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College of Agriculture and Life Sciences

Emerging Technologies and Consumer Trends in Global Food Markets

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What Comes First?
Technology or Trends?

Current Consumer Trends

- Aversion to “chemical” additives & GMO
  - Fueled by social media and TV personality misinformation
    - “The Food Babe”, Dr. Oz

- High nutrition composition
  - Micronutrient focus
  - Antioxidant/phytochemical rich foods

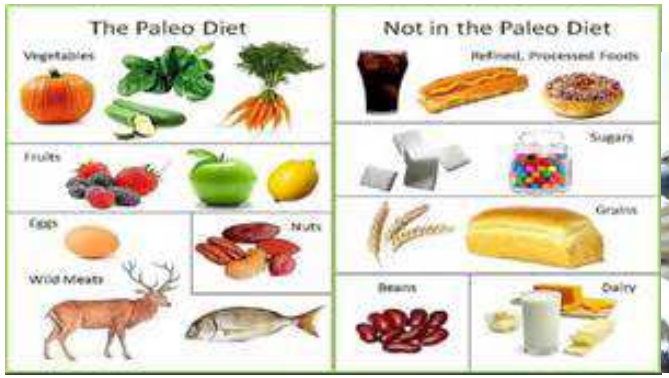
- Minimally or unprocessed foods
  - “Raw foods” diet movement

Technologies to Meet Trends

- Alternatives to “chemical” additives
  - Natural food sources
    - Preservatives
      - Cranberry extracts for benzoic acid
      - Celery extracts for nitrite/nitrates
      - Horseradish/wasabi extracts for allyl isothiocynates
      - Bacterial fermentates (Microguard™)
    - Antioxidants
      - Rhubarb extracts for anti-browning
      - Citrus extracts for anti-browning
    - Colors
      - Plant-based sources (kale origins)

Current Consumer Trends

- High nutrition composition
  - Ancient grain/paleo diet food emphasis
  - Tropical fruits
    - Acai, coconut water, dragon fruit

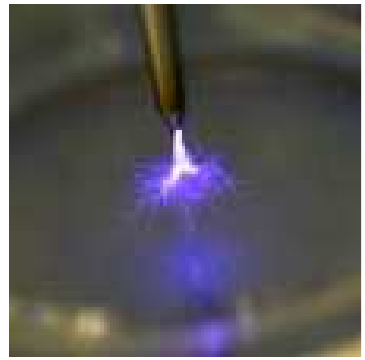


Current Consumer Trends

- Minimally or unprocessed foods
  - Fruit and vegetable juices
  - Fruit and vegetable purees
  - Milk and dairy products
  - Prepared meals and snacks
  - Baby foods
  - Seafood and shellfish

Emerging Technologies

- High pressure processing
- Pressure-assisted thermal processing
- Light technologies
- Pulsed electric field
- Ionized plasma



Emerging Technologies

- High pressure processing
  - Commercialized
    - Hiperbaric & Avure
  - Refrigerated, extended shelf life products
  - Retention of “fresh” qualities & nutrition
  - Enzymatic activity of foods
    - Polyphenol oxidase, pectin methylesterase
  - Good inactivation against vegetative bacteria, but much less against spores (bacteria & mold)

Emerging Technologies

- Pressure-assisted thermal processing
  - Thermal inactivation with higher pressures (500-700 Mpa)
  - Lower temperatures than retorting (90-120˚C)
  - Higher quality retention than traditional thermal processing
- Light technologies (pulsed light & ultraviolet)
  - Surface decontamination of solid foods and non-turbid or UV absorbing foods
  - Dimerization of DNA bases

Emerging Technologies

- Pulsed electric field (PEF)
  - Electrically arcing and thermalization results in destabilization of microbial membrane & thermal inactivation
  - Rapid inactivation kinetics
  - Liquid applications
  - Solid PEF consumer units being developed

