

Government – Industry Collaborations

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USDA FSIS Public Meeting on
Use of Whole Genome Sequencing
Washington DC
October 26-27, 2017



IFSH Mission

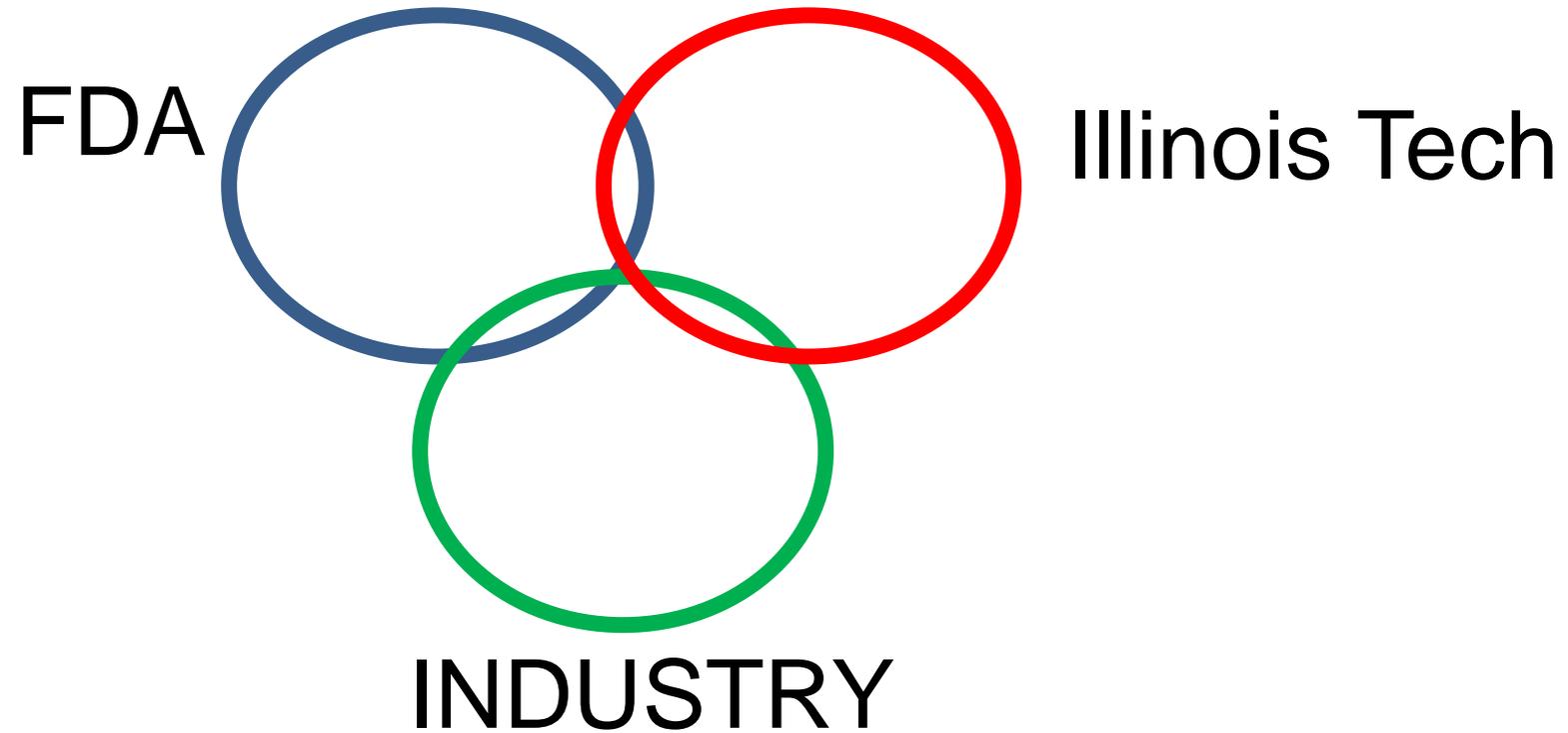
All industry and association members together with FDA and IIT scientists meet to promote understanding and resolution of significant food safety and nutrition issues that confront the public, industry and government and to advance knowledge and science in related fields.



