
Bacterial Populations: How we study them and how we use them

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Outline

- Methods to study gut bacterial populations
- Applications: 2 uses for altering our gut bacteria
- Current research directions

Bacteria are hard to work with

- Most work is on one species at a time, need to study whole gut population
- We can't culture vast majority of bacteria that live in the gut
- Need methods to accurately survey entire bacterial populations

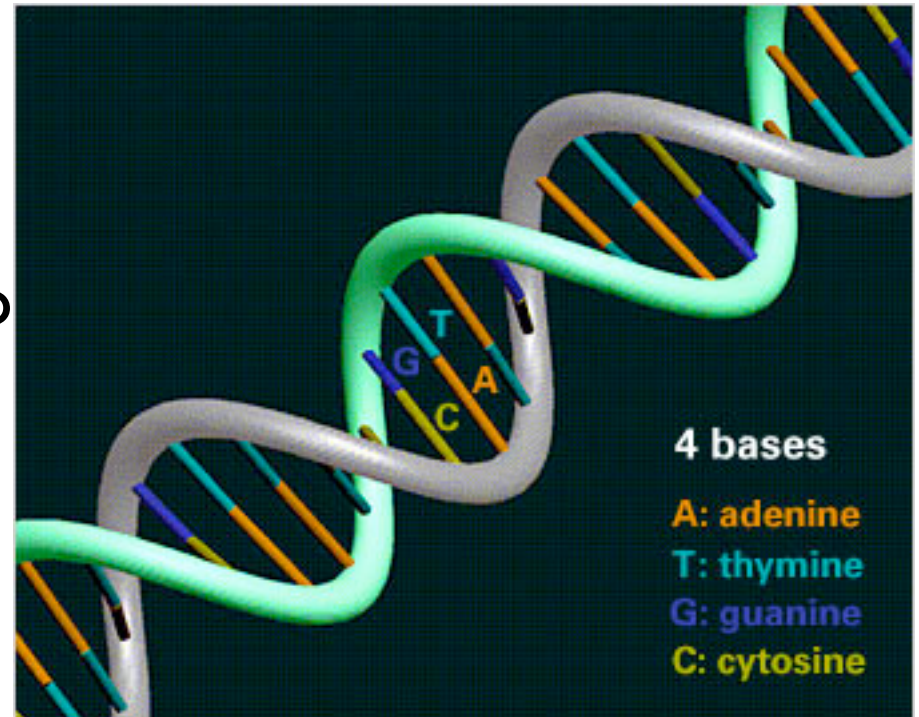
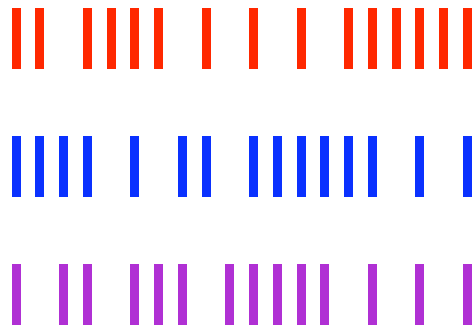


www.drugsandpoisons.com

http://en.wikipedia.org/wiki/File:No_sign.png

Genome sequencing = bacterial barcode

- 1,000s species/strains have been sequenced, now easy and cheap
- Can match new sequences to database, identify like a barcode



