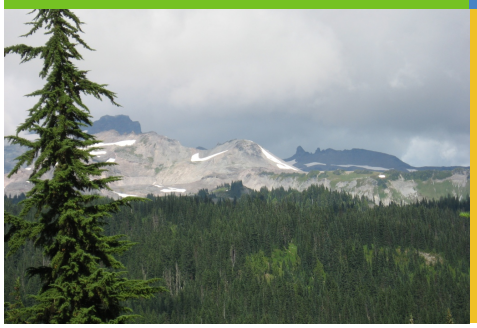
# Caries Prevention



Ecology = The study of the interactions of organisms and their environment.

Balance and diversity of life is better!

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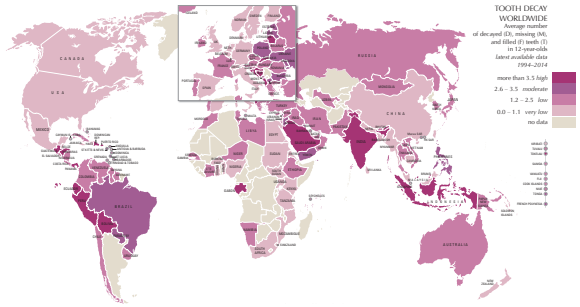
# Problem – Dental Caries




Caries = Most common chronic disease of all ages in the world. Cost of treatment is immense.

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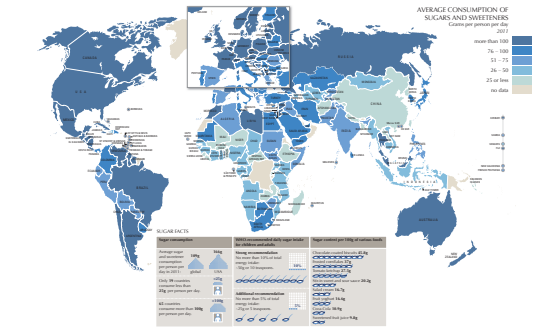
# Problem - Sugar




On average, we eat too much sugar!

Out of the four major factors influence caries risk, sugar (and highly processed carbohydrates) has changed the most in recent centuries.

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# Treatments

- Caries Restoration
- Periodontal Therapies
- Orthodontics
- Implants

Where Dentistry currently spends too much of its time - Fixing the Problem.

# Caries Prevention

- Primary – Preventing caries before it occurs
- Secondary – Reducing the impact of early caries
- Tertiary – minimizing the impact of cavitation via restoration


Where dentistry should spend more of its time - Preventing the Problem!

Most bang for the buck is Primary Prevention.

# 1° Prevention - Current

- Fluoride
- Sealants
- Saliva Stimulation
- Diet Modification
- Antimicrobials
- Oral Hygiene


Where dentistry should spend more of its time - Preventing the Problem!

Of growing importance, but not much has changed in too long. Plus, the problems of Caries and Periodontal Disease in fact have gotten slightly worse in the last two decades. We need to turn that curve back down!

# 1° Prevention - Future?

- Vaccines
- STAMP
- Probiotics
- Replacement

Some of the exciting new possible prevention strategies 'in the pipeline':

**Vaccines** - Target the most cariogenic bacteria, such as *S. mutans*.

**STAMP (specifically targeted anti-microbial peptides)** - In vitro biofilms treated with *S. mutans* STAMP, resisted recolonization with wild-type *S. mutans*. Once established an ecosystem resists change!

**Probiotics** - "Live microorganisms, which when consumed in adequate amounts, confer a health benefit on the host."

**Replacement** - Genetically modified, 'designer' probiotics. GMO's are a hard sell in many communities. GMO germs would probably be even harder!

