a way of relating to self?

And, all the neurobiological and gut health intervention is not just for eating disorders...which, of course, makes it more likely that we will see it in individuals struggling with eating disorders.
Our emerging science, practice, and response of our patients, in addition to the ever-changing nutritional marketplace, will continue to weave the story we read with great interest.
And your gut-mediated neurobiology