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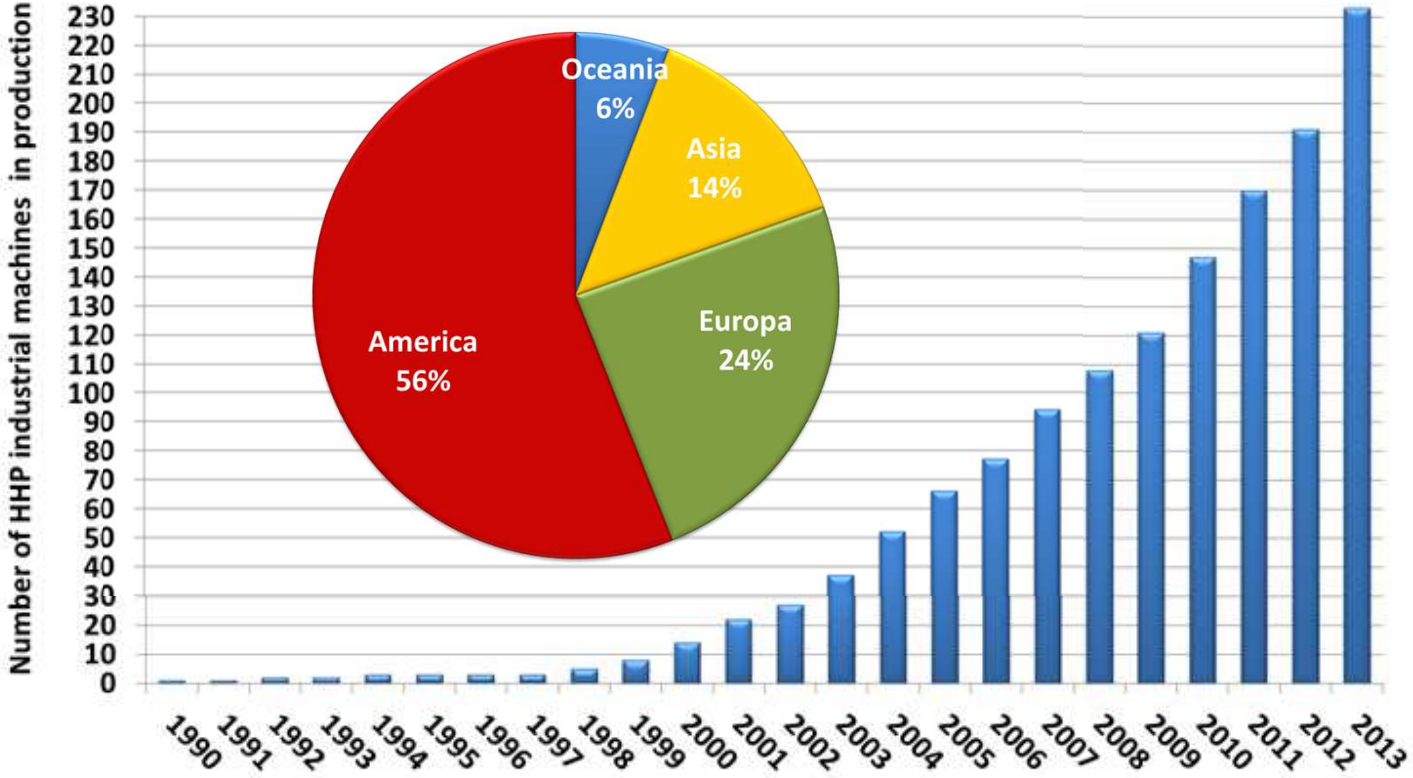
The Fastest Increasing Trends in Commercial Food Processing

Evolution of Total Number of HPP Industrial Machines



- **Total machine number in production end 2013 : 235**
- ***Not included : 15 dismantled machines (all installed before 2003)***

HPP Processed Foods

- Juices, dressings, jams, guacamole, baby food, deli meats, seafood, shellfish

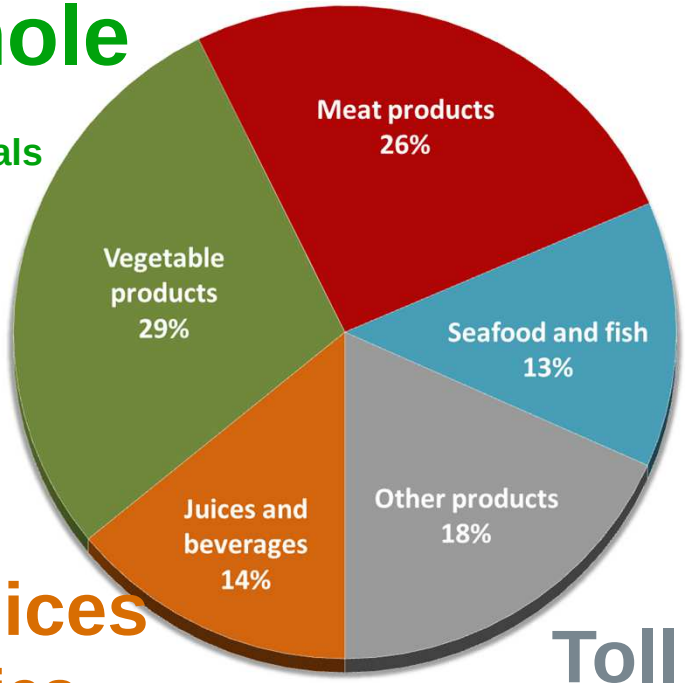
Industrial HPP Machines vs Food Industries

