



# Battling Biofilms in Beer Draught Lines



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# DRAUGHT BEER QUALITY MANUAL



- Industry wide recommendations
- Version 1 published in 2009
- Version 4 published in 2019



# Cleaning Essentials

15 minutes  
recirculation

80°-110° F

Time

Temperature

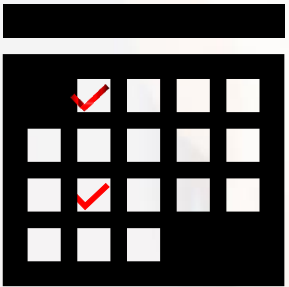
Mechanical  
Work

Chemical

Recirculating  
pump

2-3% caustic  
solution

## How often?



- Caustic every 2 weeks
- Acid every 3 months

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Beer line tubing  
materials

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Age of beer lines

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Line cleaning  
frequency

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Sales velocity

**Cleaning  
method  
challenges**

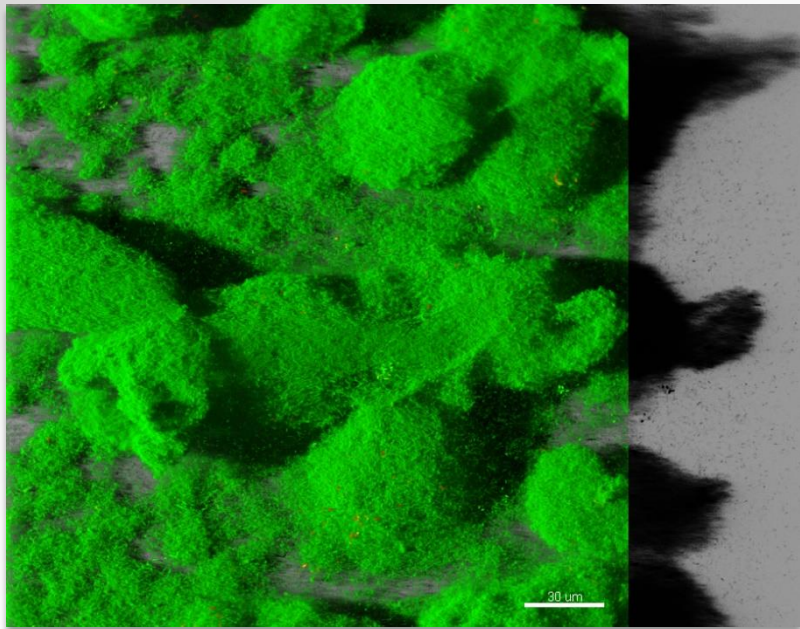
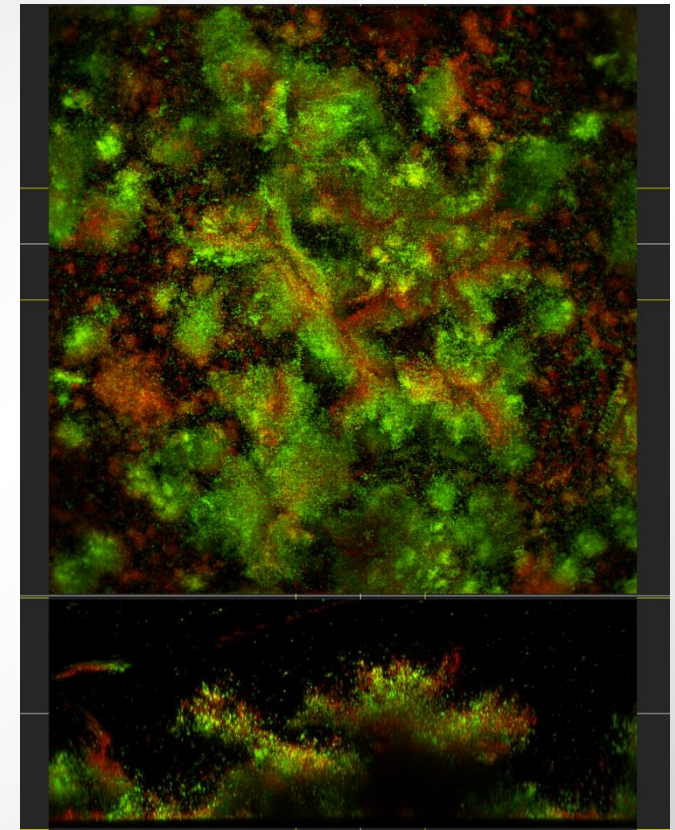
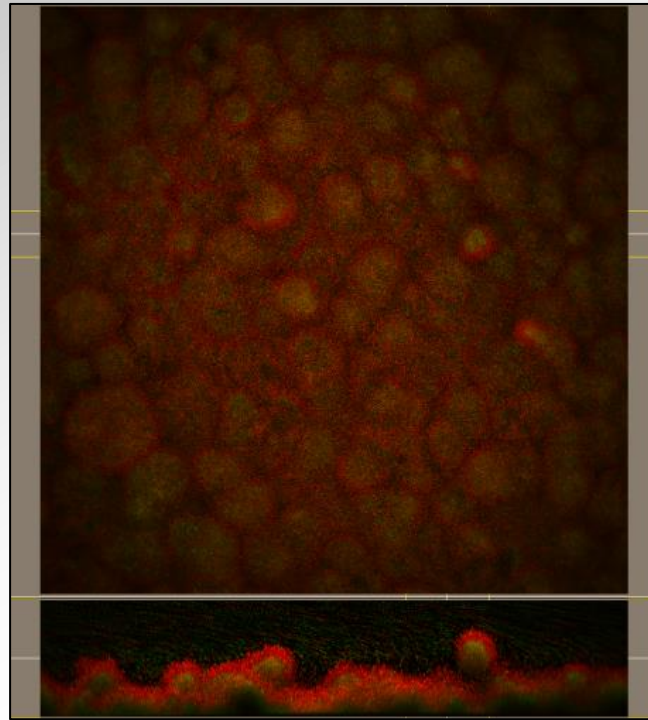
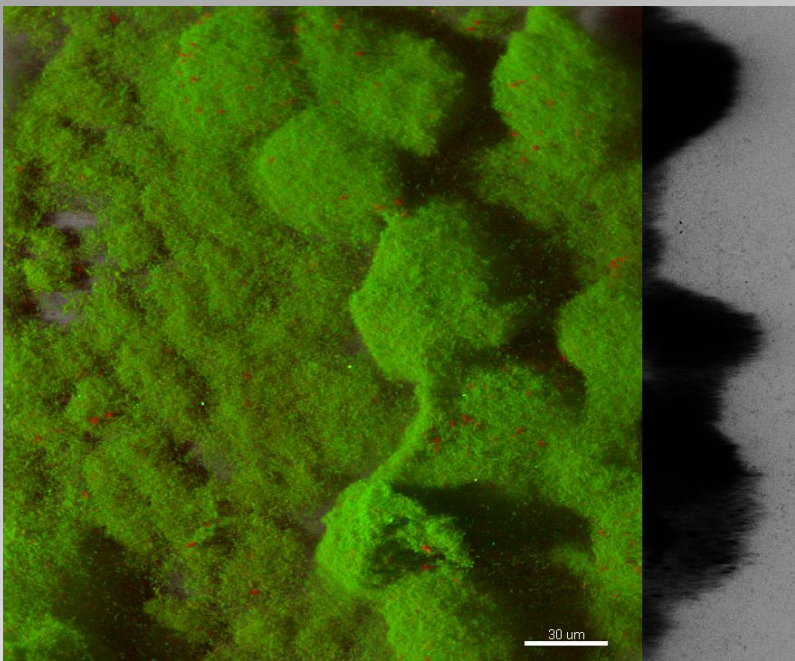
# Battling Biofilms in Beer Draught Lines

