



Genome Sequence of *Listeria monocytogenes* Strain HPB2088 (Serotype 1/2a), an Environmental Isolate Collected in Canada in 1994

Arthur W. Pightling,^{a*} Hugh Rand,^b Errol Strain,^b Franco Pagotto^a

Listeriosis Reference Centre Microbiology Research Division, Bureau of Microbial Hazards, Food Directorate, Health Canada, Ottawa, Ontario, Canada^a; Biostatistics and Bioinformatics Branch, Office of Analytics and Outreach, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, College Park, Maryland, USA^b

* Present address: Arthur W. Pightling, Biostatistics and Bioinformatics Branch, Office of Analytics and Outreach, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, College Park, Maryland, USA.

Listeria monocytogenes is a foodborne pathogen that causes severe illness. Thus, ongoing efforts at real-time whole-genome sequencing are of utmost importance. However, it is also important that retrospective analyses that place these data into context be performed. Here, we present the genome sequence of strain HPB2088, which was collected in 1994.

Received 7 June 2016 Accepted 10 June 2016 Published 4 August 2016

Citation Pightling AW, Rand H, Strain E, Pagotto F. 2016. Genome sequence of *Listeria monocytogenes* strain HPB2088 (serotype 1/2a), an environmental isolate collected in Canada in 1994. Genome Announc 4(4):e00760-16. doi:10.1128/genomeA.00760-16.

Copyright © 2016 Pightling et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International license.

Address correspondence to Franco Pagotto, Franco.Pagotto@hc-sc.gc.ca.

isteria monocytogenes, the etiologic agent of listeriosis, is a Gram-positive bacterium commonly found in plant, soil, and surface water habitats (1). Listeriosis is a life-threatening illness that may occur when foods contaminated with L. monocytogenes are consumed, especially by immunocompromised individuals such as neonates and elderly people (2). As part of ongoing efforts to minimize the impacts of listeriosis, governmental organizations routinely collect L. monocytogenes from foods and food-processing facilities and sequence their genomes in real time (prospective studies). In addition, groups are sequencing the genomes of historical L. monocytogenes isolates (retrospective studies). Here, we present the genome sequence of the Canadian L. monocytogenes strain HPB2088 (serotype 1/2a) collected in 1994 (NCBI BioSample no. SAMN02867555; https://www.ncbi.nlm.nih.gov/biosample/SAMN02867555). Studying HPB2088 may provide valuable insight into the biology and history of *L. monocytogenes* in Canada.

We assembled Illumina sequencing reads with SPAdes v3.0.0 (3), using the BayesHammer error correction tool (4). The assembly yielded 38 nonoverlapping contiguous sequences with 192.33-fold coverage, a total length of 2,979,080 nucleotides, and an N_{50} of 211,340 nucleotides (NCBI RefSeq assembly accession GCF_000712425.1; https://www.ncbi.nlm.nih.gov/assembly/GCF_000 712425.1). The NCBI Prokaryotic Genome Annotation Pipeline was used to annotate the genome (5). A total of 2,994 features were identified, including 2,912 protein-coding regions, 15 pseudogenes, one CRISPR array, three rRNAs, 62 tRNAs, and one ncRNA. We also identified *Listeria* genomic island 1 (LGI1), a feature that, to date, has only been reported in a small group of Canadian isolates (6, 7).

Analysis of HPB2088 with pulsed-field gel electrophoresis indicates an LMACI.0001 AscI restriction digest pattern and an LMAAI.0001 ApaI pattern. The ribotype pattern is 21-S-4, or DUP-1045. During a previous study, the sequence type was determined with *in silico* multilocus sequence typing to be ST120 (*abcA* – 5, *bglA* – 6, *cat* – 2, *dapE* – 29, *dat* – 5, *ldh* – 3, *lhkA* – 1) (8). HPB2088 is a member of evolutionary lineage II and clonal complex CC8. **Nucleotide sequence accession numbers.** This whole-genome shotgun project was deposited at DDBJ/EMBL/GenBank under the accession number JOKU00000000. The version described in this paper is the first version, JOKU01000000.

FUNDING INFORMATION

This work, including the efforts of Franco Pagotto, was funded by Genomics R & D Initiative (4500834).

REFERENCES

- 1. Farber JM, Losos JZ. 1988. *Listeria monocytogenes*: a foodborne pathogen. CMAJ 138:413–418.
- Farber JM, Peterkin PI. 1991. Listeria monocytogenes, a foodborne pathogen. Microbiol Rev 55:476–511.
- Bankevich A, Nurk S, Antipov D, Gurevich AA, Dvorkin M, Kulikov AS, Lesin VM, Nikolenko SI, Pham S, Prjibelski AD, Pyshkin AV, Sirotkin AV, Vyahhi N, Tesler G, Alekseyev MA, Pevzner PA. 2012. SPAdes: a new genome assembly algorithm and its applications to single-cell sequencing. J Comput Biol 19:455–477. http://dx.doi.org/10.1089/cmb.2012.0021.
- Nikolenko SI, Korobeynikov AI, Alekseyev MA. 2013. BayesHammer: Bayesian clustering for error correction in single-cell sequencing. BMC Genomics 14(suppl 1):S7. http://dx.doi.org/10.1186/1471-2164-14-S1-S7.
- Angiuoli SV, Gussman A, Klimke W, Cochrane G, Field D, Garrity G, Kodira CD, Kyrpides N, Madupu R, Markowitz V, Tatusova T, Thomson N, White O. 2008. Toward an online repository of standard operating procedures (SOPs) for (meta)genomic annotation. Omics 12:137–141. http://dx.doi.org/10.1089/omi.2008.0017.
- Gilmour MW, Graham M, Van Domselaar G, Tyler S, Kent H, Trout-Yakel KM, Larios O, Allen V, Lee B, Nadon C. 2010. High-throughput genome sequencing of two *Listeria monocytogenes* clinical isolates during a large foodborne outbreak. BMC Genomics 11:120. http://dx.doi.org/ 10.1186/1471-2164-11-120.
- Kovacevic J, Ziegler J, Wałecka-Zacharska E, Reimer A, Kitts DD, Gilmour MW. 2016. Tolerance of *Listeria monocytogenes* to quaternary ammonium sanitizers is mediated by a novel efflux pump encoded by *emrE*. Appl Environ Microbiol 82:939–953. http://dx.doi.org/10.1128/AEM.03741-15.
- Pightling AW, Petronella N, Pagotto F. 2015. The *Listeria monocytogenes* core-genome sequence typer (LmCGST): a bioinformatic pipeline for molecular characterization with next-generation sequence data. BMC Microbiol 15:224. http://dx.doi.org/10.1186/s12866-015-0526-1.