

# #1 Noroviruses (NoV) & Hepatitis A

>50% NoV; 1/6 ill every year; shedding a trillion NoV virions/day; vomit is infectious

Shellfish: US 4.4%    EU >70%

HAV uncommon in US... Developing world high; Foodborne exposure through global trade

# High Pressure Processing & Shellfish

- Shucks the shellfish-separates meat/shell
- Enhances shelf-life
- Kills *Vibrio sp.*
- Commercial pressures 275-300 MPa
- 1 MPa = approx 10 atm or 150 psi

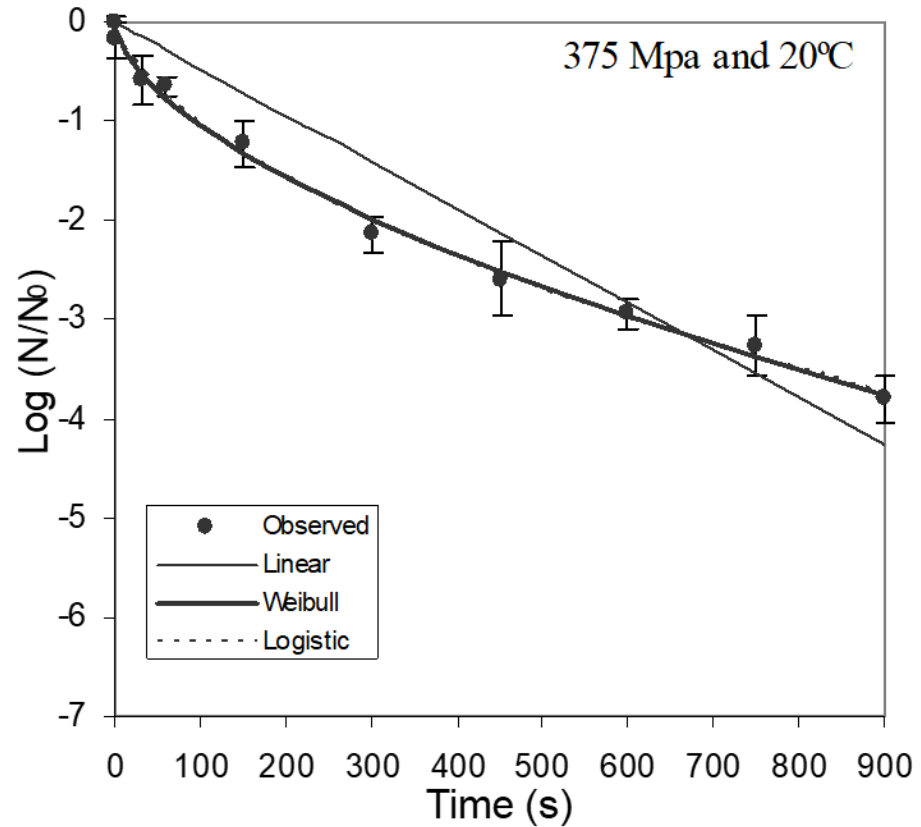
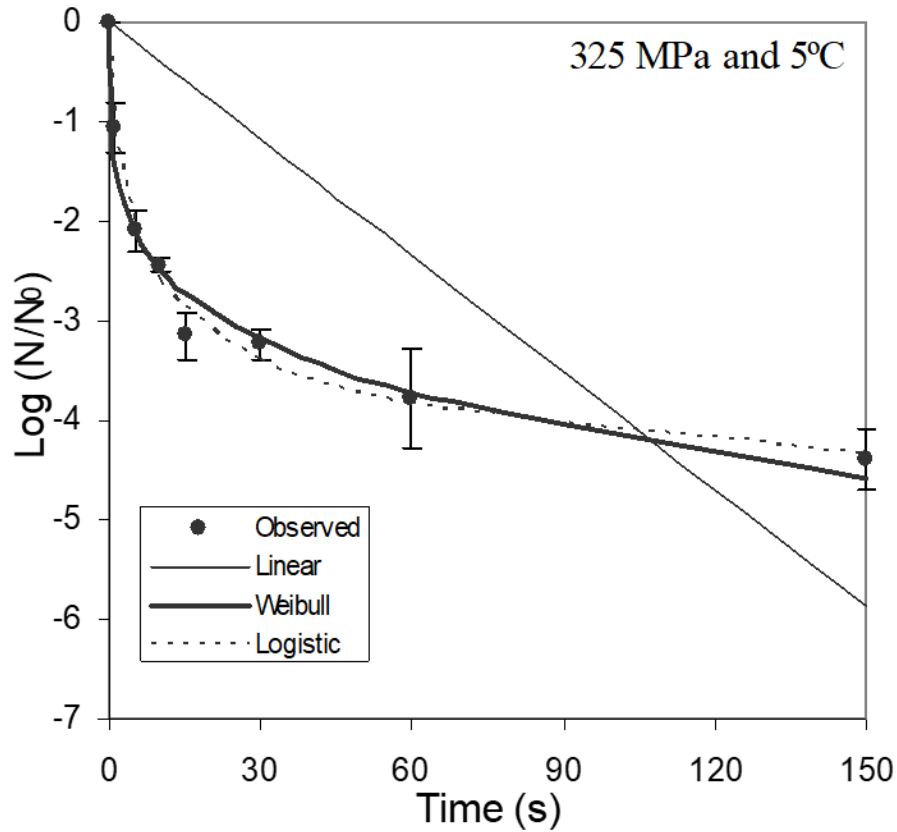
# HPP & Virus: Universal Themes