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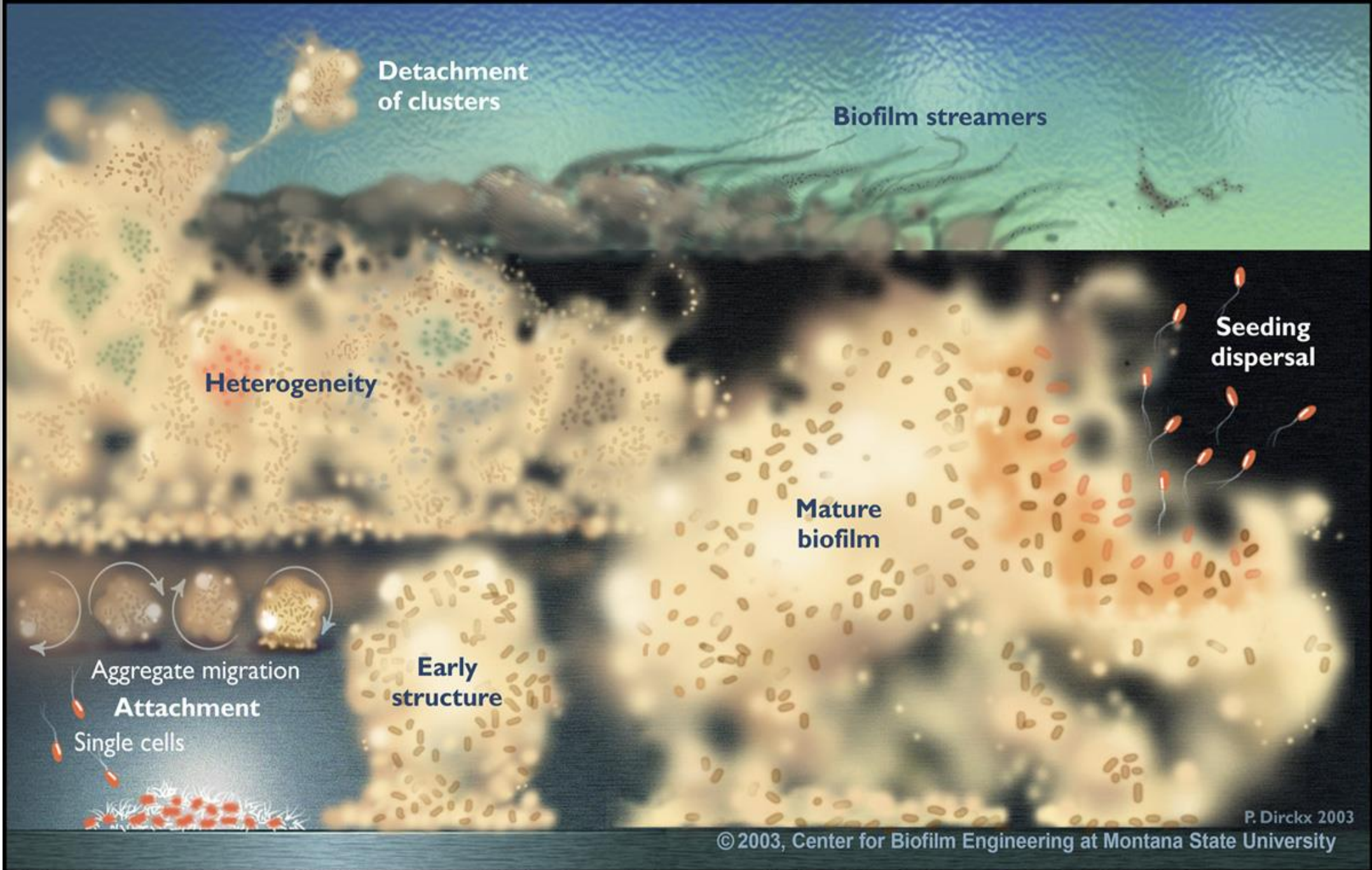
Center for Biofilm Engineering  
Montana State University