IIT Moffett Campus, Bedford Park, IL



What is IFSH?



IFSH – At a Glance

- Four research centers with primary focus:
 - Food processing safety
 - Nutrition research
 - National security related to food
- Holds consortium between IIT/FDA/Industry (70 Members)
 - Location for FDA's Division of Food Processing Science & Technology
- 100+ Scientists 50/50 IIT/FDA
- 176 IIT Graduate Students
 - Masters and Professional Certificates in FST and FPE
 - Students gain valuable research experience with FDA on research projects



IIT Main Campus, State Street, Chicago, IL



IIT Moffett Campus, Bedford Park, IL

Examples of Recent Foods Implicated in Outbreaks Traced with WGS

- Traditional foods

- Raw milk
- Soft cheeses
- Sprouts
- Eggs



- Novel foods

- Caramel dipped apples
- Ice cream
- Packaged salads
- Stone fruits
- Frozen vegetables



LISTERIA AND BLUE BELL ICE CREAM

Contaminated production facilities and illnesses linked to Blue Bell Creameries

CDC recommends that people not eat, serve, or sell any recalled Blue Bell brand products. This complicated investigation of a listeriosis outbreak involved serious illnesses from 2010 through 2015 linked to two Blue Bell production facilities.



Cluster #1 – Feb 2015

- Lm found in ice cream, many PFGE patterns
- PulseNet – 5 cases, 4 patterns
- WGS identified all as highly similar and linked to strain found in Texas plant

Cluster #2 - Pre-wrapped scoops in hospital freezer

- Lm with rare PFGE and matched with 5 hospital cases over 5 years in 3 other states
- Product made at second production plant that served hospitals
- WGS matched patients, ice cream and isolates from plant



Stopping An Outbreak

- Sharing of data from CDC and FDA with company
- Halt production and recall all product
- Issued warning to public and health care facilities
- Implemented new in-plant monitoring

- **Prior to 2015 - ice cream is not recognized as a hazard or high risk**
- Novel food vehicle – industry reform through rigorous sanitation, monitoring and preventive controls

Future Foodborne Outbreaks

- Likely to be more dispersed in space and time i.e. multi-state or international and spread over long periods of time
- Outbreaks associated with
 - Fresh produce and minimally processed foods
 - Imported foods
 - Foods not previously recognized as hazardous or novel foods
 - Previously not recognized routes of contamination