- HPP is effective against HuNoV and HAV in Foods! Oysters do taste good...must be fresh!
- Different viruses have variable sensitivity with pressure (first order)
- Time under pressure (Weibull/log-logistic curves)
- Matrix effects: pH is an issue

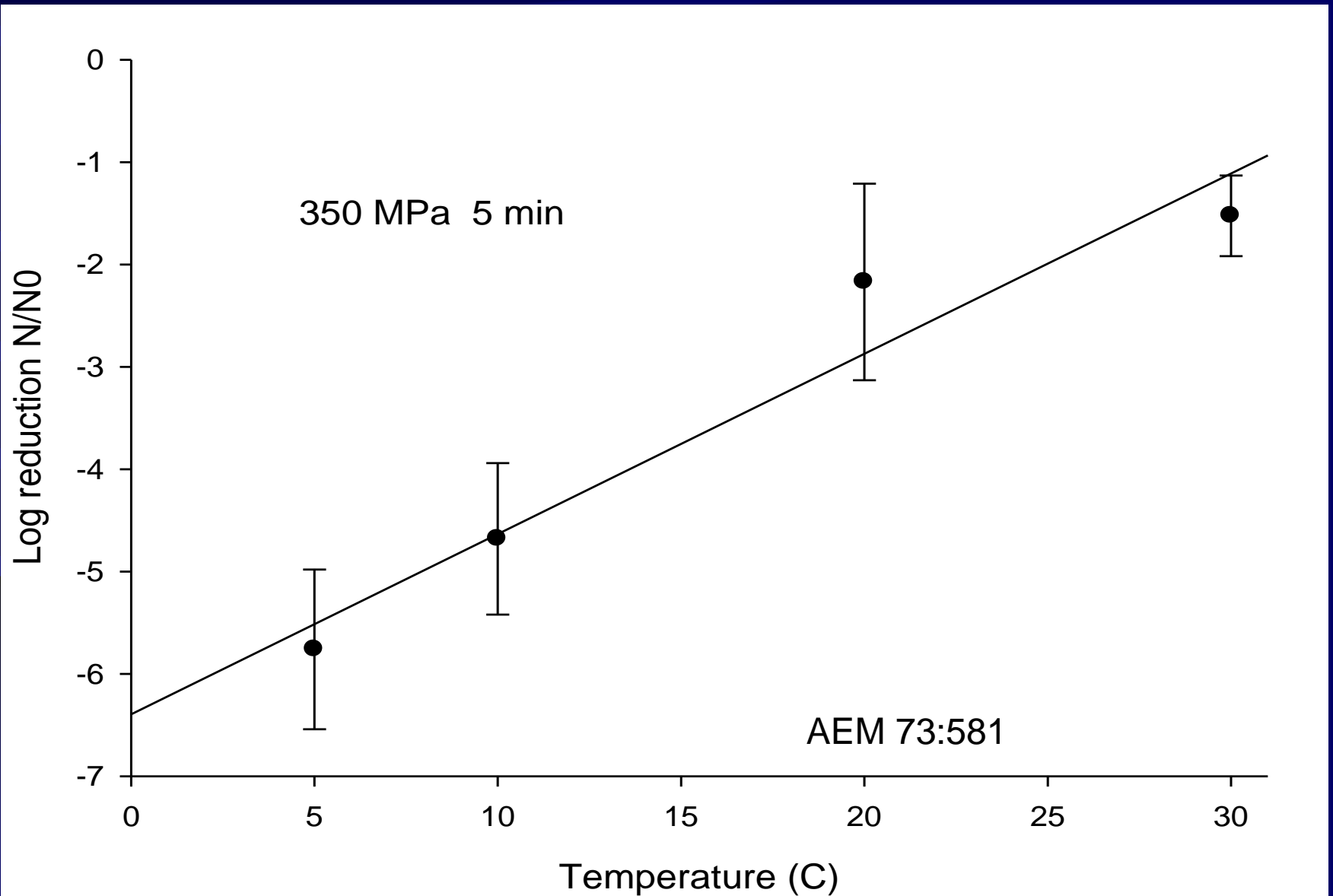
# Theme Exceptions

- Exception is Acidic pH (HAV; HuNoV)
- Second exception: Temperature (cold)  
(HuNoV; HAV)