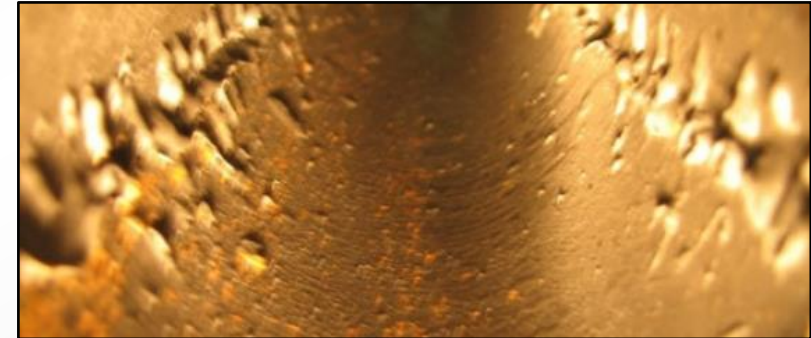
**Biofilm bacteria are a self-organized, cooperative community of microorganisms embedded in a matrix of extracellular polymeric substances.**





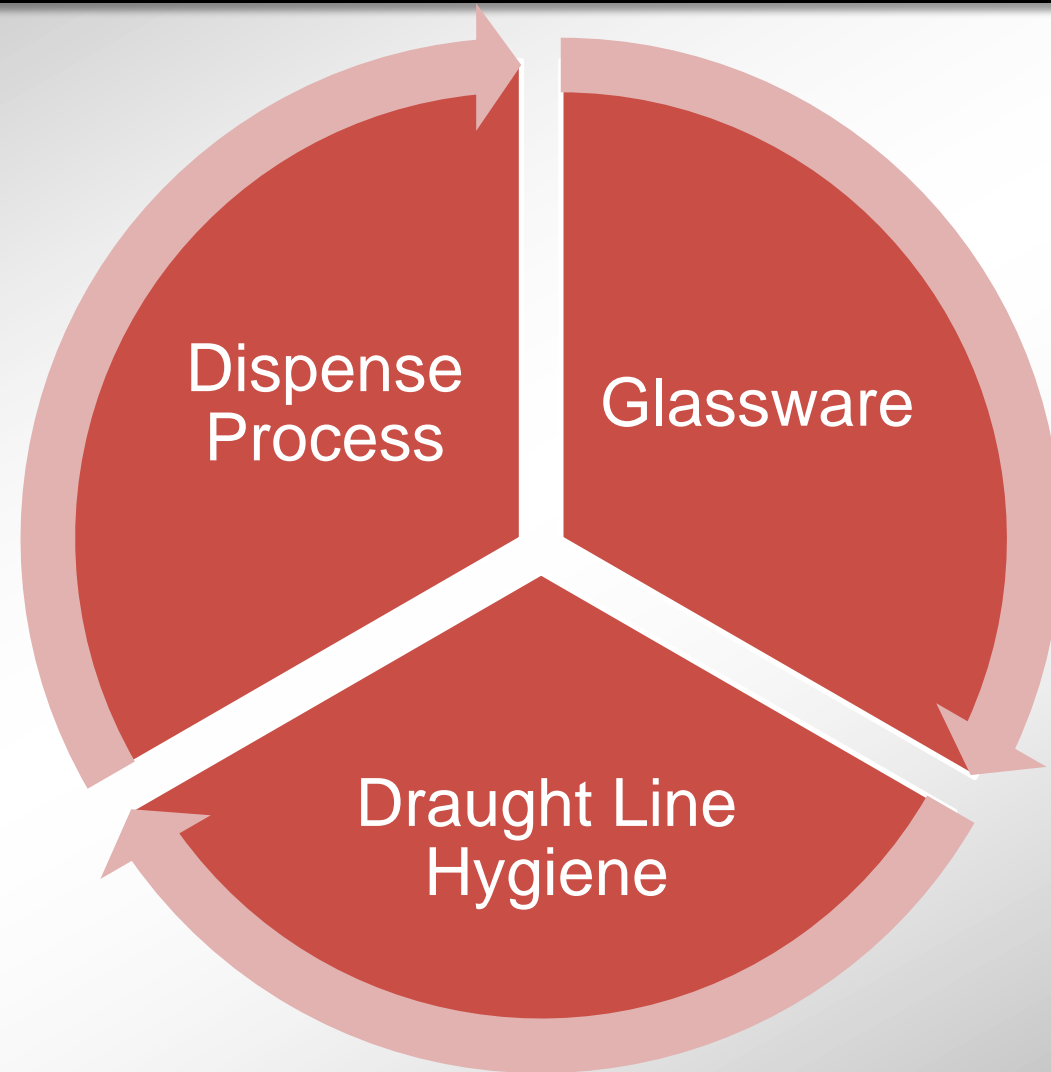
# Why do we care about biofilm?

- Tolerant to antimicrobials
- Public health
- Structure & equipment degradation
- Safety
- Aesthetics & **taste**
- Bioremediation & biofuels