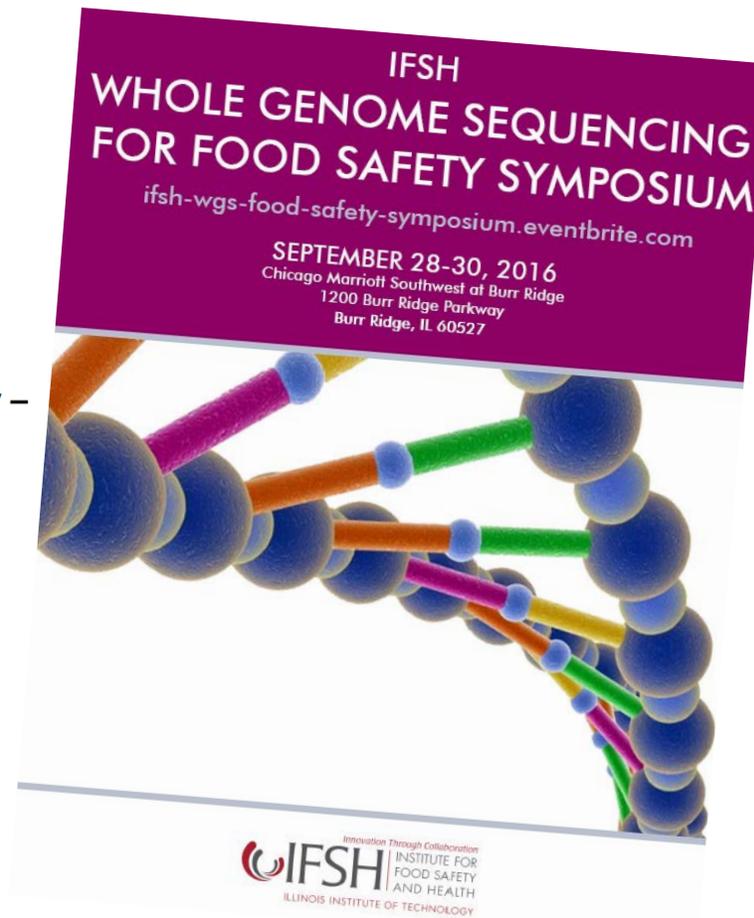


Annual IFSH Symposia



Save the Date – March 16, 2015
10AM – 1PM CST

**Workshop: Whole Genome Sequencing for Food Safety –
Opportunities and Applications to the Food Industry**



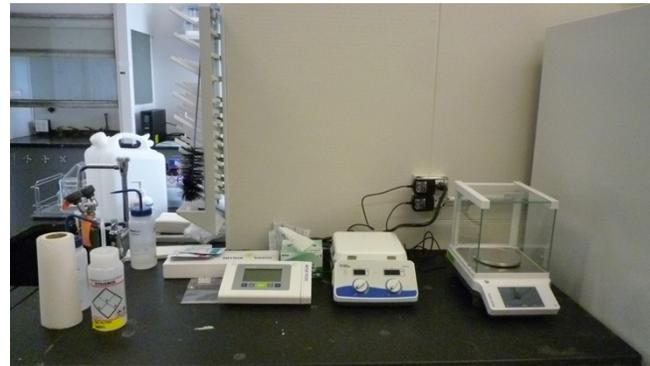
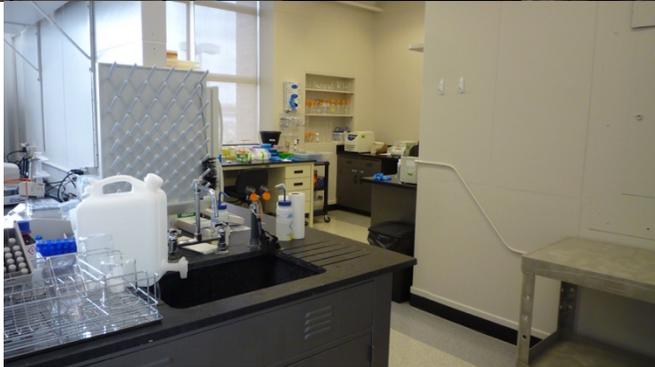
- The Industry Advisory Committee - quarterly meetings
- The Industry-Government Council – currently 2 face-to-face meetings

Industry Issues and Concerns

- What information and identifiers will be collected?
- How will the information be used by regulators?
- What are the implications in absence of a culture?
- Can the company self-incriminate?
- Legal issues relating to the use of WGS
- What benefit does industry get from WGS?
- Legal issues in donating sequences or plant-derived isolates?



IFSH WGS Laboratory



WGS Uses

- Identify isolates
- Differentiate closely related isolates
- Tracking sources of contamination
- Monitor production environments
- Prevent outbreaks, recalls, financial losses

IFSH WGS Initiative

Objectives

- Promoting the technology
- Collaboration with food companies
- Research and laboratory services
- Pathogen sequencing
- Contribute to GenomeTrakr
- Data analyses
 - QC on sequence data, sequence assembly, phylogenetic analyses



