The Microbiome Matters
Part 3
2018

Teresa Martin MS, RD, CDE, LD
cdepower@hotmail.com
541-220-1136
Microbiome research is still growing at a rapid rate

Publications (journals, books, articles)
1972 = 2
1982 = 8
1992 = 23
2002 = 116
2012 = 5,512
2015 = 18,212
2016 = 24,224
In the last year...
25,724 peer reviewed articles
53 books and over 34,000 articles published
“death sits in the bowels’…. “
“bad digestions is the root of all evil“ ~Hippocrates 400BC

“If you don't like bacteria, you're on the wrong planet.”
~Stewart Brand
“trust your gut”- Rob Knight

“the 150 year old war against the microbes has got to stop” ~Larry Smarr

“the gut is the seat of all feeling”…..
“the junk food diet is one of the most important modifiable risk factors for depression for our adolescent population”
~Prof Felice Jacka

“we need to protect our friends with benefits”
“Food is a language that speaks to our genes” — Jeff Bland

~Slide image from Rob Knight
What will we cover today?

1. **Review (quiz)/Deeper Dive**
2. **Popular Questions**
3. **Crazy & New Discoveries**
4. **Teresa’s Top Ten Tips for 2018** (any changes?)
Disclosures

- None
- Senior Educator for the Novo Nordisk Education Program
- The information and ideas presented today are my own and are based on my experience and my review of the current research and literature
- These views do not represent the positions, views or opinions of Novo Nordisk Inc.
REVIEW
What do we still know about the human microbiome?

The human microbiome is huge, diverse, makes us unique, constantly adapting, complex, plays critical role in our health and wellbeing.
Joshua Lederberg coined the term “microbiota” in what year?

A. 1954
B. 1960
C. 1986
D. 2001
How much money are federal agencies pooling to forward the causes of the National Microbiome Initiative?

A. $667 million
B. $412 million
C. $121 million
D. $10 million
How much money did the Bill & Melinda Gates Foundation invest to study human and agricultural microbiomes?

A. $100 million
B. $10 million
C. $5 million
D. $1 million
Microbes play a role in 9 out of the top 10 global causes of death

A. True
B. False
Global Burden of Disease Study

- Huge global, regional, and national comparative risk assessment that is funded by Bill & Malinda Gates Foundation
- 1800+ researchers around the world
- 180+ Countries
- Most comprehensive study about health & risk factors for disease

What has this study found?

Poor diet is the second leading cause of early death across the globe

Number one in men, middle and high income countries

Over nutrition kills more people than undernutrition
What is a Poor Diet?

Not enough of what we NEED
- Fruit
- Vegetables
- Whole Grains
- Nuts & Seeds
- Beans
- Fiber
- Omega 3 FAs

Too much of what we DON’T NEED
- Red meat
- Processed meats
- Added sugar
- Sugar sweetened beverages
- Trans fat
- Sodium

~Professor Felice Jacka
Definitions

- Genome
- Microbiota
- Microbiome
- Metabolome
Alessio Fasano MD has a beautiful metaphor using a piano that helps understand how these all relate.

In his metaphor which is:

- The piano?
- The piano player?
- The music sheets?
what is possible

what appears to be happening

what makes it happen

what is happening
(Canaries of the Genome)
How big is the human microbiome? (~# of microbial cells)

A. 3,000
B. 3,000,000
C. 3,000,000,000
D. 39,000,000,000,000
What % human are we genetically?

A. 50%
B. 30%
C. 10%
D. 1%
What are some of the major sites of microbial colonization identified in the human body?

- Airway
- Oral
- Skin
- Urogenital
- Gastro-Intestinal
What are the two distinct microbiota populations in our gut?

Luminal

Mucosal
How long does it take for new babies to fully develop their gut microbiomes?

A. ~6 months
B. ~1 year
C. ~3 years old
D. ~6 years old
How do we define a healthy microbiome?

A. Diverse
B. Large Mass
C. Resilient
D. All of the above
What helps make a healthy microbiome?

- Vaginal Birth
- Breast Feeding
- Early exposure to dirt, whole foods, animals, pets, people, places
- Limited exposure to antibiotics—especially the 1st 3 yrs of life
- Playing outdoors
- Pets—dogs all ages—especially children (asthma)
- Adequate sleep
- Stress management—meditation, yoga
What else helps make a healthy microbiome?