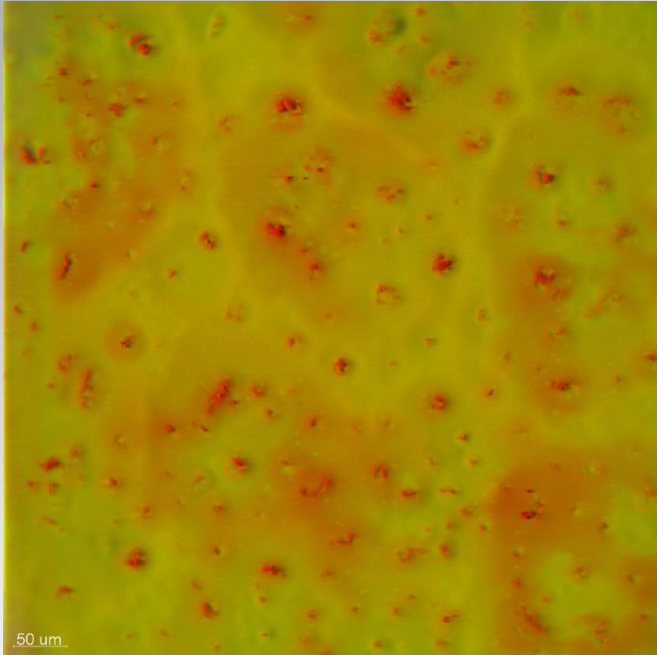
# Great Tasting Beer



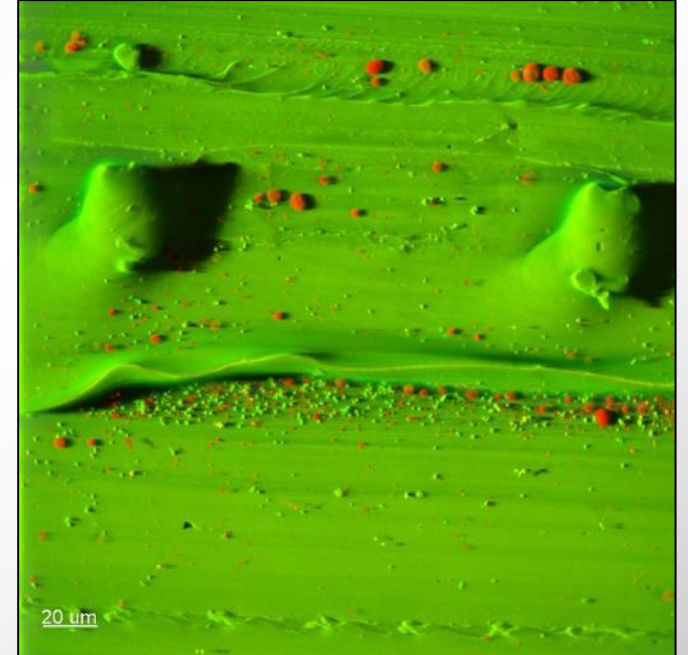
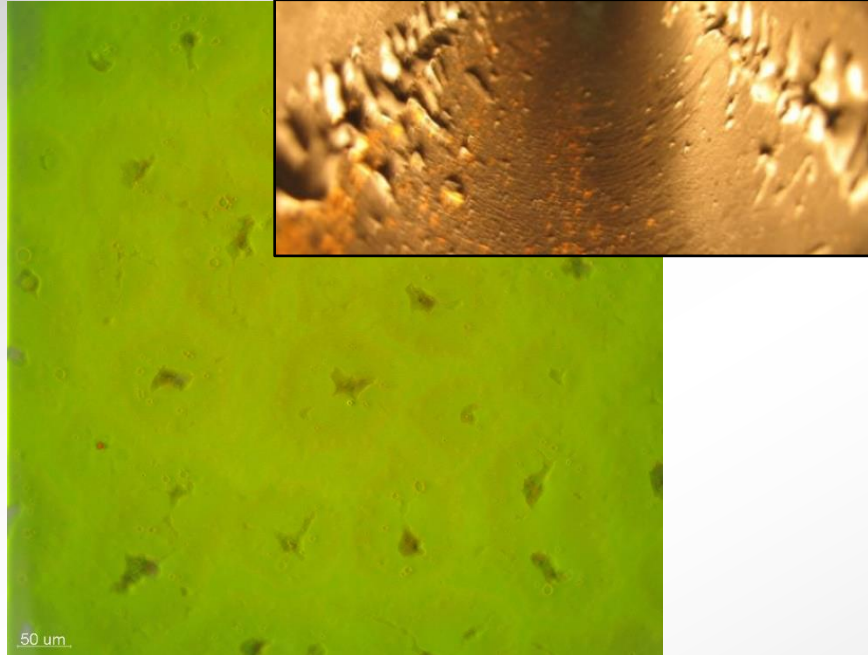
# Biofilm & Beer



# Biofilm grows in compromised tubing



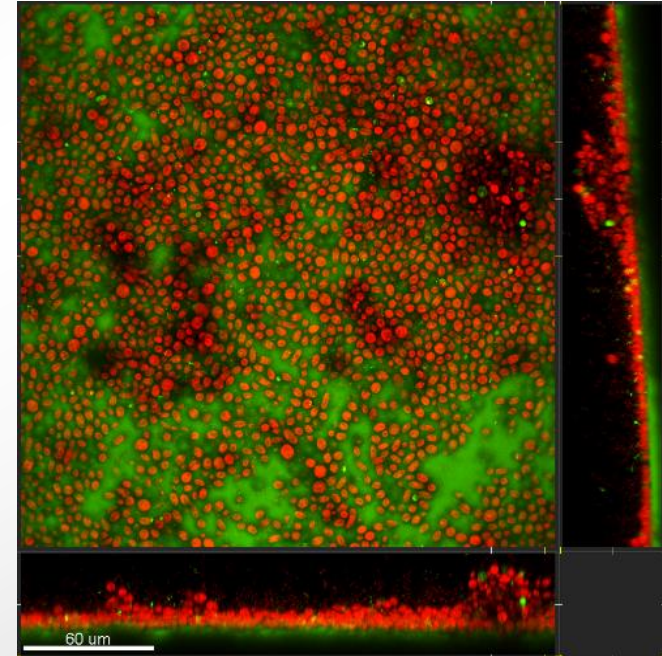
Images of beer line tubing  
collected from a bar



Images of etched beer line  
tubing in the laboratory

# Research Question

- Does beer draught line tubing aged to simulate 1, 2 and 5 years of cleaning support more biofilm growth?
- Is the resulting biofilm more challenging to kill?