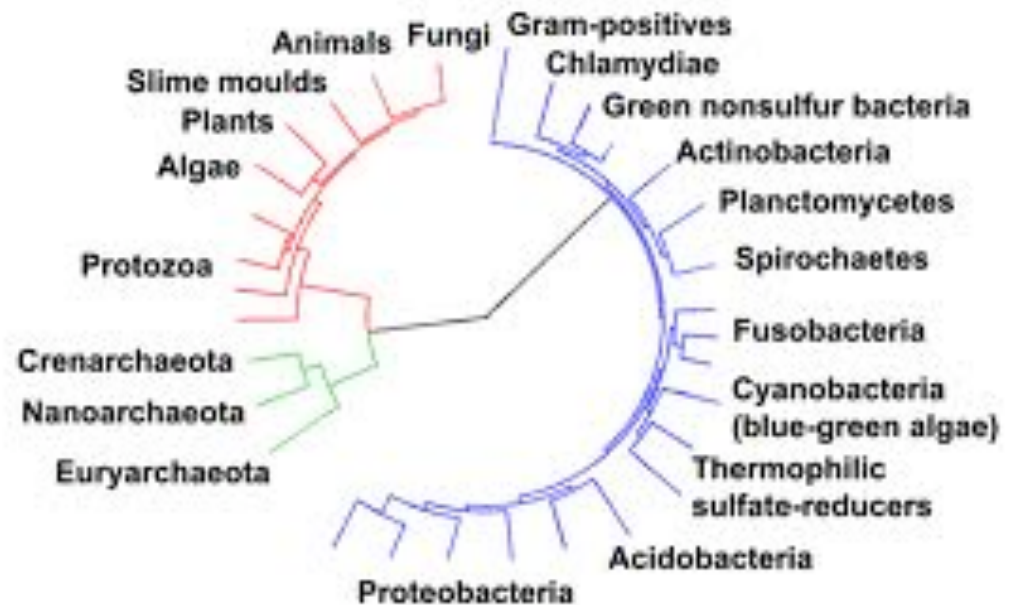
The Power of DNA Sequencing

- Can differentiate between strains (commensal *E. coli* vs EHEC)

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- Can identify new species/DNA!!!



Current Applications of Gut Microbes

Probiotics



- Probiotic = live microbes intentionally used for health benefit
- Food and supplements for:
 - Digestive health
 - Enhance immune function
 - Anti-inflammation

http://sitemaker.umich.edu/huffnagle.lab/_the_probiotics_revolution___book_

<http://www.webmd.com/digestive-disorders/probiotics-10/slideshow-probiotics>

Supplements are NOT regulated by FDA !!!

- Not tested for safety/efficacy
- Anyone can make/sell supplements
- Probably do nothing, potentially dangerous!

Some probiotics do work

A Certain Yogurt Brand

- Popular yogurt brand containing $>10^9$ *Bifidus Regularis*® bacteria/cup
- Product claims eating for 14 consecutive days improves digestive health and comfort



Bifidobacterium lactis DN 173 010

- *B. lactis* DN 173 010 shown to decrease colonic transit time 20% after 2 weeks
- Also found to increase digestive comfort (by self-reported survey)
- Potential treatment for some forms of Irritable Bowel Syndrome



Bouvier et al, 2001 Biosci Microflora

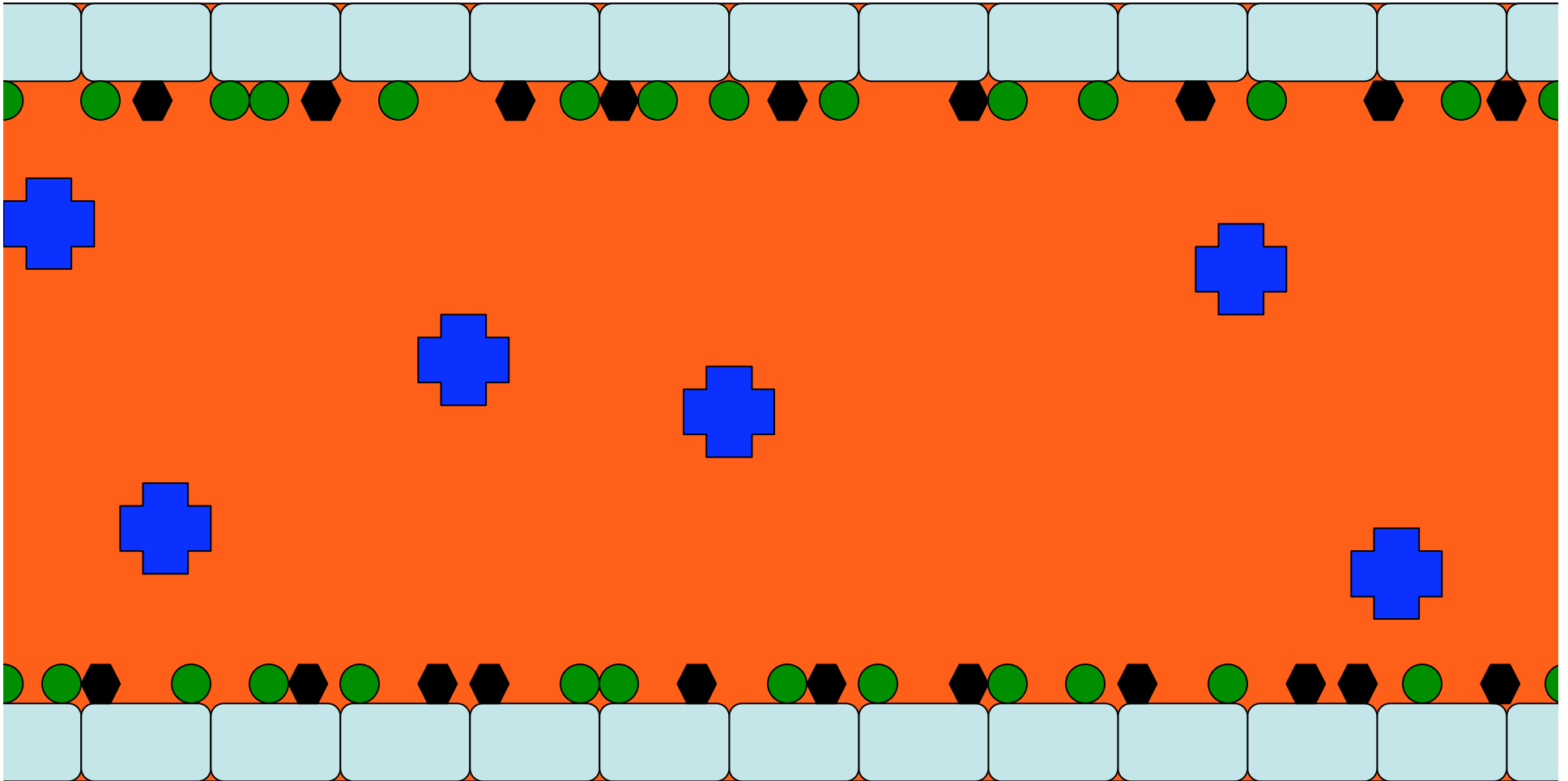
Marteau et al, 2002 Aliment Pharmacol Ther