# Time: MNV

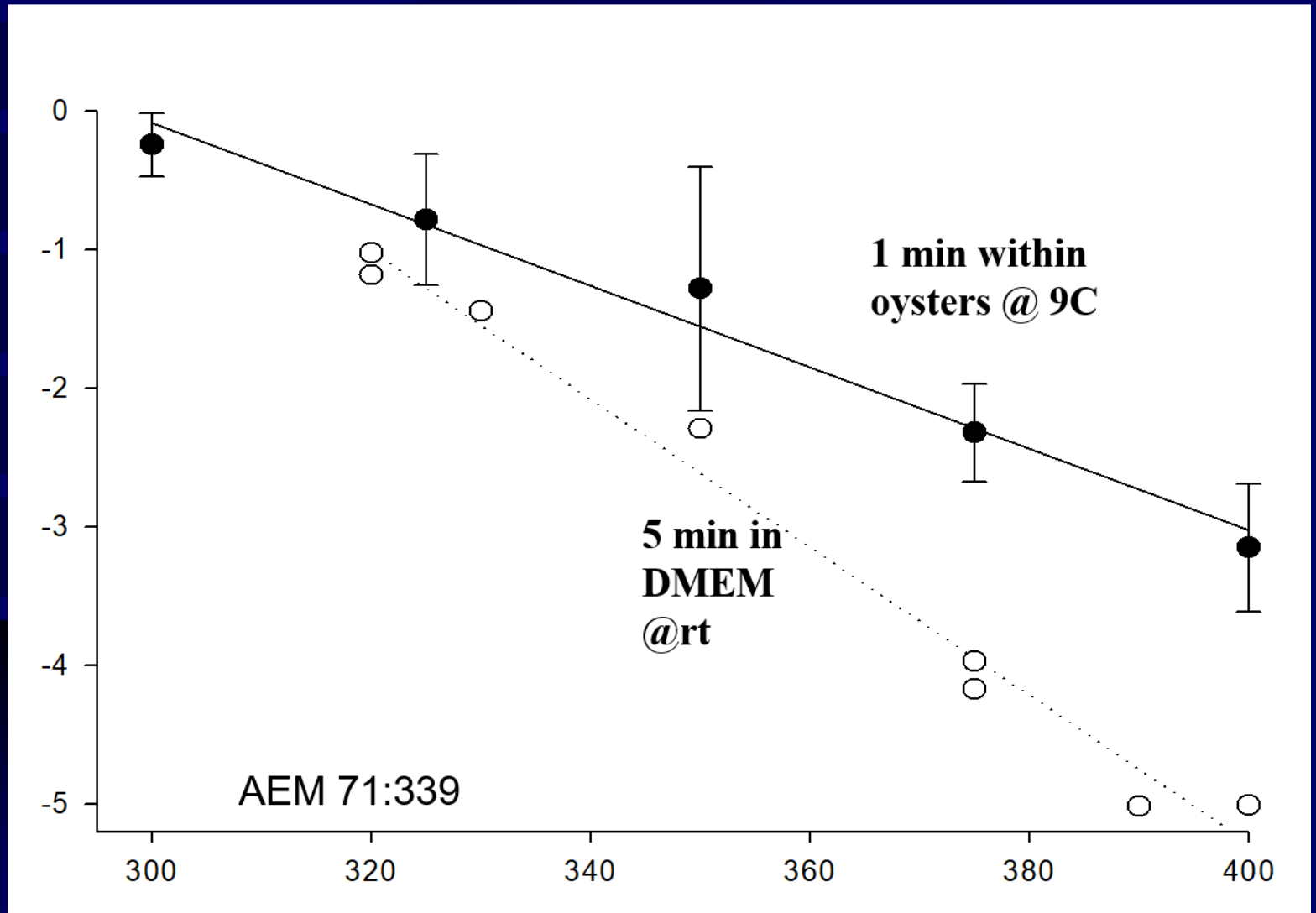


# Effect of Temperature on Pressure Inactivation