Pathogens-free sliced cooked meats

Preservative-free deli meats

Guacamole

Wet salads
RTE vegetable meals



***Listeria*-free dry-cured products**
Raw beef products
Preservative-free sausages

Oysters shucking

Lobster meat extraction
Clams & mussels shucking
RTE seafood meals

Fruit juices

Smoothies
Vegetable juices

Toll processing

Cheese products

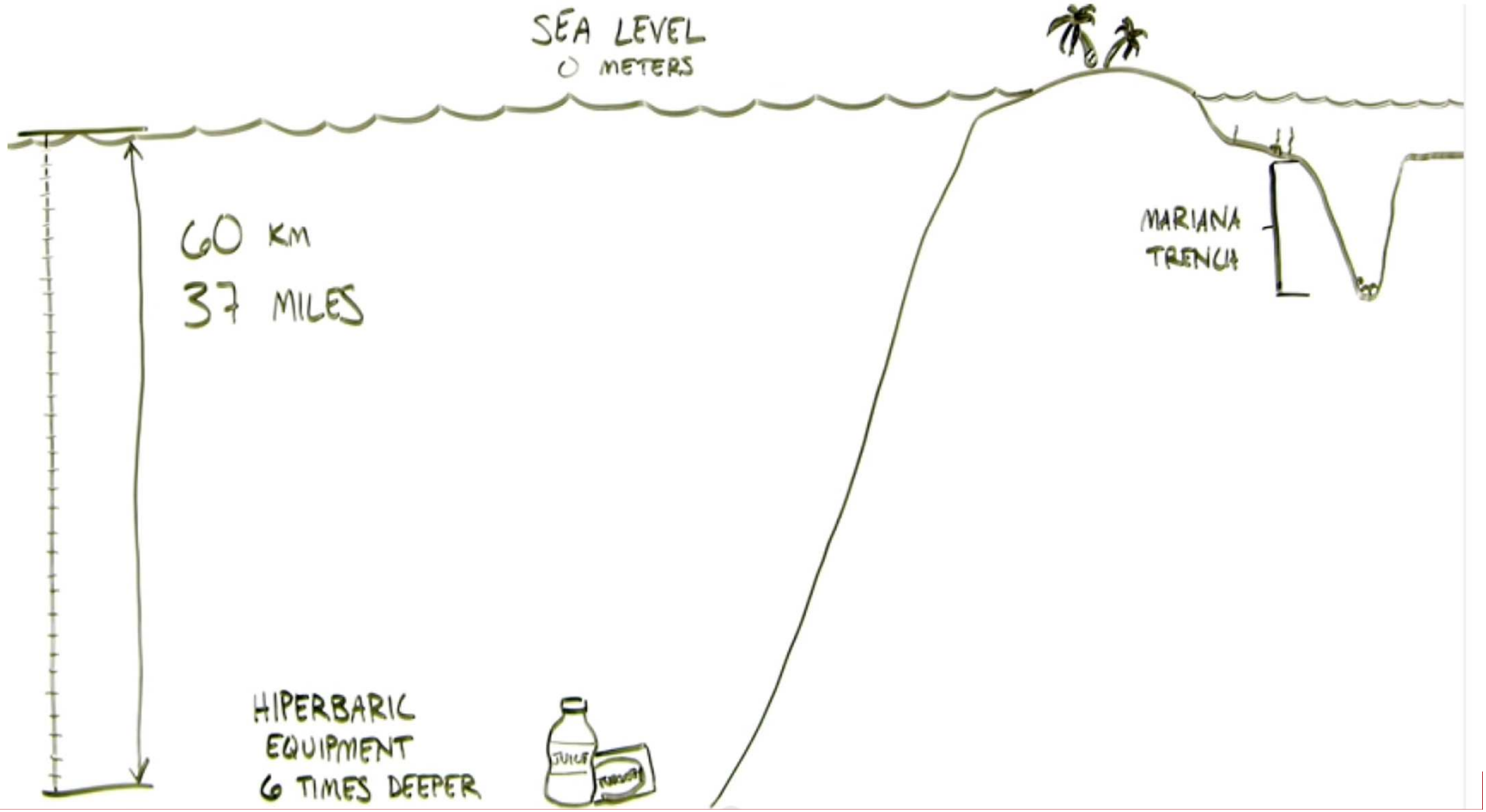
- Global HPP food production in 2012 : + 350 000 000 kg / + 770 000 000 lbs

What is High Pressure Processing???

