Chronic Inflammation, Systemic Health and the Future of Food As Medicine

The Gut Microbiome
The Gut’s Physical Structure

30 ft tube

Ridges of Muscle – Moving Food

Villi and Microvilli – Absorption
Extension of Our Brain

Gut Has 500 Million Nerve Cells and 100 Million Neurons
Which is the Equivalent of a Cat-Sized Brain

Chemical and Mechanical Sensing
Secretion of Enzymes and Hormones

50% of Dopamine originates in the gut
Nearly 100% of Serotonin does also!
Mucosal Layer and Gut Microbiome

The villi and microvilli are covered in a mucosal and bacterial layer.

New research is exploding about the role these bacteria have in our health and how our bodies function.

The research is pointing to a new lens through which to view and approach in treating and preventing disease.
Quack Science? New Fad?

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Prior to 2002 only way to study gut bacteria was culturing
In 2002, Gene Sequencing technology was developed
Allowed researchers to identify by unique genetic blueprint
This led to an absolute explosion in research
Your Gut is a Bioreactor

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Small Intestine - Where simple sugars are absorbed

Colon - larger, complex material (fibrous) is fermented by the bacteria creating Short Chain Fatty Acids - 5% to 15%

Proteins are needed to break down food materials and polysaccharides.

Humans have 20 genes dedicated to this

One bacterial strain can have 260 genes for this breakdown
Gut Bacteria are Very Small

10 trillion total human cells make up the body

100 trillion bacterial cells in the body

Over 1000 species meaning over 99% of genetic material in our bodies is not human!

Total bacterial weight = 6 lbs

60% stool
Gut microbes are essential for health and survival

Germ free animals, with sterilized guts:

- Nutritional deficiencies
- Poor growth
- Defective/leaky gut
- Defective immune system development
- Defective antibody production
- Very susceptible to infection (typically fatal)
Each person’s microbiota is unique to them (even twins)

57 species > 90% people share

75 species > 50% people share

The rest is shaped by environmental factors
Two main types in all individuals

1. Bacteroidetes - energy production, transport, metabolism
2. Firmicutes - CHO metabolism/vitamins

Functional core microbes are highly conserved in all people

- Breakdown of complex carbohydrates
- Synthesis of essential fatty acids
- Source of indispensable amino acids and vitamins

200+ species of core microbes and 800+ species of variable
Ever wonder why people react differently to meds?

They are metabolized differently according to what species and colonies of microbes are helping to break them down.

- Produce enzymes to alter their structure
- Produce factors that can interfere with their action
- Alter how tissues (liver and gut) break them down

In the future, people will be prescribed drugs according to the microbial makeup of their gut.
Gut microbes influence their host’s food choices! Wait, what?!?

The makeup and diversity of the bacterial biome is mostly selected and maintained by the food we consume and how we behave in the environment (remember 800+ species vary)

People in different parts of the world have vastly different microbial diversities.

Gut bacteria, by influencing how our bodies work, influence our appetite and food preferences

They actually release neurotransmitters encouraging you to eat what they need to survive.
YOUR FOOD CHOICES Dictate WHICH COLONIES OF BACTERIA THAT WILL FLOURISH.

The type of gut bacteria you have, dictates what foods you will crave.
Stress and the microbiota

Psychological stress increases the circulating levels of the hormones epinephrine and norepinephrine (adrenaline) - fight, flight or freeze hormones.

These two hormones affect bacterial growth, increasing the growth of specific bacteria 10,000 fold.

Bacterial diversity greatly changes in studies of mice put under stress.
Neurotransmitters

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GABA - inhibits neural receptors

Benzodiazepines, ethanol (yumm!) and muscle relaxers

Probiotic foods promote the production of GABA

Dopamine - 50% originates in the gut

Serotonin - nearly 100% originates in the gut

Instead of SSRI’s (keep’s serotonin from being recycled by the body), we could promote healthy serotonin production!
Microbiota products that can alter host behavior/health

- Energy and metabolism (Fatty Acids)
- Cell growth and metabolism (Vitamin K)
- Blood coagulation (Vitamin K)
- Neurotransmitters (tryptophan, serotonin, dopamine, GABA, noradrenalin, acetylcholine)
- Sleep and mood (HCA, HMS)
- Bad breath (putrescine)

People who have had gastric bypass surgeries have drastically altered food cravings and eating behavior.
Food cravings!

Food cravings are sent along the vagal nerve and can be blocked by changing the microbes.

Diversity in the microbiota leads to fewer food cravings, since specific cravings are the result of an overgrowth of a particular species. It’s their tool for survival!
How does this relate to inflammation and disease?

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Remember, 80% of our immune system is in our gut!

That bacterial layer is much like the soil of our gut, with the villi and microvilli being the roots for our body’s various systems.

All you gardeners know that plants are only as health as their soil!
Leaky Gut

Imbalances in microbes can lead to exposed and weakened spaces between cells.

The result can be leakage of foods directly into the bloodstream, creating inflammation and an immune response, which can target many different parts of the body.

The same imbalances can create inflammation directly in the gut, leading to most digestive conditions we know today.

Chronic inflammation, in any one area, leads to disease.
What the hell does this have to do with Obesity?

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When we have inflammation we retain and gain weight

When we eat crap, we promote the reproduction of bacteria that tell us to eat crap so they can survive (feedback loop)

Diets with little to no nutrition leave us with less than half the normal bacterial species in our gut

Most of those overpopulate and can create severe imbalances in hormones and neurotransmitters leading to so many of the chronic health conditions we see today.
Well that sucks!    Now what?

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Rebuild and balance your gut flora

Take probiotics

Eat a diversity of prebiotics (fruits, vegetables)

Learn what foods create inflammation in your body

Do an elimination diet (The Plan)

Keep a food journal

Be active, get outside, get dirty!
The Future of Food as Medicine

What are our society's biggest challenges applying this information?

Third generation of not knowing how to prepare foods

Healthcare practitioners without sufficient time to understand root cause of symptoms (15 minute appt)

Food education is not a focus of community health

Takes time for a generation of doctors to be trained with this knowledge (20 years from research to practice)

Eating healthy foods is expensive

School food is for profit (fast food quality)
The Future of Food as Medicine - Innovation

GAPS (Gut and Psychology Syndrome) – Dr. Campbell-McBride

Cured non verbal autistic son

Developed postdoctoral program at Cambridge

Diet developed not very practical for general population

Family Therapy programs using food preparation and education as base of teaching healthy interactions and building a knowledge base for living healthy lifestyles.
More Innovative Programs

Elderly care programs that go into the home and prepare nutritious foods for patients

- Plays into future decentralized health care model
- Infection rates (UTI, kidney, pneumonia) decrease
- Fills the biological need for nurturing
- Overall healthcare costs decrease
More Innovative Programs

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Farm-to-table school programs

Food education for children

Healthy breakfast and lunch

Reduces body’s natural response to being hungry and malnourished

Possible reduction in inflammatory symptomology and conditions
More Innovative Programs

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Anti-Inflammatory Centers

Psychiatric hospitals focused on rebuilding the gut biome and immune system.

Disease treatment that focuses on balancing the gut biome and immune system prior to starting other treatments

FMT (crapsule)
More Innovative Programs

Outdoor-centered learning

- Interaction with environment (get dirty!)
- Grow and learn about foods
- Exercise
- Much more natural and effective way to learn
- Can promote prosocial skills
- Vocational skills
- Seed to preserving programs
Your Turn

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What are your thoughts?
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