of MNV



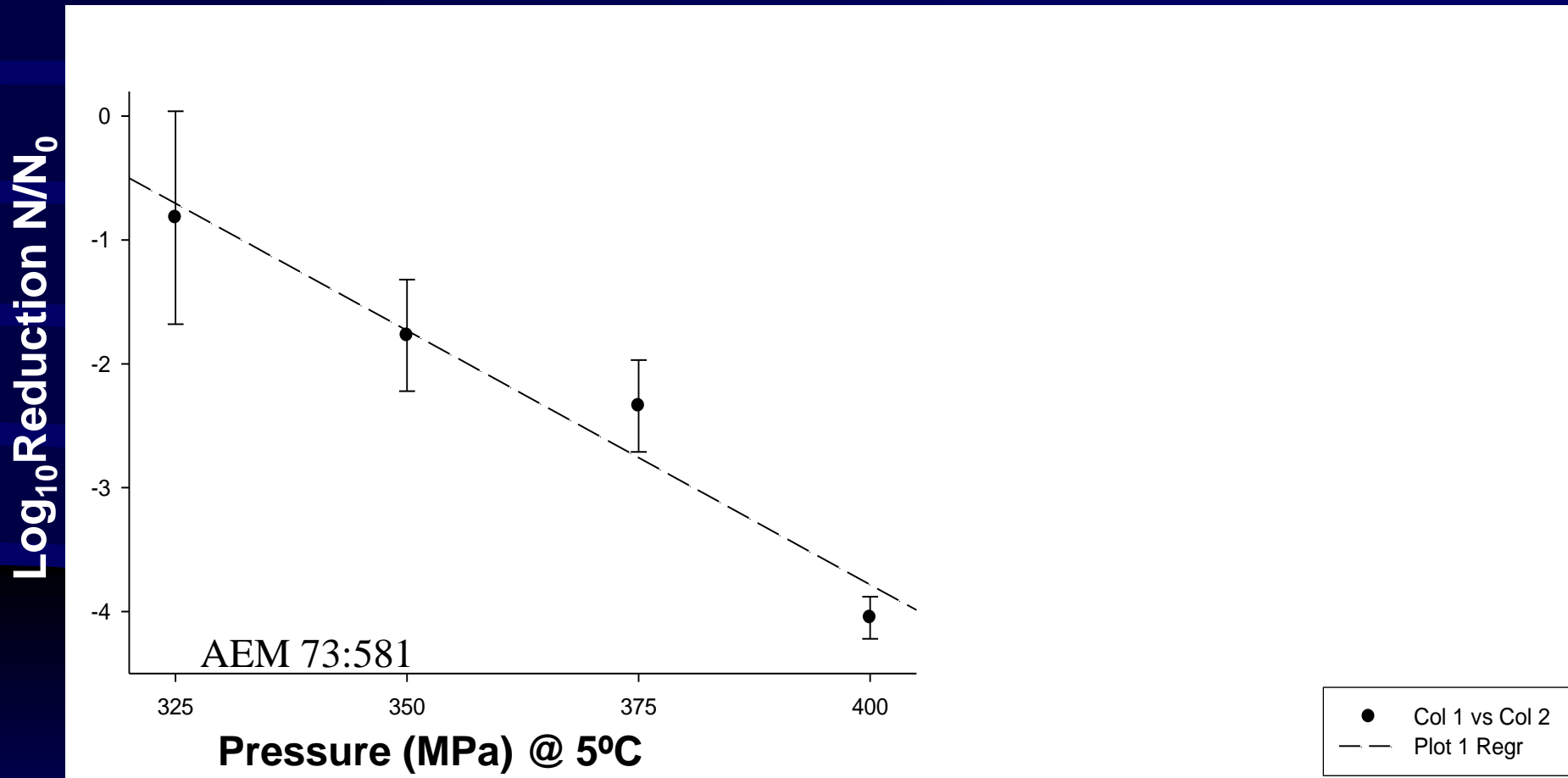
# Pressure Treatment of HAV *within Oysters*