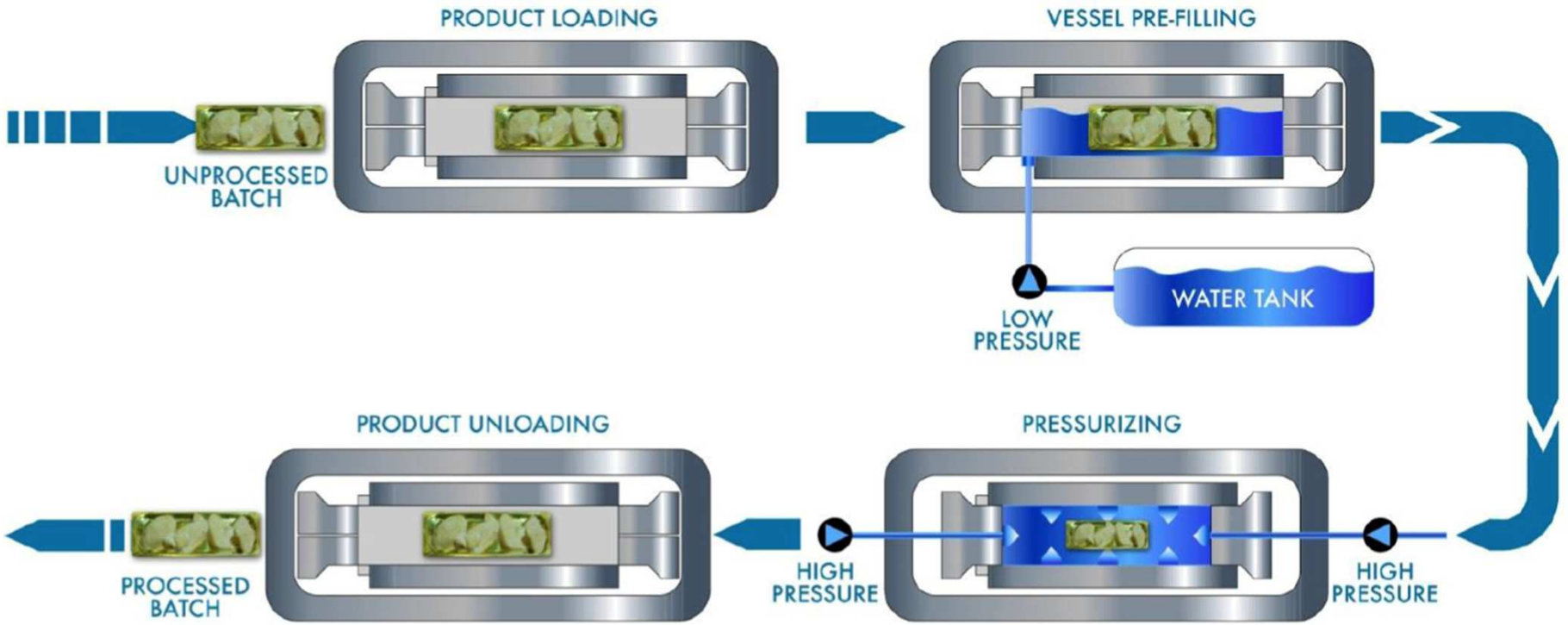
High Pressure Processing (HPP)

- High hydrostatic pressure or ultra high pressure
- Non-thermal or cold process
- Ranges: 100 – 800 MPa / <0 – 100˚ C
- Uniform throughout food mass
- Pressure-induced protein denaturation does occur
- Treatment conditions 600 MPa for 30-180 seconds

How Much Pressure is Involved?