L. Miller, 2020

# Age Vinyl Beer Tubing



\*390 minutes

\*\*60 minutes



# Inoculum

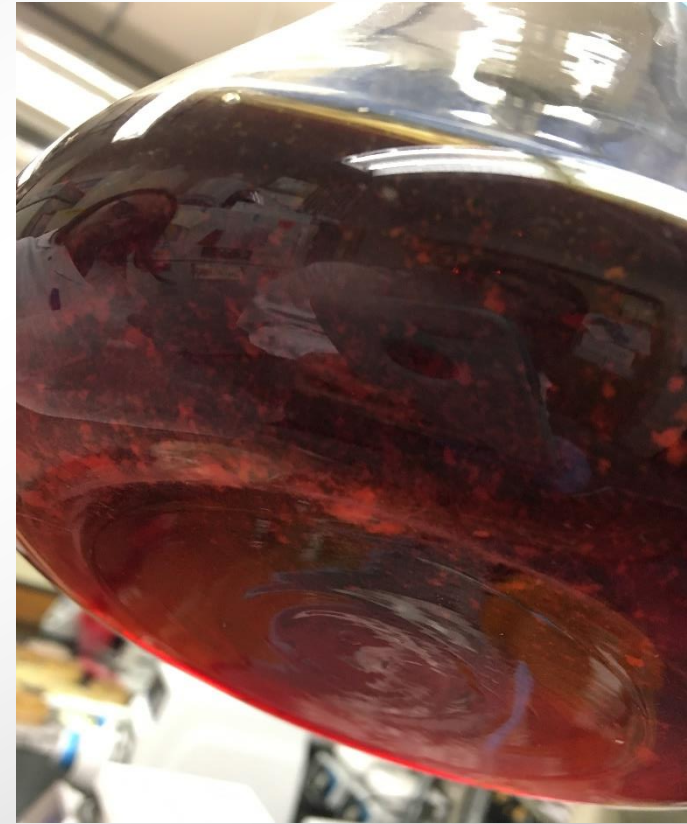
Prepared in Barney Miller Medium +  
pale ale beer:

- *Pediococcus damnosus* ATCC 29358
- *Acetobacter aceti* ATCC 15973
- *Lactobacillus rhamnosus* ATCC 8538

Prepared in Yeast Peptone Dextrose:

- *Saccharomyces cerevisiae* (Safale yeast packet)

Incubated at 4 °C for 3 days. Target density =  $10^4 - 10^6$  CFU/mL



*Acetobacter aceti*

# Experimental Design

Combine  
inoculums + flat  
pale ale

Recycle:  
10 mL/min  
1 hr/day  
2 days

Sample

Treat with  
caustic (no  
recycle)

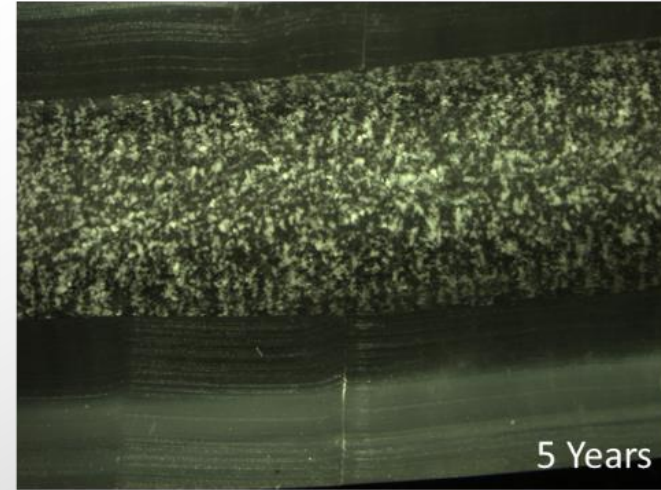
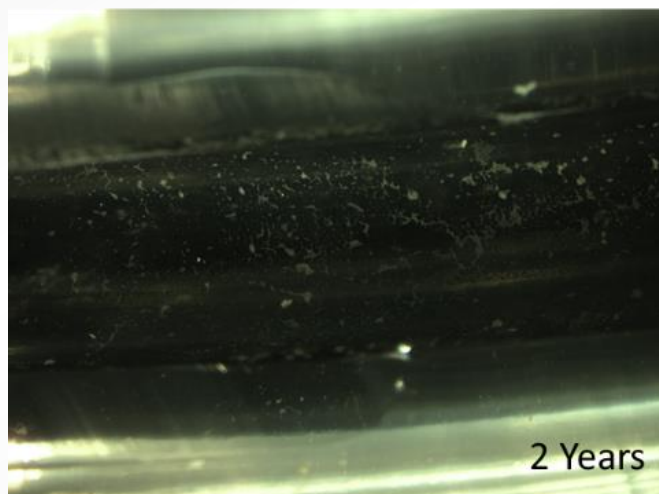
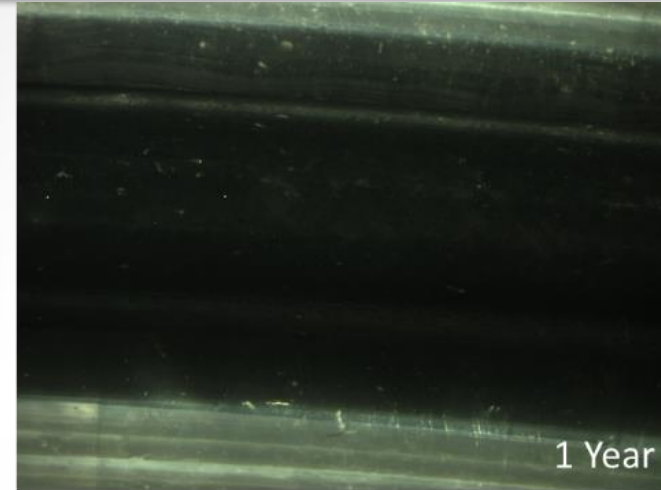
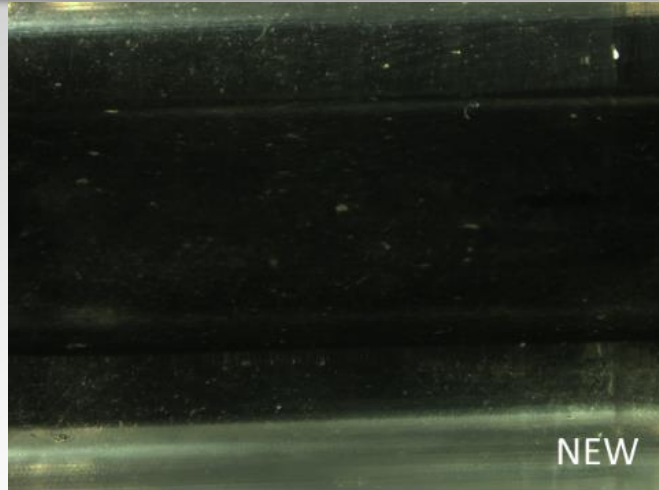
Rinse with  
water