http://www.danone-zdrowie.pl/activia_dowody_naukowe.html



An Unlikely Therapeutic Probiotic?

Clostridium difficile: Vicious Cycle



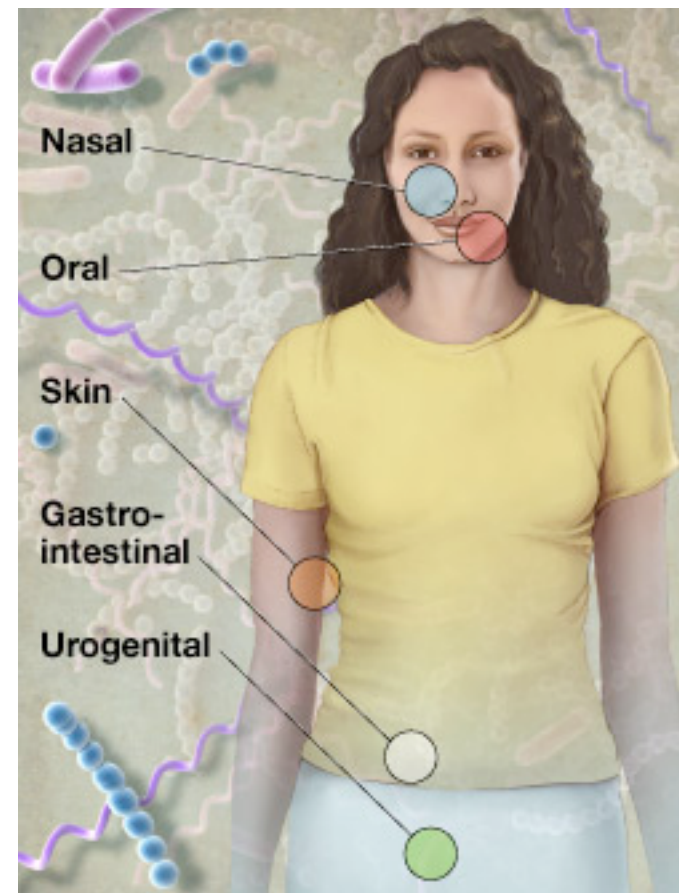
It's not toilet humor: Fecal Transfer Therapy

- *C. difficile*-caused pseudomembranous colitis is essentially incurable by antibiotics, high mortality rate
- Fecal transfer from healthy donor cures >90% of infections
 - Normal bacterial population kills/displaces *C. difficile*
- Interesting fact: genetic relatives/spouses better donors than strangers
 - Suggests more similar microflora give better treatment

A Comprehensive Survey of the Microbial Organ

Human Microbiome Project

- Govt.-funded super-project to sample and sequence microbes from multiple body sites of 300 healthy volunteers
- Whole genome sequencing will determine common human microbiome
- Data will be released to public to aid research/application



Social impact of HMP

- Similar to Human Genome Project, will take years after completion to get practical applications
- HMP also to examine ethical/legal consequences of project
 - Who owns new genes/species? Patents?
 - Discrimination because of bacteria?
 - Need for protective legislation (GINA)?

Thank you!

- Higgins lab tour following Q&A
- Questions?