HPP Process Flow



Regulatory Requirements

- USDA & FDA log reduction regulation requirements
  - Juice, milk & dairy products, meat, acidified foods
  - Can not be called “Fresh”
- Canada & EU consider HPP treated foods as “novel foods”
  - Case by case assessment by Health Canada
  - EU requires risk assessment or notification for “substantial equivalence” status

New Regulatory Approvals

- June 1, 2016
  - New South Wales, Australia permits the sale of HPP treated milk

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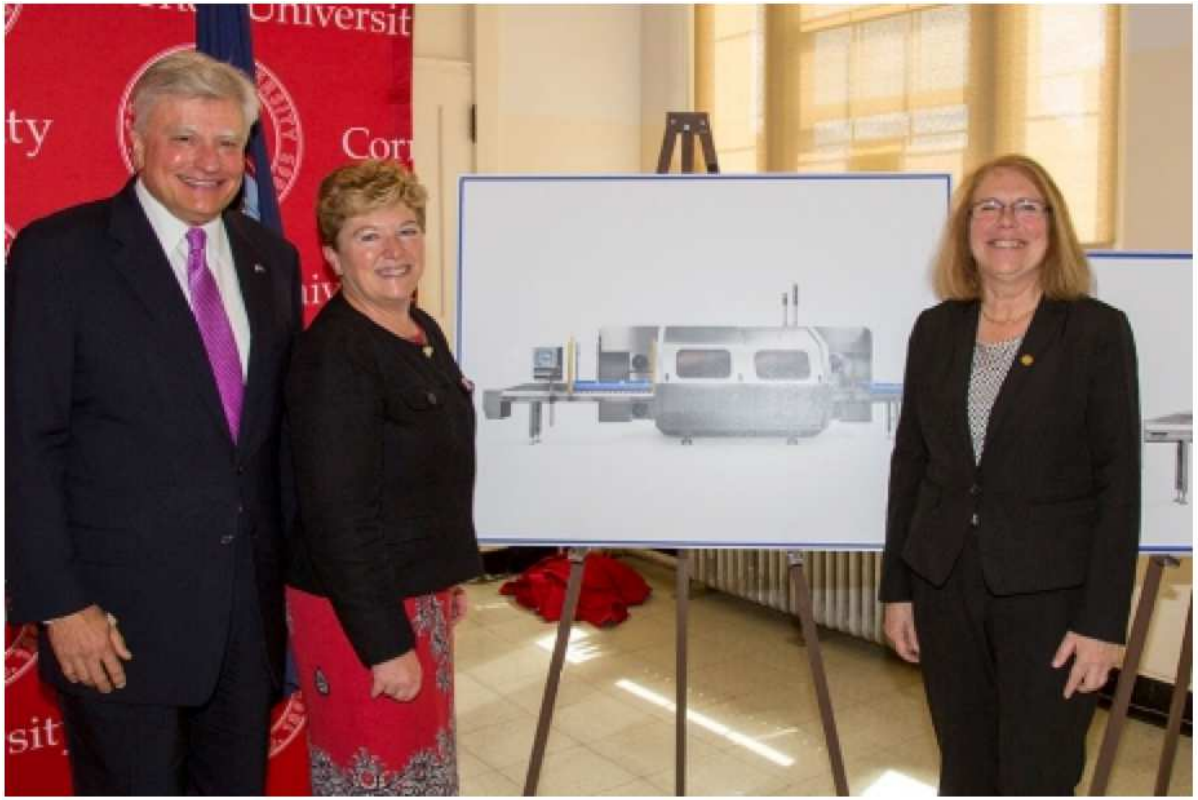
High Pressure Processing and the National Validation Center for Hiperbaric at Geneva



Rob Way/Provided

New York State Sen. Michael Nozzolio, R-54th Dist., poses in front of a photo of the Hiperbaric 55 along with Kathryn J. Boor, the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences, and Susan Brown, the Goichman Family Director of the New York State Agricultural Experiment Station in Geneva.

New High Pressure Processing Laboratory to open Summer 2016: National HPP Validation Center

- Supported by Hiperbaric, LiDestri, Suja, Wegmans
- NYS – $600,000 from Senator Nozzolio

Establishing Processing Conditions

Food Safety

- Validation studies with foodborne pathogens in actual packaged finished product
- Varying pressures and times
- Conditions achieving target log reduction established and reported to client
- **BSL2 requirement for lab space**

Establishing Processing Conditions

Shelf life & Quality

- Packaged finished product treated with varying pressures and times
- Monitoring physicochemical quality parameters and microbial shelf life over time at retail conditions or accelerated conditions