Sample

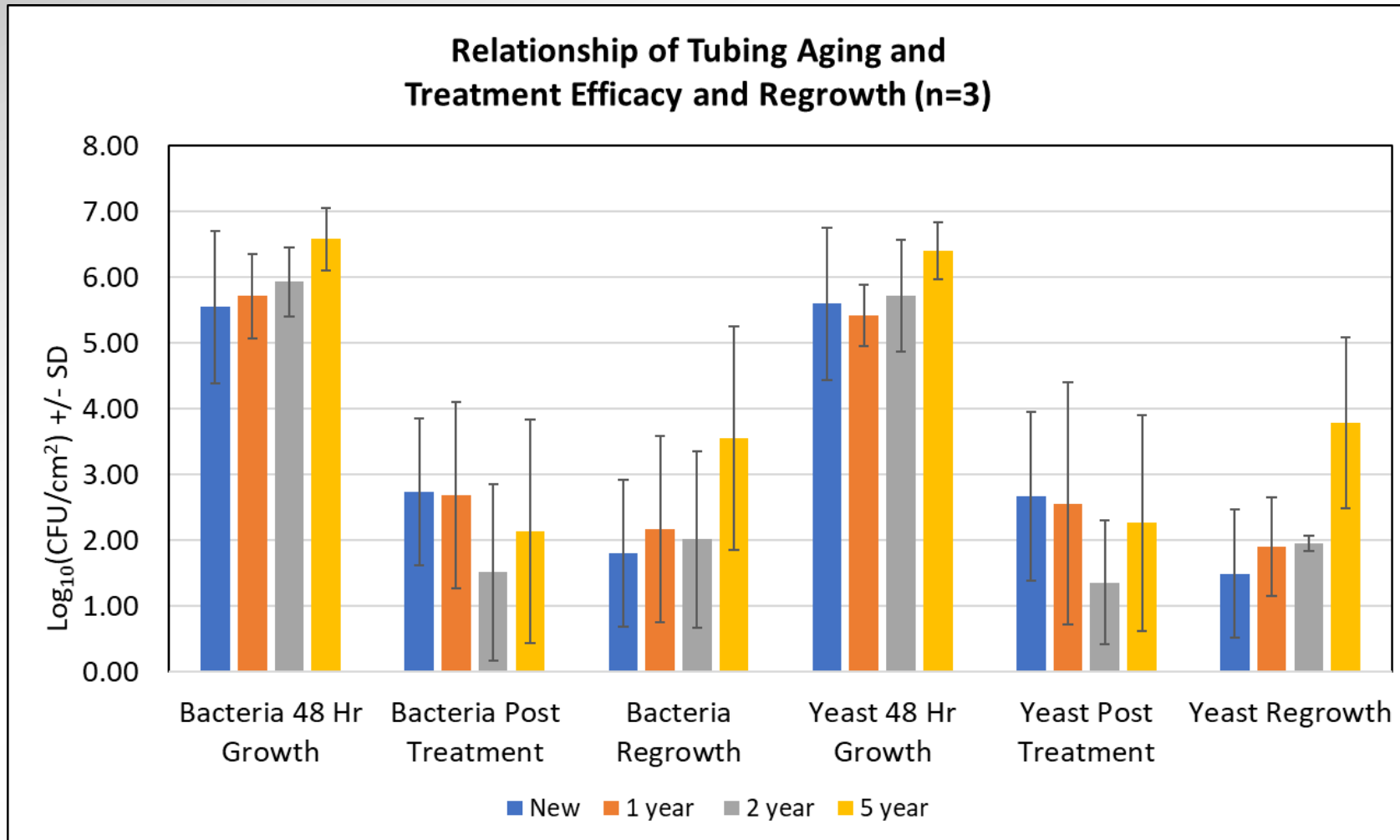
Fill with  
Barney  
Miller + pale  
ale (24hr)

Sample

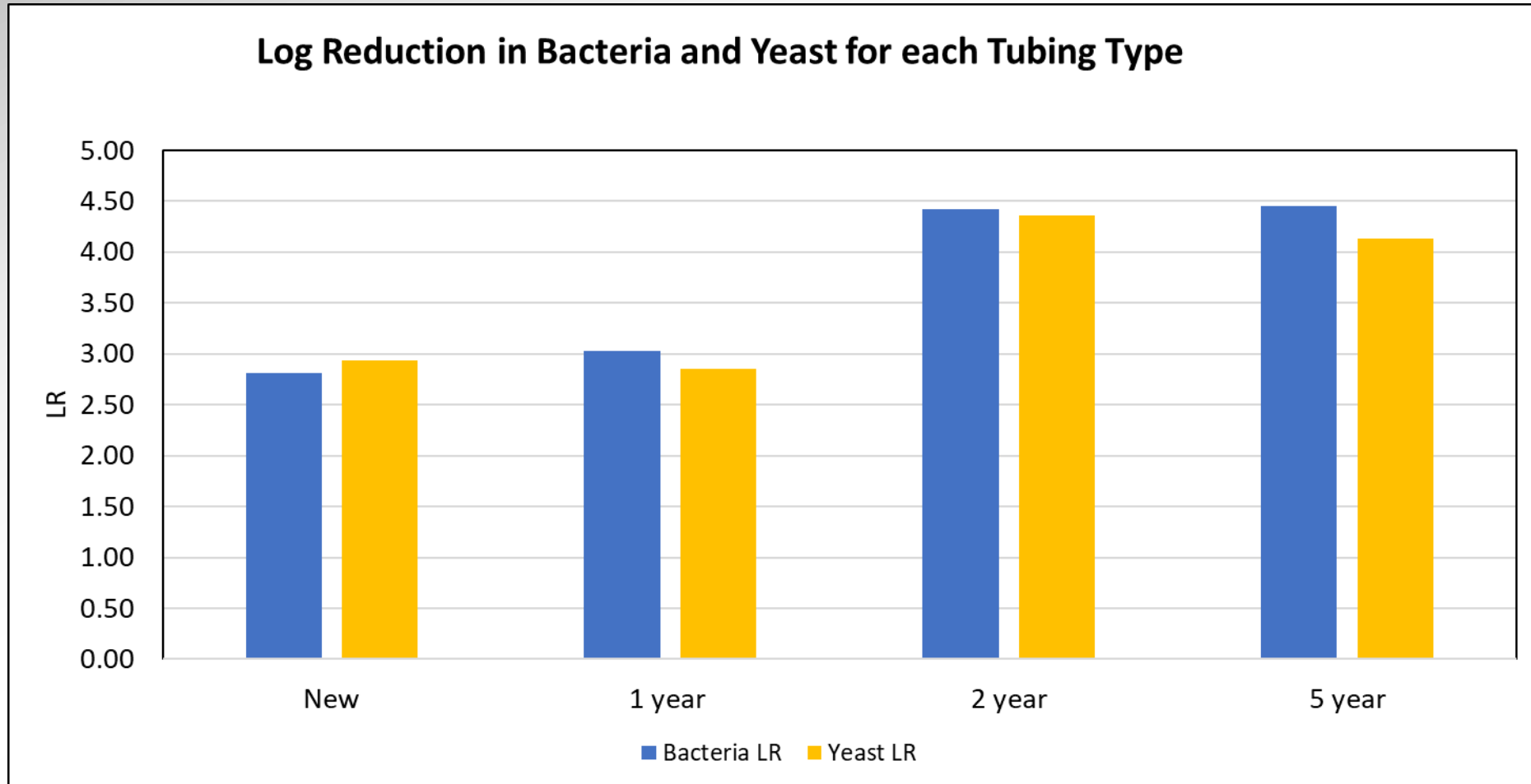
# Results: tubing visually changes after 2 years of simulated treatment