Log<sub>10</sub> HAV Reduction



MegaPascals (MPa)

# MNV-1 contaminated oysters



In vivo mice confirmed inactivation (JFP 74:209)



# HPP Human volunteer study w GI.1 Norwalk virus

Whole live commercial oysters shucked with  
400 MPa then  $10^4$  RT-PCR units (total)  
injected into 3 oysters

Sealed in bags and pressure-treated with 400-  
600 MPa

Fed to human volunteers

Stools tested for GI.1 NoV



# Volunteer Results

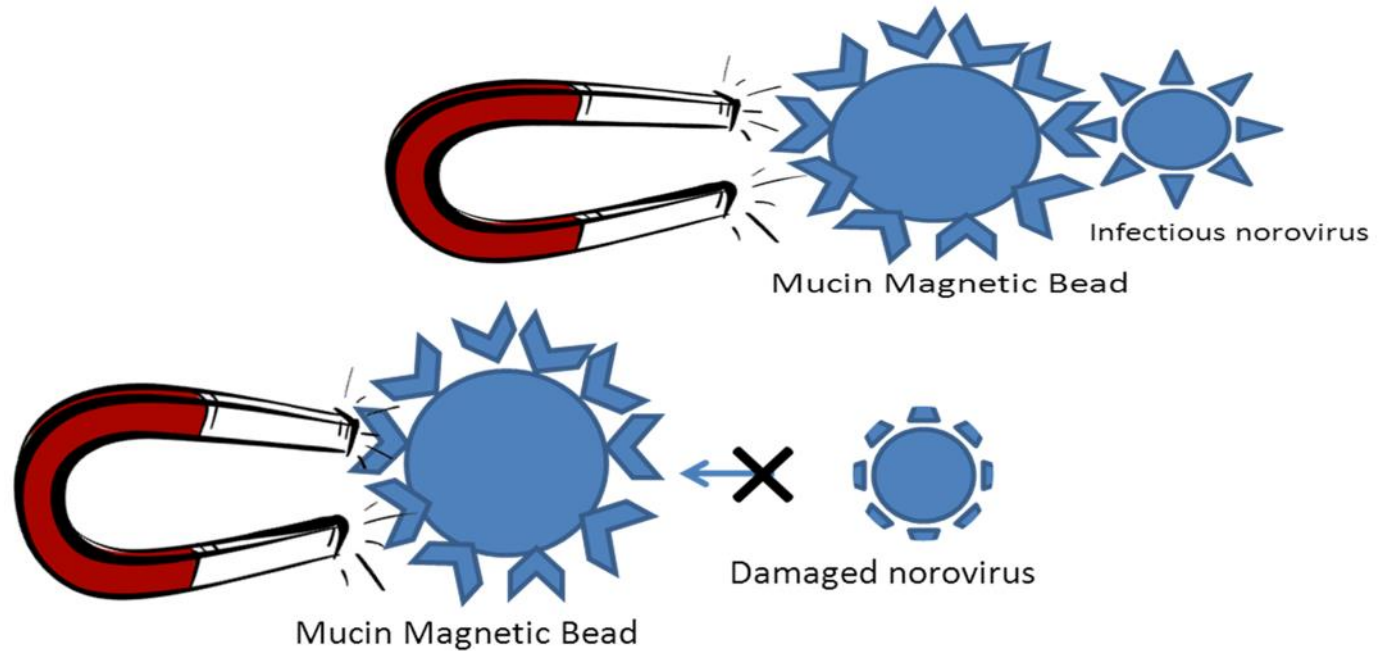
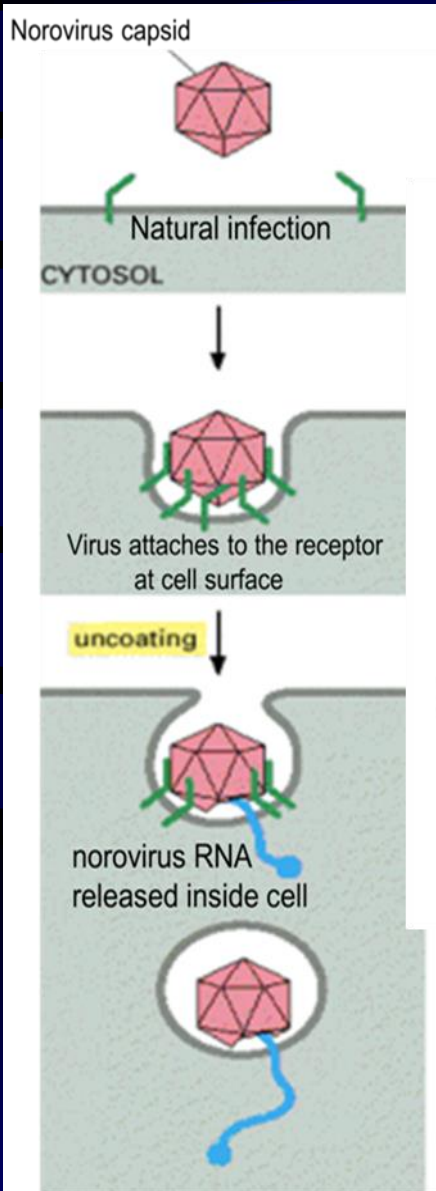
Untreated	7/15	47%
400 MPa 25°C	3/5	60%
400 MPa 6°C	3/14	21%
600 MPa 6°C	0/10	0%

