Healthy Gut, Healthy Brain

Healing Through Connection: Overcoming Trauma, Toxic Stress and Disease
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"It is reasonable to propose that the composition of the microbiome and its activities are involved in most, if not all, of the biological processes that constitute human health and disease."

Martin J Blaser, MD
J Clin Invest. 2014;124(10):4162-4165

Healthy Digestion

- 1-2 soft bowel movements per day
- Absence of bloating
- No abdominal pain
- No blood or mucus
- Unable to see pieces of food in the stool
- Able to consume small quantities of food

Bristol Stool Chart

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces. **Entirely Liquid**

Microbiome

- Over 100 trillion of naturally occurring bacteria
- Total weight: 2-5 lbs
- Gut **microbiome** represents this community of bacteria (microbiota) and the genetic material that comes along with them
- The gut microbiome is very frequently referred to as a *virtual organ* because of the profound impact it has on health and disease

Functions of the Microbiome

- Production of peptides and other compounds that act as neurotransmitters
- Vitamin synthesis (e.g. B12, biotin & K)
- Involved in immune regulation
- Provides a barrier from the outside world
- Protect us from harmful bacteria, parasites, viruses
- Help digest food

Microbiota

- Gut microbiota can modulate anxiety- and depressive-like behaviors in mice
- Can lead to molecular changes in the hippocampus, hypothalamus, and liver
- Also modulate the stress response

Germ Free Mice

- When under stress, they have a heightened response
- Produce more cortisol releasing hormone, cortisol, aldosterone --- stress hormones
- When the gut was repopulated, this resolved
- Microbiota affect sensitivity to stress

Imbalance

- Dysbiosis – condition of having microbial imbalances on or within the body
- Dysbiosis is most prominent in the digestive tract, but can also occur on any exposed surface or mucous membrane such as the skin, vagina, lungs, nose, sinuses, ears, nails, or eyes
- Can be from bacteria, yeast, fungus, parasites

Causes of Imbalance

- SAD = low fiber, high in fat & simple carbohydrates
- Broad-spectrum antibiotics
- Chronic maldigestion (including PPIs)
- Chronic constipation
- **Stress, Fear, and Anger**
  - Stress suppresses Lactobacilius, Bifidobacteria and sIgA
  - Catecholamines stimulate growth of gram negative organisms (Yersinia, Pseudomonas)
  - Anger or fear increases Bacteroides fragilis

Inflammation

Dysbiosis *causes* ***unchecked total body (and brain) inflammation*** that results in imbalances in your hormones, neurotransmitters, immune cells, growth factors, and metabolic parameters.

Natividad JM, Verdu EF. Pharmacol Res. 2013 Mar; 69(1): 42-51. doi:10.1016/j.phrs.2012.10.007.Epub 2012 Oct 23. Modulation of intestinal barrier by intestinal microbiota:pathological and therapeutic implications.

- Miller 2009: **Depression is an inflammatory process**, speculation in bipolar
- Dowlati 2010: **TNF-alpha** and **IL-6** elevated in meta-analysis of 24 studies of patients with Major Depression.
- Depression results in a release of **pro-inflammatory cytokines**, which create feelings of being ill.

Dowlati Y, Herrmann N, Swardfager W, Liu H, Sham L, Reim EK, Lanctôt KL. A meta-analysis of cytokines in major depression. Biol Psychiatry. 2010 Mar 1;67(5):446-57.
Miller AH, Maletic V, Raison CL. Inflammation and its discontents: the role of cytokines in the pathophysiology of major depression. Biol Psychiatry. 2009 May 1;65(9):732-41.

Gut-Brain Connection

- Gut has it's own nervous system: **enteric nervous system**
  - brain and enteric nervous system are actually developed from the same fetal tissue
  - sends and receives impulses, records experiences and respond to emotions

- Has it's own set of neurotransmitters
  - 90% of serotonin is made in the gut

- Connected by the vagus nerve, and the two systems are in constant communication

Gut-Brain Axis

- Components
  - central nervous system
  - neuroendocrine and neuroimmune systems
  - sympathetic and parasympathetic system
  - enteric nervous system
  - intestinal microbiota

- The gut and the brain may communicate through multiple mechanisms
  - immune responses
  - Vagus nerve
  - short–chain fatty acids
  - endocrine signaling
  - tryptophan metabolism

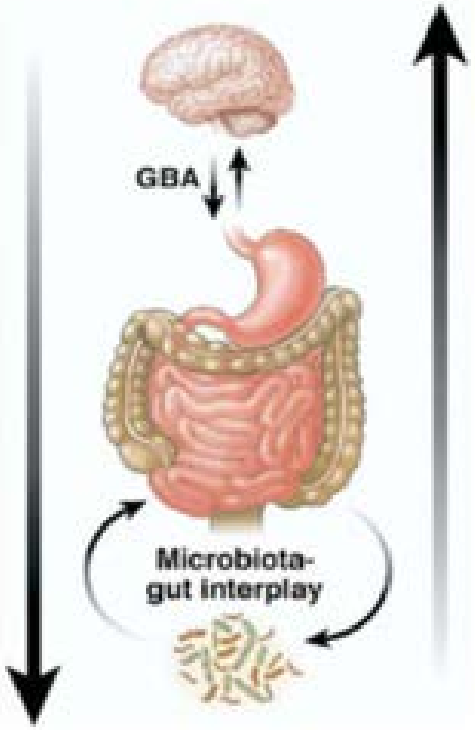
The Bidirectional Gut-Brain Axis

The ability of the brain to influence the intestinal microbiota

Perturbation of your normal habitat via stress-induced changes in gastrointestinal:

- Physiology
- Epithelial function
- Mucin production
- EE cell function
- Motility