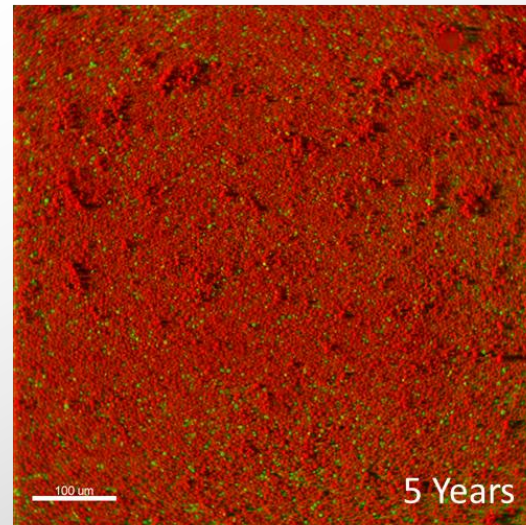
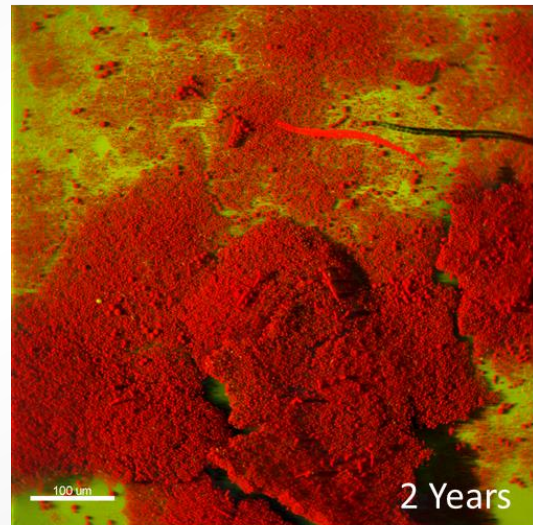
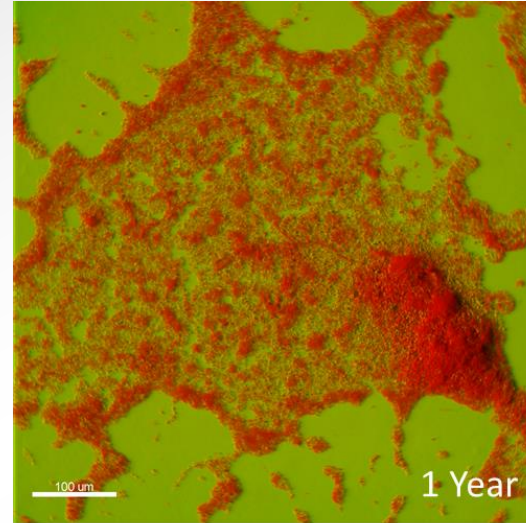
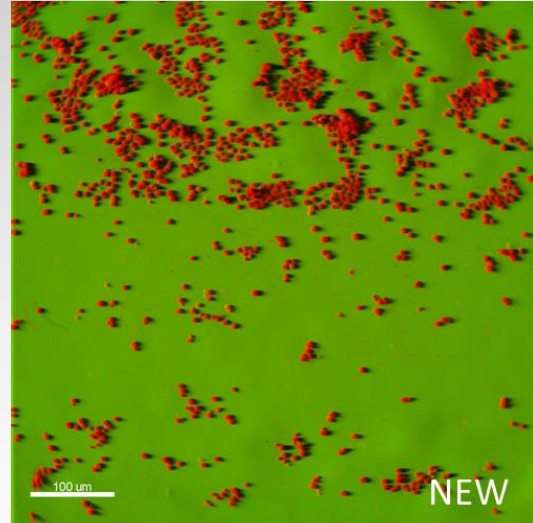
# Results: more biofilm harvested from aged tubing; more regrowth