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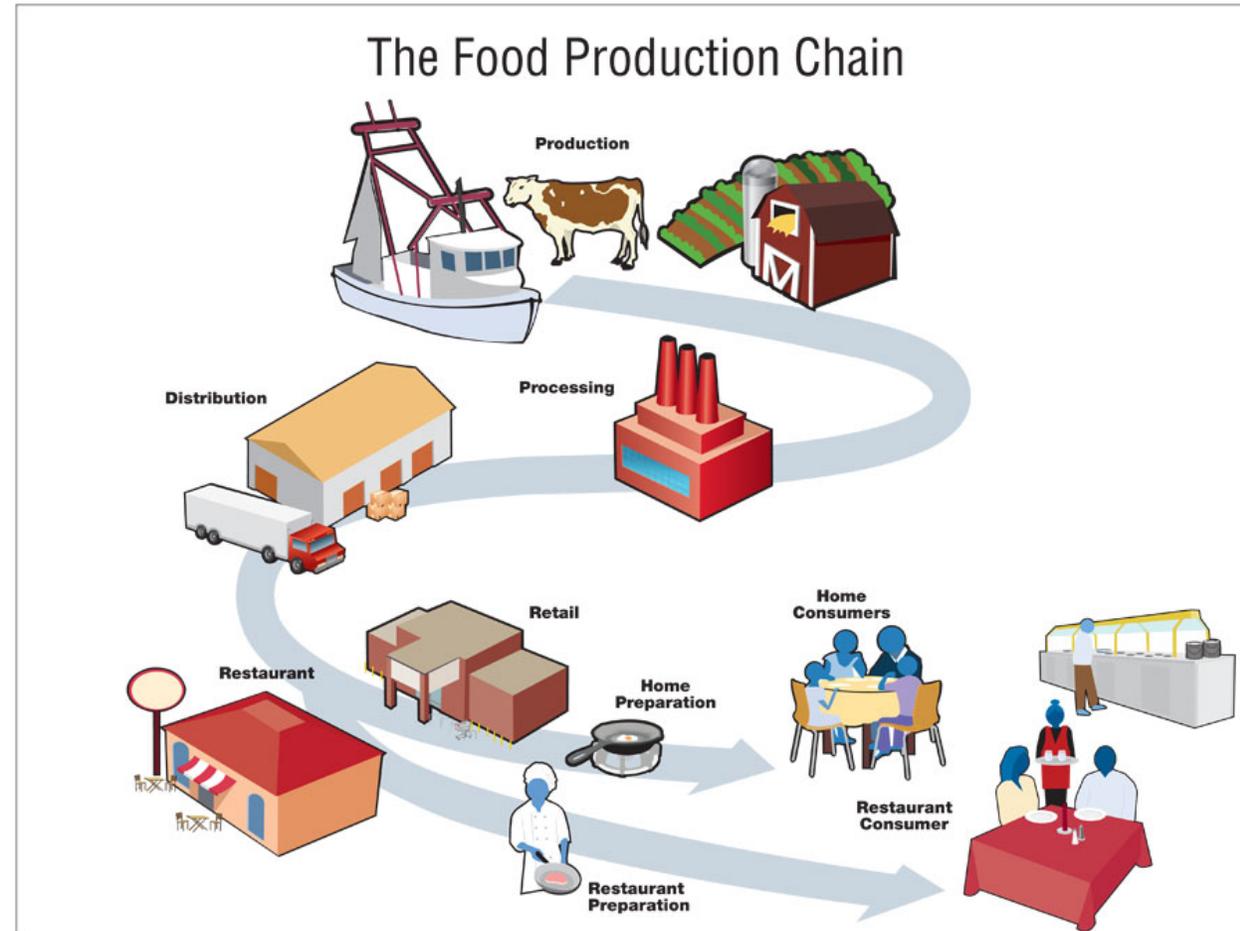
Collaborative Projects at IFSH

- Photonic curing instrument / Pulsed Light (academia + industry)
 - Examination of bacterial community and changes
- Role of plasmids in toxin production in *C. botulinum* (WGS) (government)
 - Regulation of toxin production in *C. botulinum* (RNA-seq)
 - Better understanding of *C. botulinum* in low acid foods and impact of acids/pH and heat
- Alfalfa seeds and sprouts (academia + government)
 - Tracking and detection of *Salmonella*
- Environmental monitoring (academia + industry + government)
 - Metagenomics before and after cleaning and sanitation
 - Assess effectiveness/enhancement of sanitation procedures
 - Tracking of spoilage events