# Prevention - Future?

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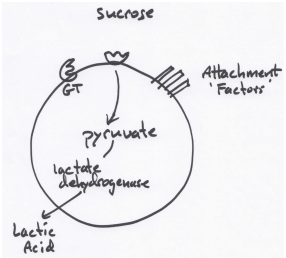


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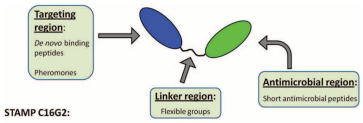


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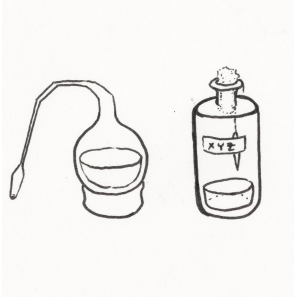
# Mid-1800's Pasteur

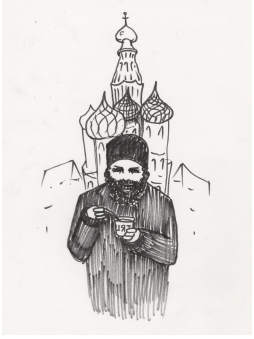
- Germ Theory
- Microbes Bad!




The first microbiologists focused on understanding disease-causing microbes, which led to a concept: Microbes = Bad. To this day this still 'clouds' much of our thinking about our relationship with microbes!

# Early 1900's - Metchnikoff

- Observation: People living in parts of rural Russia seemed to live longer - Why?
- Theory: Optimize microbial flora = longer life!?
- Probiotics
- Some Microbes Good!

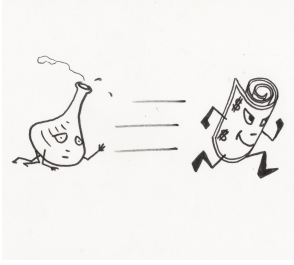


Current understanding shows that the body's the Microbiota represents a health asset, with some microbial constituents becoming a liability in susceptible hosts. In fact most of the microbes that colonize us (normal flora) are 'on our side.'

The rational for probiotics is to enhance microbial assets and to offset liabilities.

# Late 1990's - Now

- Reawakening interest of research into Probiotics
- Marketing - 'Ahead of the curve'!



Despite the hyperbole often linked with a 'popular' research field, the scientific rational for probiotics is sound. There is always the risk, especially with probiotics, that unfounded product claims will ruin it for all.

## Probiotics - 'Old School'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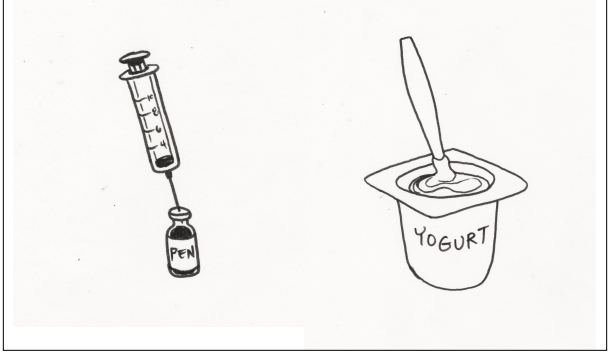


## Probiotic Mechanisms?

- Competitive exclusion of pathogens
- Inhibit growth of pathogens
- Optimize immune response
- Restore healthy flora after treatment

Probiotics may work via any number of mechanisms, including:

- Competition
- Inhibition
- Regulating Immunity
- Restoration

## Probiotic Mechanisms?

- Competitive exclusion of pathogens
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**Competition**:

Looking through a microscope at bacterial biofilm. (Yup, they're watching a movie!)

Empty 'seats' provides opportunities for more pathogenic microbes to 'sit' and colonize.

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**Competition**:

Once 'seated,' pathogenic microbes are not good neighbors, and have a negative influence on the wider community.

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**Competition**:

A pathogen 'gang' becomes established. Often influencing less pathogenic microbes to join (yup, just like a mob). Area becomes trouble!

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## Probiotic Mechanisms?

- Competitive exclusion of pathogens
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**Competition**:

By filling all the 'seats', less harmful microbes make it harder for pathogens to first colonize area (competitive exclusion).

## Probiotic Mechanisms?

- Competitive exclusion of pathogens
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**Inhibition**:

This can occur through a variety of ways, including:

1. Competing for nutrients
2. Releasing toxic substances such as:
   - Acids
   - $H_2O_2$
   - $NH_3$
   - Bacteriocins

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**Optimize Immunity**:

Through a wide variety of means, Probiotics can bring the immune system, both innate ad adaptive, into 'balance'.