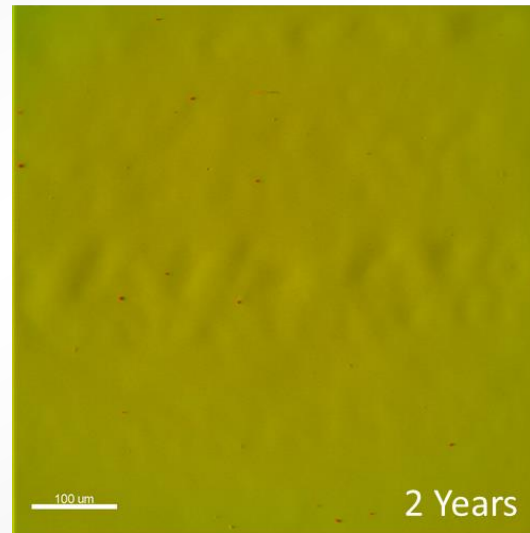
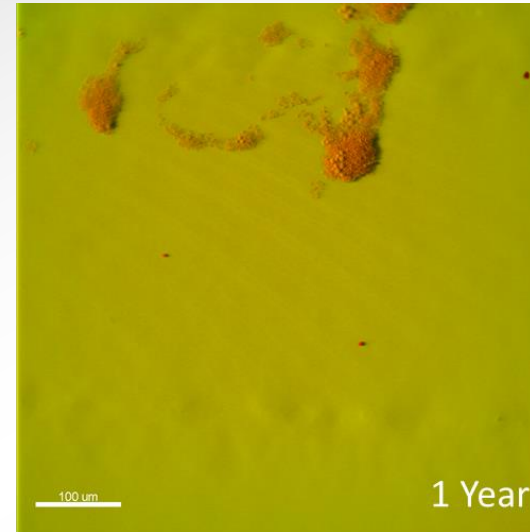
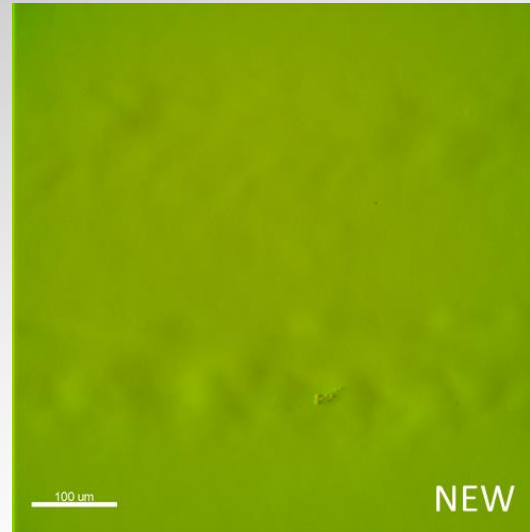
# Results: caustic was effective against biofilm in aged tubing



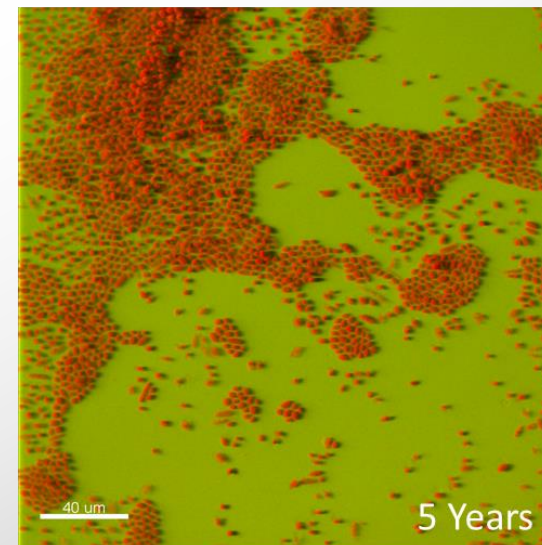
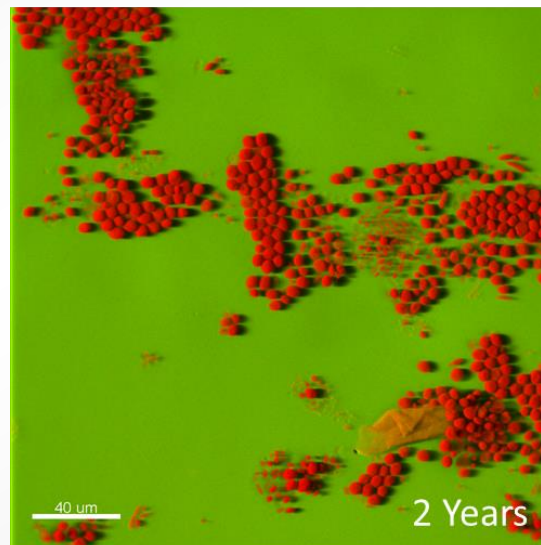
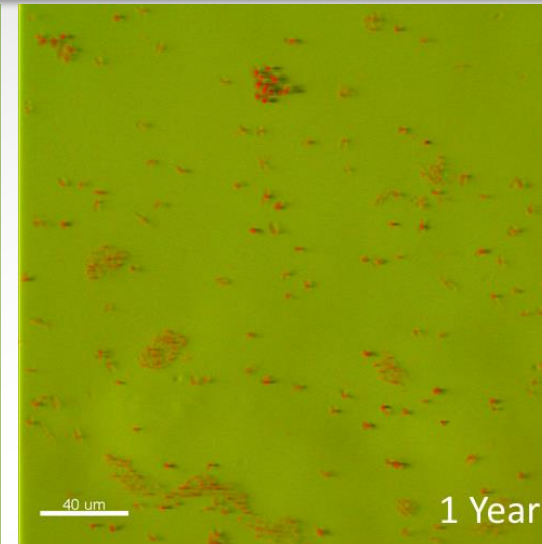
# Images confirm plate counts: 48 hr growth



# Images confirm plate counts: following treatment



# Images confirm plate counts: regrowth





# Summary

- Data demonstrated a trend between biofilm accumulation and age of tubing.
- Extended exposure to caustic and acid compromised tubing integrity.
- Caustic effectively killed/removed biofilm, regardless of tubing age.
- Biofilm recovered more quickly in aged tubing, suggesting the caustic will cease to be as effective as system ages.

# Recommendation

- Always consider biocide and material compatibility
- Consider changing system components 'more frequently'
- Challenge the industry to develop a biosensor that monitors microbial contamination in real time to optimize cleaning protocols

# Cheers



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Meyer

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**Brewers Association**  
Chuck Skypeck

**SBML**  
Evan Turner



**THANKS!**