WGS and Production Environment

- Hygiene is an essential step
- 16S rDNA sequencing showed milk with higher somatic cell counts = higher abundance of bacteria including spoilage (Rodrigues et al. 2017. J Dairy Sci)
- Ecology of processing environment can influence food quality

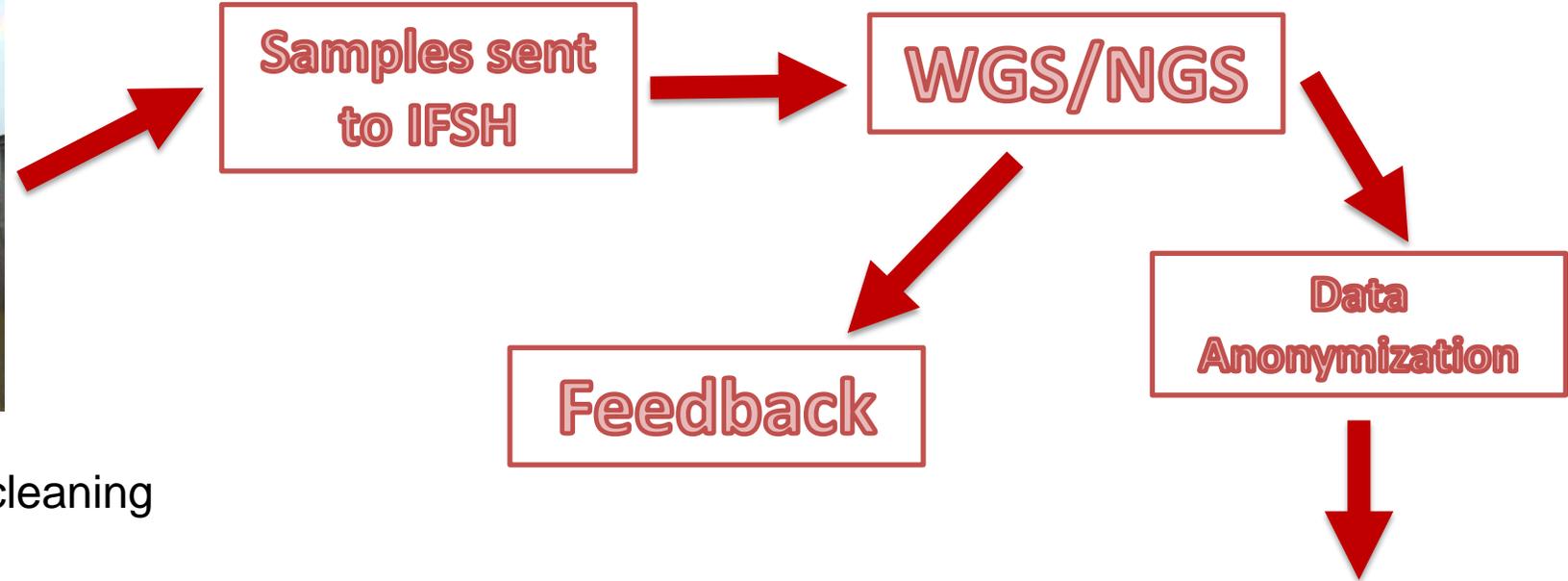


WGS and Production Environment

- Food plants can harbor unique bacterial colonies
- Sprouts, spinach, lettuce, tomato, pepper and strawberries – high abundance of Enterobacteriaceae
- Apples, peaches, grapes and mushrooms – Actinobacteria, Bacteroidetes, Firmicutes and Proteobacteria

Source Tracking (Pilot)

Environmental monitoring (academia + industry + government)



- Metagenomics of before and after cleaning
 - Effectiveness of cleaning
 - Changes to microbial ecology and effect on spoilage bacteria
- Metagenomics of spoilage events
 - Prediction of spoilage
- More effective food production processes



Acknowledgements



IFSH and IIT Collaborators

- Behzad Imanian and Melissa Widel
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Thank you & Questions