- Exercise - outdoors
- Plant based diets
- High plant diversity
- Limited animal products - processed
- Limit processed foods (added sugars, emulsifiers, sugar substitutes)
- Limited exposure to antibiotics, PPIs, long term use of other medications
- Being young - see all 3 decline after 65yrs
Which of the following is a function of the gut microbiome?

A. Allow us to adapt to our environment faster than our own genes
B. Immune and protective functions
C. Digestion and metabolic functions
D. Play a significant role in the absorption and bioavailability of drugs and their metabolites
E. Major player in the gut-brain axis with a sig role in production of neurotransmitters
Functions of the gut microbiome

Allow us to adapt to our environment faster than our own genes will allow us to adapt

Lateral gene transfer & rapid reproduction

In 7 hours, one bacterium of E coli can generate

a. 1000 bacteria
b. 10,000 bacteria
c. 100,000 bacteria
d. 2,100,000 bacteria
Functions of the gut microbiome

Immune and protective functions

✓ Pathogen displacement
✓ Nutrient competition
✓ Receptor competition
✓ Production of anti-microbial factors (bacteriocins, lactic acids)
✓ Structural: barrier fortification, induction of IgA, role in maintaining tight junctions, immune system development

★ Disease may be due to missing microbes- extinction (4th gen)
Functions of the gut microbiome

Digestion and metabolic functions
✓ Break down our food to extract nutrients
✓ Determine how much energy we get and store
✓ Play a role in appetite control/eating behavior
✓ Influence lipid and cholesterol metabolism
✓ Influence our ability to metabolize polyphenols which allows them to have antioxidant benefits
✓ Influence our ability to synthesize essential amino acids and certain vitamins (biotin, folate, vit K)
✓ May help metabolize dietary carcinogens
✓ Involved in our bodies ability to make SCFA
What are SCFAs?

A. Fatty Acids that are made through hydrogenation to solidify liquid oils

B. A class of FA’s that can lower the levels of cholesterol and LDL in the blood - found in fish, walnuts, flaxseeds

C. A very beneficial microbial waste product that results from microbes fermenting certain fibers in our diet

D. Basic building block of lipids/fats with 14 or more carbons - found in olive oil, soybean oil, nuts, avocado
Deeper dive into SCFA’s (cont)

Most abundant types of SCFAs in humans include (~98%)

- butyrate
- propionate
- acetate

ENERGY
- Provide ~10% of our daily energy requirements

IMMUNE SYSTEM
- Lowers the colonic pH
- Provide intestinal barrier function-via activation of mucin
- Anti-inflammatory effects
Deeper dive into SCFA’s (cont)

Play a role in lipid metabolism
- Increase fatty acid oxidation in liver, muscle, and brown adipose tissue
- Inhibit storage of fat in white adipose tissue
- Decrease free fatty acids

Decreases FFA-induced insulin resistance
Deeper dive into SCFA’s (cont)

Impact weight, insulin signaling, glucose tolerance, intestinal transit time

- Alter expression and secretion of gut hormones (GLP-1, GLP-2, peptide YY, ghrelin)
- Provide gut-brain crosstalk to influence appetite, type of food intake, mood
Recent studies using SCFA’s

- Recent research has connected low levels of SCFAs to neurodevelopmental disorders such as Parkinsons, Bipolarism, PTSD, MS

- Oral administration of acetate and propionate decreased glycemia in mice

- SCFAs reduced plasma concentration of cholesterol (rodents and humans)

- SCFAs are currently being used to help treat UC, CD Colon CA and antibiotic-associated diarrhea (promising results yet limited)
What will your patients ask?

- How much fiber do we need to eat?
- Which type of fiber do these microbes like …soluble or insoluble fibers?
- Do over the counter fiber supplements work?
How much fiber?

Ancestors ate 100-130 grams/day
Tanzanians eat 100 gms/day
Current SAD: 5-15 grams/day

Current Daily Recommendations:
AHA, ADA: 25-30 gm
AND: 14g/1000 kcals (25-38 gm)
Microbiome Experts: 35-50 gm

Study—how much is upper limit?
50 gm—people get full
80 gm—max most people could consume in a day
What is better for our microbes... soluble or insoluble?