Release of Neurotransmitters



The ability of the microbiota to influence brain, behavior, and mood

Activation of neural pathways to the brain

Activation of musosal immune responses

Production of metabolites that directly affect the CNS

Grenham S, Clarke G, Cryan JF, Dinan TG. Brain-gut-microbe communication in health and disease. Front Physiol. 2011;2:94. Epub 2011 Dec 7. PubMed PMID: 22162969; PubMed Central PMCID: PMC3232439

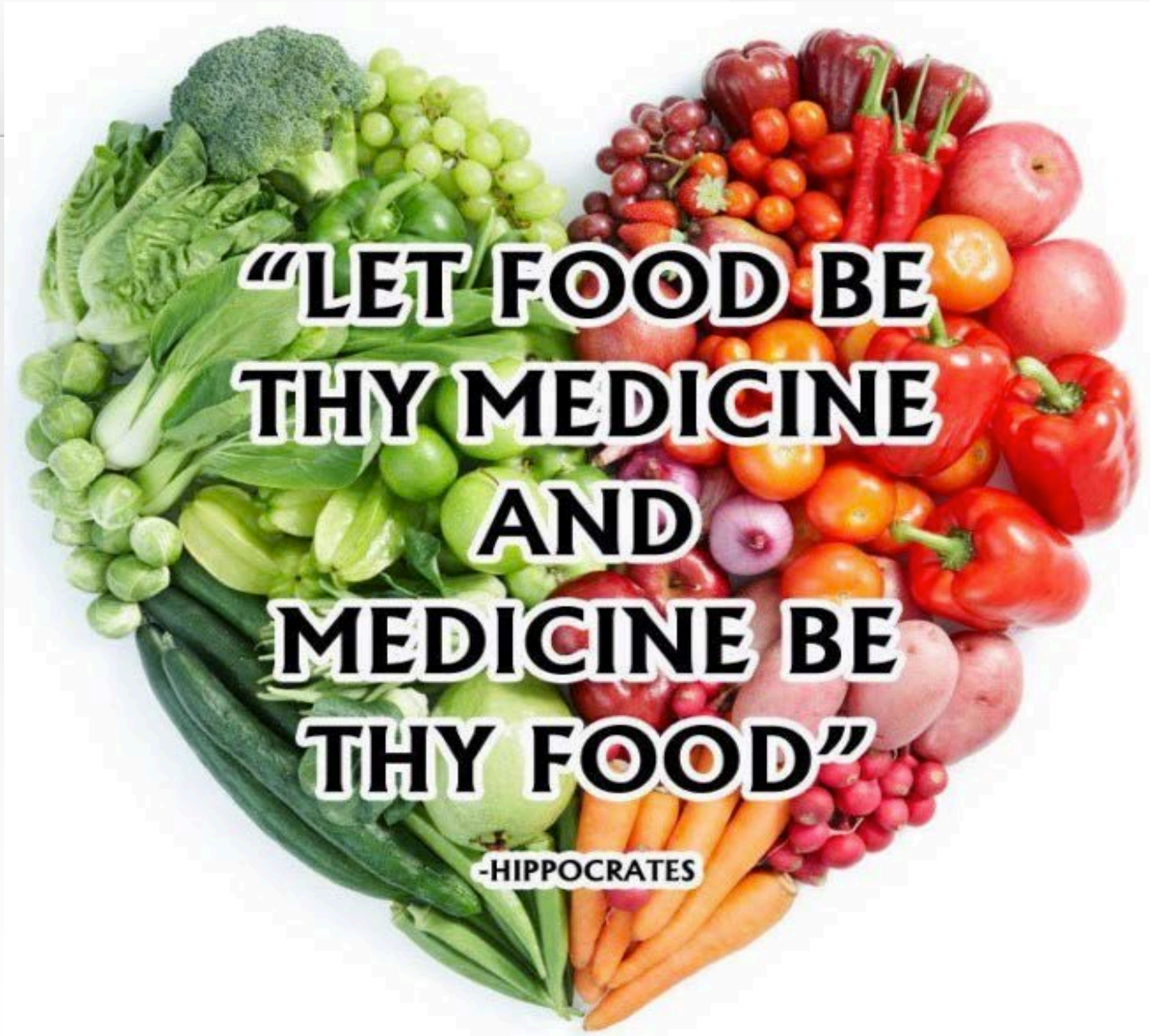
Irritable Bowel Syndrome (IBS)

- Stress-related brain–gut axis disorder
- Most common functional gastrointestinal disorder
- Affects an estimated 10–15% of the general population in Western Europe and North America[1]
- Abdominal pain or discomfort, an alteration in bowel habit, bloating, and the absence of reliable biomarkers

[1]Quigley E. M. M. (2011). Antibiotics in irritable bowel syndrome: a novel approach to a challenging disorder. Clin. Investig. (Lond.) 1, 479–48210.4155/cli.11.31

IBS

- Many studies have found a high prevalence of mood disorders such as depression and/or anxiety in patients with GI Disorders including IBS and IBD.
- Indicate importance of the gut–brain axis in the pathophysiology of mood disorders.
- Stress (catecholamines) – stimulate bacterial virulence factors and pathogenic bacteria to grow


"LET FOOD BE
THY MEDICINE
AND
MEDICINE BE
THY FOOD"
-HIPPOCRATES

How Do We Heal?

- Dietary changes to support microbiome
  - fermented food (sauerkraut, kimchi, natto, miso, conconut kefir)
  - eat a diversity of food (raw and cooked)
  - plant food
- Be careful with sugar, alcohol, poor quality fatty foods and processed foods
- Supportive eating habits
- Get into the parasympathetic state
  - deep breathing, meditation, prayer
  - chewing
  - singing
  - gargling

Thank you!