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## Probiotic Mechanisms?

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**Optimize Immunity**:

The immune response is often seen in terms of the military or police - protecting us. But too much of this can cause too much 'collateral damage'. I.e., the immune response itself causes most of the damage.

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## Probiotic Mechanisms?

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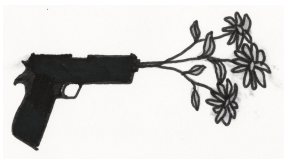

**Optimize Immunity**:

Sometimes we need to lower the immune response.

Of course the opposite is also true.

## Probiotic Mechanisms?

- Competitive exclusion of pathogens
- Inhibit growth of pathogens
- Optimize immune response
- Restore normal flora after treatment

**Restore**:

Treatments (antibiotics, dental treatments, etc.) often leave a lot of 'empty seats', which may allow an opening for more pathogenic microbes!

Dental treatments typically 'open seats'. Maybe like our lawn, dentists should consider 'seeding' the area with good bugs to quickly fill up the seats for a better outcome!

Once established an ecosystem resists change!

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## Probiotic Research - Med.

- Neonatal Necrotizing Enterocolitis
- Antibiotic-Associated Diarrhea
- Clostridium difficile-Associated Diarrhea
- Irritable Bowl Syndrome (IBS)

**Neonatal Necrotizing Enterocolitis** - Impressive results: probiotics lower 15-20% mortality -> ~5%

**Antibiotic Associated Diarrhea** - Modest, but consistently good results: lower chance of developing diarrhea, less severe if it develops.

***Clostridium difficile*-Associated Diarrhea** - A very serious, growing subset of Antibiotic-Associated Diarrhea. Mortality 7-15%. Modest but consistently good results: lower chance of developing C. diff.-Assoc. Diarrhea; less severe if it develops.

**Irritable Bowl Syndrome (IBS)** - The most commonly diagnosed GI pathology. Supportive evidence for probiotics, which lessen symptoms.

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## Probiotic Research - Dent.

- Gingivitis
- Halitosis
- Dental Caries
- Periodontal Disease


**Gingivitis** - Modest, but good results. Easy in vivo experiments to carry out. Simple, easy to measure outcomes.

**Halitosis** - Modest, but good results. Easy in vivo experiments to carry out, with simple, easy to measure outcomes.

**Dental Caries** - Supportive evidence. Harder, longer experiments, that often involve surrogate outcomes such as *S. mutans* levels in saliva and or plaque. Mostly using milk or yogurt containing probiotic.

**Periodontal Disease** - Intriguing results. Hardest experiments to carry out, especially prevention. But most similar to GUT experience! In vivo animal experiments very promising as adjuncts to therapy (e.g., SRP).

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## Probiotics - Future...

- Need Governmental Oversight (FDA?)
- Still stuck using mostly 'yogurt bacteria'
- For more than a million years our ancestors only sharped one side of their stone tools!


Currently NO oversight! Lots of 'snake-oil' being sold.

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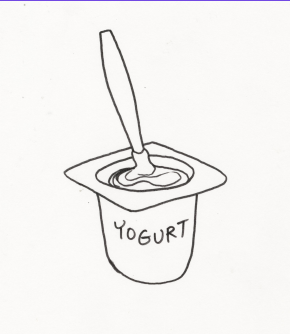


Yogurt bacteria: *Lactobacillus*
*Bifidobacterium*
*Streptococcus*

Recent in vivo studies that have looked at the whole mouth have shown that while certain species (e.g., *S. mutans*) are 'highly influential,' 'keystones' in caries outcome, other bacterial species are 'highly influential' 'keystones' in the opposite direction (including *Lactobacillus acidophilus*, a common Probiotic)!

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# Probiotics - Future…

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- Still stuck using mostly 'yogurt bacteria'
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Sometimes good ideas stop us from opening our minds to even better ideas!

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