Switching definitions

**OLD**: (chemical definition)

**Soluble**- bind with FAs and help lower LDL  
(psyllium, pectin, gums, inulin, oligofructose, beta-glucans, resistant starch)

**Insoluble**- provide bulk and decrease colon cancer  
(cellulose, lignin)

**NEW**: (FDA- July 26th, 2018) (biological activity)

**Intrinsic fiber**- intact, found naturally in foods

**Synthetic fiber**- added fibers with beneficial physiological effects to human health
Current FDA approved intrinsic fibers

- Beta-glucan soluble fiber- bran fiber (heart dz)
- Psyllium husk
- Cellulose
- Guar gum (Regular Girl, SunFiber)
- Pectin
- Locust bean gum
- Hydroxypropyl methylcellulose-gluten free foods

? Inulin
Which fibers are best for SCFA production?

- Resistant starch
- Fructo-oligofructose (FOS)
- Inulin
- Cellulose
- Pectin
- Lactulose

★ May depend on the person and the microbes present
Food Sources that increase SCFAs

- Jerusalem Artichoke
- Bananas
- Onions
- Chicory root
- Garlic
- Asparagus
- Jicama Root
- Leeks
- Flaxseeds
- Barely
- Sugar beets
- Dandelion Greens
- Carrots
- Wheat Bran
- Oats
- Apples
- Konjac Root/Elephant Yam
- Burdock Root
- Yacon Root
Can’t I just take butyrate supplements?

- Not FDA regulated
- Butyrate has an offensive odor
- Free butyrate has been shown to be largely absorbed in the upper GIT
- The administration of a daily butyrate enema (10,000 mg/kg) benefited healthy individuals yet did not for pts with UC
- Not enough research to know which form and how much has the most benefit
Which of the following has been associated with the highest level of microbial diversity?

A. Organic foods
B. High plant diversity
C. Fermented foods
D. Intermittent fasting
Dietary Interventions that increase microbial diversity:

- High consumption of plant fibers (prebiotics)
- High-plant diversity
- Low-heat cooking
- Low-protein –esp animal protein
- Low-refined carbohydrates
- Fermented foods (probiotics)
- Organic (dirty dozen)
- Intermittent fasting
- High-polyphenols (green tea, red wine, legumes, flaxseeds, dark chocolate, coffee)
- High Omega 3 FAs
# Organic Matters

## Dirty Dozen
- Strawberries
- Spinach
- Nectarines
- Apples
- Grapes
- Peaches
- Cherries
- Pears
- Tomatoes
- Celery
- Potatoes
- Sweet Bell Peppers

## Clean Fifteen
- Avocados
- Sweet Corn
- Pineapples
- Cabbages
- Onions
- Sweet Peas
- Papayas
- Asparagus
- Mangoes
- Eggplants
- Honeydews
- Kiwis
- Cantaloupes
- Cauliflower
- Broccoli
Exercise and the gut microbiome

- Exercise increased butyrate concentrations in mice
- Exercise altered gut microbiota which results in decreased ghrelin and increased leptin
- Exercise initiated during early in life may have a more pronounced impact on the gut microbiota than exercise initiated in adulthood (mice) these changes were associated with a lean phenotype
- Exercise altered the gut microbiota and prevented weight gain in a mouse model on high fat diet-induced obesity
What can hurt a healthy microbiome and cause dysbiosis? (decreased diversity and decreased mass)

Wang and Roy
Which of the following have been found to contribute to dysbiosis?

- A. Emulsifiers
- B. GMOs
- C. Vaccines
- D. Moderate Alcohol
Studies have shown all the following things can limit/damage our microbial ecosystem:

- C-section
- Formula
- Sleep deprivation
- Smoking
- Inactivity
- Certain medications
- Repeated antibiotics
- Hand sanitizers
- Stress
- Highly processed diet (emulsifiers, nitrates)
- Diet high in added sugar (>25gm/day)
- High salt/nitrates
- Excess alcohol
- Insufficient fiber intake
- Animal protein
- Sugar substitutes
Dysbiosis has been observed in all of the following, except?

A. Diabetes
B. Autism
C. Dwarfism
D. Depression
E. Anxiety
F. Jet Leg
G. CVD
Gut Microbiota

- Metabolic syndrome
- Endotoxemia/septicemia
- Systemic inflammation
- Diabetes/Insulin resistance
- Obesity/Adiposity
- Cardiovascular diseases
- Rheumatoid arthritis
- NAFLD/NASH/HS
- Hypertension
- Endocrinial imbalance
- Colorectal cancers
- Diarrhea/constipation/Celiac disease/Gastroenteritis
- IBD/IBS/UC/Crohn’s disease
What else has been associated with microbial dysbiosis?