400 MPa 25°C did not protect

400MPa 6°C ??

600 MPa did protect

# Infectious Assay by RT-PCR



>3 log drop at 400 MPa at 5°C (5 min)

# PGM Assay for HPP and HuNoV

Chen (UD) report:

IJFM 167: 138

GI.1 norovirus 450 MPa 2 min 1°C inactivates 3 log stock virus

For GII.4: 250 MPa 2 min 1°C inactivates 2.9 log stock virus

## Oyster Homogenate

GI.1 400 MPa 5 min at 25, 6, and 1°C = 1.0, 1.3, 2.9 log rd

GII.4 400 MPa 5 min at 25 and 6°C = 1.3 and 3.6 log rd

Clam Homogenate=similar results

AEM 80:2248

# HPP for HuNoV best at neutral pH

GI.1 500 MPa 21°C 2 min pH 4= ~ 0.4    pH 7= ~2.3 log rd

550 MPa 21°C 2 min pH 4= ~ 1.5    pH 7= ~3.0 log rd

GII.4 300 MPa 21°C 2 min pH 4= ~ 0    pH 7= ~1.3 log rd

350 MPa 21°C 2 min pH 4= ~ 1.2    pH 7= ~3.8 log rd

(PGM assay; IJFM 167:138)

# HPP Oysters...How do they taste!?

- Literature says good to 400 MPa... others say no!
- Temp for HPP may matter for taste
- Oyster taste test HPP at two temps: **RT and Fridge**
- **5 criteria using 1-7 likeability score (appearance, texture, flavor, aroma, acceptability)**
- **triploid small/medium size summer oysters from Cape May NJ (high salt)**

# Mean values for hedonic scale ratings for each characteristic and each sample

(N=56-61, depending on sample)

	Control	300 MPa 22°C	400 MPa 22°C	500 MPa 22° C	400 MPa 6°C	500 MPa 6°C	600 MPa 6°C	F value (Sig P value)
Appearance	4.11±1.6	5.46±1.5	5.39±1.4	5.20±1.6	5.39±1.5	5.45±1.4	5.22±1.7	5.78 (0.000)
Texture	4.54±1.9	5.23±1.7	5.36±1.8	5.55±1.6	5.20±1.6	5.47±1.5	5.43±1.7	2.46 (0.024)
Flavor	4.64±1.7	5.04±1.8	5.05±1.7	5.13±1.7	4.86±1.6	5.35±1.6	5.27±1.6	1.24 (0.287)
Aroma	4.90±1.4	5.27±1.3	5.04±1.2	5.30±1.3	5.27±1.4	5.33±1.3	5.33±1.4	0.94 (0.469)
Acceptability	4.64±1.6	5.14±1.6	5.13±1.6	5.28±1.6	5.02±1.5	5.53±1.4	5.38±1.6	2.05 (0.058)

Rating scale: 7 – Like very much; 1 – Dislike very much  
Medium triploid summer high salt oysters

# High Pressure Processing and Viruses: Take Home Messages

- HPP kills HAV, HuNoV
- Pressure level is predominate; time secondary
- Temperature is important: For HuNoV-cold kills
- Food matrix effects are important
- HPP is a viable intervention for raw oysters (*taste good*)
- Must be fresh!



# Collaborators

H. Chen and D. Hoover: Univ of DE

George Flick: Virginia Tech

Calci: US FDA, Dauphin Island AL

C. Moe: Emory