



Cornell University
College of Agriculture and Life Sciences

Whole genome sequencing (WGS) update/part II

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Take home messages

- Make sure someone in your organization knows how to use the NCBI Pathogen Detection database
- Have a serious discussion about use of subtyping as part of your environmental monitoring programs
 - Can be WGS or another reliable approach
- Consider WGS for root cause analysis of microbial pathogens (beyond *Listeria*, *Salmonella*, and *E. coli*) and spoilage issues
- Do a WGS pilot to test potential partners (labs etc.)

Outline

- NCBI Pathogen Detection database
- Listeria tracking example
- WGS-based characterization of bacteria

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https://www.ncbi.nlm.nih.gov/pathogens

COVID-19 is an emerging, rapidly evolving situation.
Get the latest public health information from CDC: <https://www.coronavirus.gov>.
Get the latest research from NIH: <https://www.nih.gov/coronavirus>.

[Health](#) > Pathogen Detection

Pathogen Detection BETA

i To assist the National Database of Antibiotic Resistant Organisms (NDARO), NCBI Pathogen Detection identifies the antimicrobial resistance, stress response, and virulence genes found in bacterial genomic sequences. This enables scientists to track the spread of resistance genes and to understand the relationships between antimicrobial resistance and virulence.

NCBI Pathogen Detection integrates bacterial pathogen genomic sequences originating in food, environmental sources, and patients. It quickly clusters and identifies related sequences to uncover potential food contamination sources, helping public health scientists investigate foodborne disease outbreaks.

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<https://www.ncbi.nlm.nih.gov/pathogens>

NCBI Pathogen Detection database

- Industry can do WGS without submitting isolates to NCBI
 - But, FDA may request WGS data if they are aware that WGS is being performed

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https://www.ncbi.nlm.nih.gov/pathogens

PubMed Pathogen Tracker Master Schedule Food Safety Wiki Fly Fishing Reports-US... Facebook Gaia GPS Coronavirus Coronavirus Update (L... n- Environmental Health ...

1. Search for isolates encoding a mobile colistin resistance gene and a KPC beta-lactamase
search: [AMR_genotypes:mcr* AND AMR_genotypes:blaKPC*](#)

2. Search for Salmonella isolates from the USA
search: [geo_loc_name: USA AND taxgroup_name:"Salmonella enterica"](#)

[Pathogen Detection Reference Gene Catalog](#)

[Isolates with antibiotic resistant phenotypes](#)

[Download analysis results \(FTP\)](#)

Explore the Data

Species	New Isolates	Total Isolates
Salmonella enterica	76	271,920
E.coli and Shigella	10	105,597
Campylobacter jejuni	4	51,310
Listeria monocytogenes	8	34,345

[See more organisms...](#)

Submit

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8:49 PM 4/27/2020

Summary of *L. monocytogenes* data on NCBI (release 1382, August 16,2019)

Total number of isolates	Number of clusters	Number of unclustered isolates (> 50 SNPs to any other isolate in the DB)	Number of human clinical isolates	Number of environmental/food isolates
28,285	2,492	5,508	9,857	18,428

Isolates in the same SNP cluster differ from at least one other isolate in the cluster by at most 50 SNPs.

MAY 21, 2020 | ALBANY, NY

CONSUMER ALERT: Listeria Monocytogenes Contamination in High Point Dairy Monterey Jack Raw Milk Cheese

2017 DKH Cheese Recalls (Listeria monocytogenes contamination)



Major Product Recalls

[2016 Frozen vegetable products \(Listeria monocytogenes\)](#)