- Malnutrition
- Food allergies
- Eczema
- Anorexia
- Gout
- Osteoporosis
- COPD
- Jet Lag
- Insomnia
- Autism
- Multiple Sclerosis
- Parkinsons
- Alzheimers
- Depression
- Anxiety
- OCD
- PTSD
- ADHD

Lux Research, Eating for 100 Trillion: Symbiotic Metabolism and the Microbiome Revolution, March 2014.
Asthma

- Significant increased rates over last 50 years
- 25% of children suffer from asthma
- Highest rates are in developed countries (US, Canada, UK, Australia)
- Lowest rate - Africa

20% less like to get asthma if ....
- You have a dog
- Live on farm

20% more likely to get asthma if....
- c-section
- exposed to antibiotics before 3 yrs of age
Asthma (cont)

- 4 predictive species of microbes - if you are missing these at 3 months old your are much more likely to develop asthma

- In mice, gave these 4 microbes (FMT from humans) to asthma prone mice and it protected them from getting asthma

- Same microbes were not predictive of asthma if found in 1 year old
SLEEP-GUT Connection

- Gut microbiome produces and releases sleep-influencing neurotransmitters: dopamine, serotonin, GABA. Melatonin (and others)
- Circadian rhythms influenced by microbiome-when and what you eat matters
- Two nights of sleep deprivation in healthy female adults led to a microbiome shift that looks similar to what is found with obesity and T2DM
- Fragmented sleep led to microbial shifts and increased inflammation in just one night (OSA)
- Lactobacillus casei Shirota- found to improve sleep in stressed out college students prior to exam (100 students)
SLEEP-GUT Connection

- Dysbiosis observed in pts with **anxiety and depression** that trigger sleep disruptions
- **Stress** can induce microbial shifts that in turn disrupt sleep
- **Pain** - dysbiosis has been linked to increased sensitivity to visceral pain, pain can interrupt sleep and sleep deprivation can lead to increased pain perception
- **Melatonin** deficiencies have been associated with increased gut permeability (leaky gut)
- **Cortisol** - promotes alertness, focus, energy, and plays a role in sleep-wake cycle; can alter gut microbiome and inflammation response
GUT-BRAIN Connection

Dysbiosis observed with
- Autism (70% suffer GI symptoms)
- Parkinson’s Disease
- Bipolarism
- MS
- Depression
- Anxiety
- Alzheimer’s
- Huntington’s Disease
- Stroke
- OCD
- ADHD
GUT-BRAIN Connection

Gut is responsible for:

- >90% of circulating serotonin
- >50% of circulating dopamine
- Oxytocin production

Butyrate producing probiotics fed to mice reduced anxiety in rats

FMT from timid mouse can cause outgoing mouse to become timid

Butyrate producing probiotics fed to anxious adults led to lower reported psychological stress

Children fed high fiber diets demonstrated better cognitive control than children on low fiber diet
Depression

- Mediterranean diet decreased risk of developing post partum depression by 30%

- Dietary support showed 33% more pts experiencing clinical remission than traditional social support (67 females)
  - $3000 less expensive to treat
  - Patient paid $30 less per week on food
GUT-BRAIN Connection

- Stress increases stress hormones - cortisol and adrenaline - both can impact the microbiome within one day - less Bacteroides more Firmicutes alters SCFA production

- Mindfulness practice/meditation altered microbes in one day

- Study found MIND Diet may reduce the risk of Alzheimer’s by as much as 50% (900 seniors over 5 year period)
MIND Diet

Eat these foods

- Beans
- Berries
- Fish
- Green leafy vegetables
- Nuts
- Poultry
- Olive oil
- Other vegetables
- Whole grains
- Wine - 1 glass

Limit/Avoid these foods

- Butter and stick margarine
- Cheese
- Fast or fried foods
- Pastries and sweets
- Red meats
ADHD

>6 million kids currently have ADHD; 1 in 40 have autistic spectrum

- Higher *Bifidobacterium* in infancy has been associated with increased risk of developing ADHD and Asperger syndrome
  - This difference led to decreased synthesis of phenylalanine (precursor of dopamine)

- 75 infants randomized to either receive *Lactobacillus rhamnosus* or not - followed 13 yrs
  - 17% in placebo group got ADHD or autistic spectrum vs zero in probiotic group
What will your patients ask?
What about stevia?