HPP Research Areas

- **Microbial safe harbors** for acidified and low acid foods
  - Effect of acid types and concentration
  - Effect of solids, water activity, preservatives
  - Predicting pathogen inactivation rates
  - Alternative applications
- Processing effects on organoleptic quality and physicochemical properties

The Changing Dynamics of the Food Industry & Food Science

- Global markets – sourcing and finished products
- The overarching reach of the food industry
- Synergies between food industry, government, & universities

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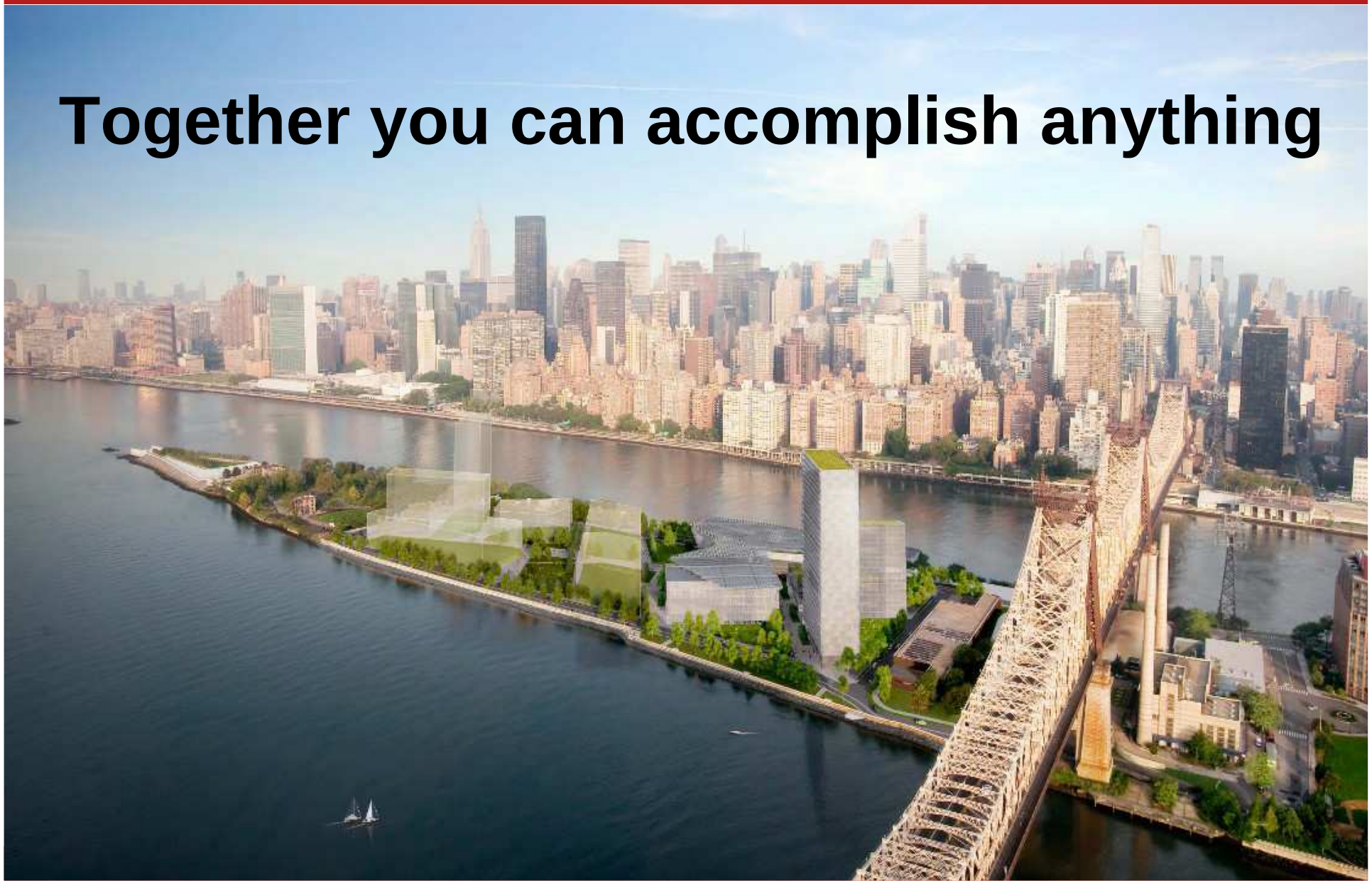
Together you can accomplish anything



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Thank You!