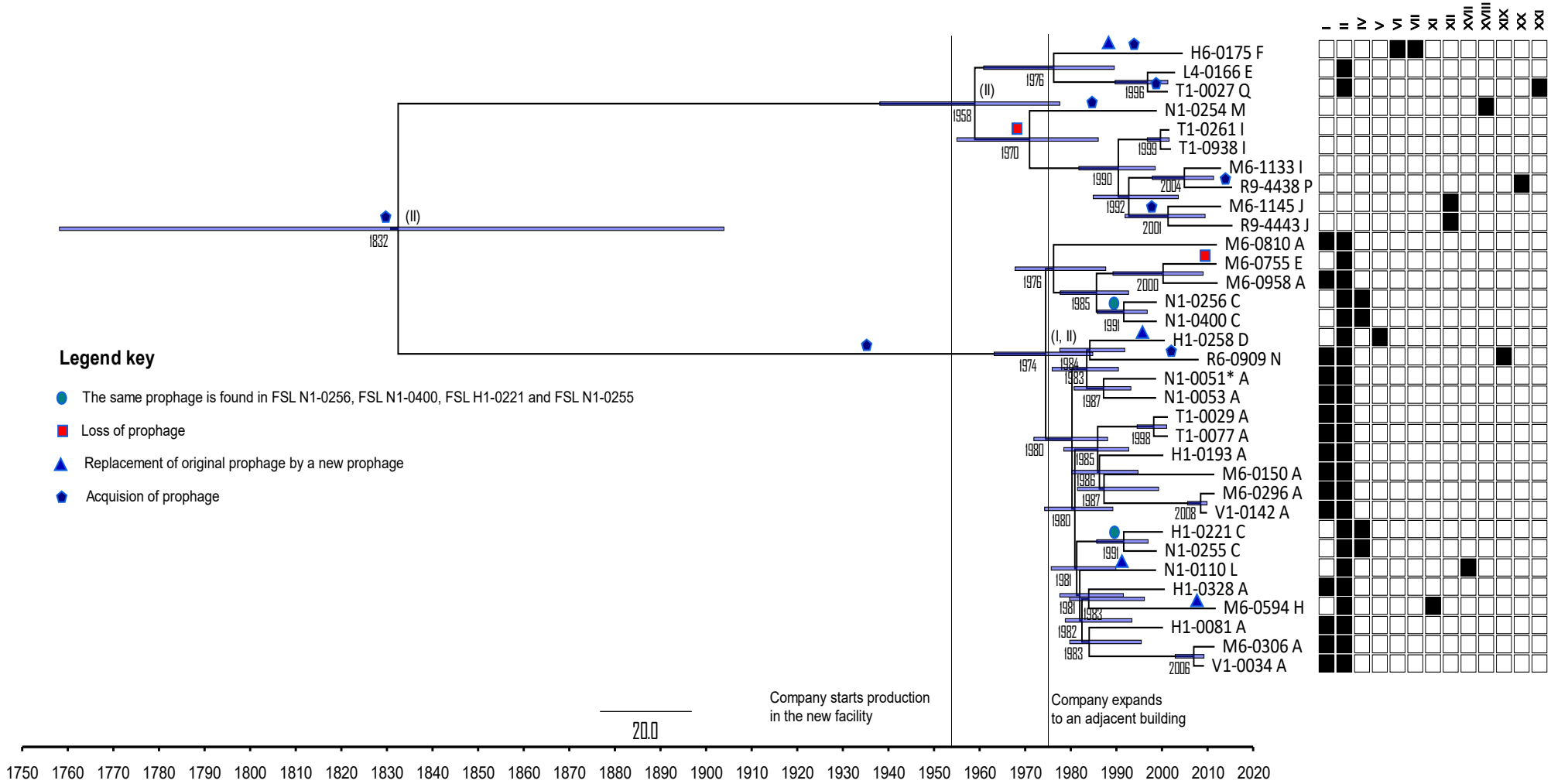
2017 DKH Cheese Recalls (Listeria monocytogenes contamination)

[2017 Vegetable/Produce Recalls Associated with](#)

Deutsch Kase Haus, LLC of Middlebury, Ind. has announced a voluntary nationwide recall on various cheese products due to the potential for it to be contaminated with Listeria monocytogenes. Deutsch Kase Haus' action has resulted in several additional product recalls of brands that received cheese from the firm. Below is a list of the recalls that identify Deutsch Kase Haus as their supplier.

Please note this list only includes recalls of FDA-regulated products from brands that named Deutsch Kase Haus as their supplier in their press release. Additionally, some recalled cheeses may not have been supplied by Deutsch Kase Haus, but were further processed in common facilities. For the most complete recall information, consult FDA's recall page <https://www.fda.gov/Safety/Recalls/> and search "cheese." For USDA-regulated products under recall, see <https://www.fsis.usda.gov/wps/portal/fsis/topics>

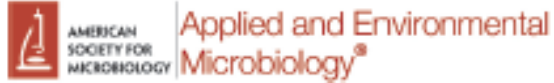
WGS-based characterization of isolates obtained from a single facility over 17 years



Reduced quat sensitivity in *L. monocytogenes* strains obtained from a seafood processing plant

Strains	Cluster	“Quat resistance” genes (based on WGS)	MIC* for			
			BC	BZT	CPC	Weiquat
FSL H1-0506	1	None	1 mg/L	2 mg/L	1mg/L	0.001%
FSL M6-0204	1	qacH	3 mg/L	4 mg/L	3mg/L	0.004%
FSL H1-0322	2	bcrABC	4 mg/L	7 mg/L	3mg/L	0.004%
FSL T1-0027	3a	bcrABC	3 mg/L	5 mg/L	2mg/L	0.004%
FSL T1-0077	3b	bcrABC	3 mg/L	6 mg/L	2mg/L	0.004%

BC= benzalkonium chloride, BZT= benzethonium chloride, CPC= cetylpyridinium chloride;
 MIC value indicates conditions for which no growth was detected (at the detection threshold OD_{600nm} 0.15) after 24 h of incubation.



Rapid, High-Throughput Identification of Anthrax-Causing and Emetic *Bacillus cereus* Group Genome Assemblies via BTyper, a Computational Tool for Virulence-Based Classification of *Bacillus cereus* Group Isolates by Using Nucleotide Sequencing Data

Laura M. Carroll, Jasna Kovac, Rachel A. Miller, Martin Wiedmann
Department of Food Science, Cornell University, Ithaca, New York, USA

Kovac *et al.* *BMC Genomics* (2016) 17:581
DOI 10.1186/s12864-016-2883-z

BMC Genomics

RESEARCH ARTICLE

Open Access



Production of hemolysin BL by *Bacillus cereus* group isolates of dairy origin is associated with whole-genome phylogenetic clade

Jasna Kovac, Rachel A. Miller, Laura M. Carroll, David J. Kent, Jiahui Jian, Sarah M. Beno and Martin Wiedmann*

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