- Very few studies on stevia plant
- Rats fed high doses of stevioside for 22 months, sperm production was severely reduced
- Consumption of saccharin, sucralose, stevia, aspartame all found to cause increased weight gain and adiposity in mice
- Some people report negative side effects
  - Dizziness
  - Muscle pains
  - Numbness
  - Nausea
  - Gas
  - Bloating
  - Insomnia
Can't I just fix it with a probiotic?
Which probiotics should I take to prevent antibiotic induced diarrhea?

**Level III Evidence**
- Florastor Capsule 2 per day
- GoodBelly Capsules 2 per day
- GoodBelly Probiotic Oat Drink Shot - 1/day
- GoodBelly Probiotic Juice Drink - 1/day
- Ideal Bowel Support 2 per day
- NatureMade Digestive Probiotic Daily Balance - 2
- UltraFlora Intensive Care - 2/day

[http://usprobioticguide.com](http://usprobioticguide.com)
What probiotic should I take if I’m constipated?

Eat some plants and drink 4-6 cups water
Exercise
Consider taking fiber supplement - results depend on microbes

- **Psyllium**: Psyllium husk and Metamucil
- **Methyl cellulose**: Citrucel
- **Glucomannan**: Glucomannan capsules or PGX
- **Inulin**: Benefibre (Canada), Fiber Choice or Fibersure
- **Partially hydrolyzed guar gum**: Hi-Maize
- **Wheat dextrin**: Benefiber (US)

Below are level II Probiotics - no level III yet

- **Visbiome**
- **VSL#3**

[http://usprobioticguide.com](http://usprobioticguide.com)
Anything I can take for mood/anxiety/stress?

- Sleep 6-8 hrs
- Eat a plant based diet/Limit processed foods
- Exercise outside
- Hang out with people you like

Level II evidence probiotics
- Calmbiotic
- InnovixLabsMood Probiotic
- Yakault

[http://usprobioticguide.com](http://usprobioticguide.com)
Crazy & New Discoveries

Synthetic Biology-Synlogic has created a bacteria that sucks up phenylalanine and breaks it down into fragments and then releases these fragments into the urine

- Just tested in healthy humans with positive results
- Hoping to test in people with PKU and then gain FDA approval
Crazy & New Discoveries

- Engineering cancer fighting bacteria

- Certain microbes regulate chemotherapy and determine whether the treatment will work or not (fluoropyrimididine based drugs)
Engineered Germ Eating Bacteria

Defense Advanced Research Projects Agency (DARPA)

Discovered predatory bacteria attacks 150 out of the 165 known human pathogens (plague, bacterial lung infections, antibiotic resistant bacteria)

- **Bdellovibrio** - bores into large bacteria eats from the inside out - attacks 145 out of the 165
- **Myxococcu** - wolf pack
- **Vampirococcus** - vampires

The nasty bugs cant become resistant
What’s in our future?

- Smart toilets - analyze daily changes; data dump
- Smart mirrors that analyze the microbial changes in your breath
- Bar codes on food could inform you what foods you need to help reshape/balance your microbiome
- Narrow spectrum antibiotics
- Phagtherapy-Virus that latches on particular microbe (lady bug to take of aphids)
SMALL WORLD: 20+ STARTUPS TARGETING THE MICROBIOME

ORAL HEALTH
- C3J Therapeutics

SKIN DISEASE
- Naked Biome™
- azitra
- Xycrobe Therapeutics Inc.

INTESTINAL HEALTH
- Symbiotic Health
- Eligo Bioscience
- Rebiotix
- enterome
- Vedanta Biosciences
- MaaT
- Second Genome

DRUG DELIVERY
- Blue Turtle Bio

DIETARY SUPPLEMENTS
- TargEDys
- ISOThrive
- MicroBiome Therapeutics
- Evolve BioSystems

GENOMICS
- uBiome
- EPIBiOME
- Microbiome Insights
- MetaBogen

CLINICAL DIAGNOSTICS
- ARTPred

CB Insights
"Here's my DNA sequence."

Aaron Bacall
It is a complex world
The healthcare providers role...

No longer is the role to exterminate the things that are making us sick...

Instead, the HCP is now more like a park rangers trying to protect all the healthy species when an invasive weed gets into the park
Physicians Committee for Responsible Medicine

Boost Healthy Gut Bacteria with Plant-Based Foods

- Broccoli, Cruciferous Vegetables
  - Packed with Glucosinolates
  - Fight Inflammation and Cancer

- Bananas
  - Fight Inflammation
  - Stabilize Gut Bacteria

- Beans
  - Release Short-Chain Fatty Acids
  - Boost Vitamin Absorption, Satiety

- Jerusalem Artichokes
  - Rich in Inulin Fiber
  - Strong Prebiotic

- Blueberries
  - Enhance Immune System
  - Destroy Harmful Bacteria

- Polenta
  - High in Fiber
  - Fermentable Component

- Miso Soup
  - Relaxes blood pressure

- Tempeh
  - Crowds Out Unhealthy Bacteria
  - Boosts Nutrient Absorption
Teresa’s Top Ten Tips for 2018

1. Be kind to your invisible ecosystem & ask **what did you do for your microbes today?**
2. Work your way up to eating >30 different plant species a day (some cooked and some raw)
3. Encourage patients to **learn how to cook and eat in season**
4. **Limit microbial assassins** (the list is getting larger)
   - Refined carbs and added sugar (<25g added sugar/day)
   - Sugar substitutes
   - Processed foods- emulsifiers (polysorbate-80 and carboxymethylcellulose are the worst so far)
   - Smoking, Vaping
   - Chronic Stress
   - Antimicrobial soaps, sanitizers, antibiotics, PPIs
   - High fat diets, processed meats
Teresa’s Top Ten Tips for 2018 (cont)

5. Move every day (move at least 30min and don’t sit for more than 30 min)
6. Open a window and get outside most days-play in the dirt
7. Relax (yoga/meditation/mindfulness)
8. Sleep 6-8 hrs
9. Probiotics for the treatment of a specific illness are gaining momentum- remember probiotics are strain specific- look for Level III evidence
10. Look at your poop!
Microbiology Society & British Society for Immunology

Launched on JUNE 27th 2018
http://worldmicrobiomediay.com/
Experts in the microbiome field

- **Prof Felice Jacka** Professor at Deakin University, Director of the International Society for Nutritional Psychiatry Research (ISNPR)

- **Anne Bikle and David Montgomery** - *The Hidden Half of Nature* (soil health)

- **Alessio Fasano MD** - pediatric gastroenterologist and researcher; heads the Center for Celiac Research at Mass General Hospital for Children; discovered zonulin; Gluten Freedom

- **B Brett Finlay PhD and Marie-Claire Arrieta PhD** - *Let them Eat Dirt* (asthma and diarrhea)
Experts in the microbiome field

- **Prof David Relman** - Microbiologist, Stanford University
- **Dr John Cryan** - Neuropharmacologist, Ireland, Univ College Cork
- **Prof Rob Knight** - Prof Univ of CA San Diego, Co-founder of American Gut Project and Earth Microbiome Project; *Follow Your Gut; Dirt is Good*
- **Prof Jo Handelsman** - Prof Wisconsin Institute for Discovery, Microbiologist
- **Prof Martin Blazer** - Prof of Translational Medicine, Director of NYU Human Microbiome Program; *Missing Microbes*
- **John Cryan Phd Ted Dinan MD, Scott Anderson** - *The Psychobiotic Revolution*
Additional Resources

- [https://commonfund.nih.gov/hmp/overview](https://commonfund.nih.gov/hmp/overview) – NIH research projects, can participate, no charge yet very extensive screening and consent forms
- [http://www.microbiomeinstitute.org](http://www.microbiomeinstitute.org) – blogs, podcasts
- [http://humanfoodproject.com/americangut/](http://humanfoodproject.com/americangut/) – information and link to the American gut project
- [http://usprobioticguide.com/](http://usprobioticguide.com/)
How can I tell if I have a healthy gut microbiome?

- American gut project- send in sample for $99 http://americangut.org/
- uBiome https://ubiome.com/
- Microbiome Quality Control Project http://www.mbqc.org/

- Look in the toilet