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# Draft Genome Sequences of Four *Propionibacterium acnes* Strains Isolated from Implant-Related Infections

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*Propionibacterium acnes* was previously described as a potential implant-related pathogen. Here, we report the draft genome sequence of four *P. acnes* strains, isolated from spine material, hip arthroplasty, and knee arthroplasty infections in France belonging to different sequence types (ST18, ST27, and ST36).

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*Propionibacterium acnes* is a Gram-positive bacterium constituting a significant part of the human skin microbiota (1). It has been associated with skin diseases such as acne vulgaris or fulminans acne (2). The role of this microorganism in deep and medical device-related infections is underestimated (3). Besides shoulder prosthetic infections, spinal instrumentation infections have been reported (4). Using multilocus sequence typing (MLST) and single-locus sequence typing (SLST) schemes, the *P. acnes* species has been subdivided into five main phylogenetic types: IA1, IA2, IB, IC, II, and III (5, 6). In the context of device-related infections, *P. acnes* antibiotic resistance may be a problem, especially when low- or high-level rifampin resistance is detected (7, 8), as rifampin remains a key drug for eradicating *P. acnes* biofilm infection (9).

Here, we present the draft genome sequences of four *P. acnes* strains (2003-1719, NTS31306190, 2004-10708, and LRY\_BL) isolated from patients at Nantes University Hospital and La Roche/Yon Hospital, France, suffering from bone infection.

All *P. acnes* strains were grown overnight at 37°C on Schaedler agar plate (Oxoid, United Kingdom) under an anaerobic atmosphere. Genomic DNA was extracted using a DNeasy blood and tissue kit (Qiagen GmbH, Germany) as described previously (10). A pair-end library was prepared with a NEBNext Ultra DNA library prep kit for Illumina (NEB) and sequenced (2 × 150 bp) on a MiSeq sequencer (Illumina, USA). *De novo* assembly was performed with Velvet version 1/2/10 and VelvetOptimizer version

2.2.5 (optimal hash value = 127). Contig reordering and annotation were performed with Mauve version 2.3.1 and the NCBI Prokaryotic Genome Automatic Annotation Pipeline (PGAAP), respectively (11, 12). Sequence alignment and comparison were performed with CLC Sequence Viewer version 7.0 and BLAST. Average nucleotide identity (ANI) with the *P. acnes* reference strain KPA171202 was calculated using Oat version 0.91 (13).

The draft genome of strain NTS\_2003\_1719 (GenBank accession no. MAVU000000000) contains 2,373 genes, 2,320 coding sequences (CDSs), 46 tRNAs, 3 rRNAs, and 4 noncoding RNAs, with an OrthoANI value of 99.1%; the draft genome of strain NTS\_31306190 (accession no. MAUY000000000) contains 2,327 genes, 2,275 CDSs, 45 tRNAs, 3 rRNAs, and 4 noncoding RNAs, with an OrthoANI value of 99.1%; the draft genome of strain NTS\_2004\_10708 (accession no. MAUW000000000) contains 2,322 genes, 2,270 CDSs, 45 tRNAs, 3 rRNAs, and 4 noncoding RNAs, with an OrthoANI value of 99.0%; the draft genome of strain LRY\_BL (accession no. MAUX000000000) contains 2,376 genes, 2,327 CDSs, 45 tRNAs, 0 rRNAs, and 4 noncoding RNAs, with an OrthoANI value of 100.0% (Table 1).

According to the diversity of *Propionibacterium* spp. on human skin (14), their potential involvement in prosthetic-related infections remains an open question for future research. The genome sequences of these four strains of *P. acnes* will also provide a valuable resource for (comparative) bone cell-*P. acnes* host relationship studies. Indeed, depending on their genetic background,

TABLE 1 Summary of genome sequencing results in the present study

| <i>P. acnes</i> strain | Clinical source | Reads (Mb) | Coverage (×) | No. of contigs | Size (bp) | G+C content (%) | OrthoANI value <sup>a</sup> (%) | Accession no.                 | BioProject designation | SLST | MLST | Phylotype |
|------------------------|-----------------|------------|--------------|----------------|-----------|-----------------|---------------------------------|-------------------------------|------------------------|------|------|-----------|
| NTS_2003_1719          | Spine material  | 3,807,168  | 186          | 19             | 2,535,892 | 60.1            | 99.1                            | <a href="#">MAVU000000000</a> | PRJNA327922            | D1   | ST27 | IB        |
| NTS_31306190           | Knee prosthesis | 3,301,044  | 127          | 20             | 2,479,585 | 60.0            | 99.1                            | <a href="#">MAUY000000000</a> | PRJNA327858            | A1   | ST18 | IA        |
| NTS_2004_10708         | Spine material  | 2,928,004  | 131          | 17             | 2,478,327 | 60.1            | 99.0                            | <a href="#">MAUW000000000</a> | PRJNA327854            | A26  | ST18 | IA        |
| LRY_BL                 | Hip prosthesis  | 2,735,728  | 49           | 32             | 2,534,633 | 60.0            | 100.0                           | <a href="#">MAUX000000000</a> | PRJNA327856            | H1   | ST36 | IB        |

<sup>a</sup> OrthoANI value compared to the *P. acnes* reference strain KPA171202.

*P. acnes* cells seem to interact differently with the bone cell matrix (G. G. Aubin and S. Corvec, unpublished data). These draft genomes of *P. acnes* will also be used for studying virulence features associated with bone infection, especially hyaluronate lyase (15).

**Accession number(s).** This whole-genome shotgun project has been deposited at DDBJ/EMBL/GenBank under the accession numbers listed in Table 1. The versions described in this paper are in the first versions, under the BioProject designations listed in Table 1.

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## REFERENCES

1. Leccia MT, Auffret N, Poli F, Claudel J-P, Corvec S, Dréno B. 2015. Topical acne treatments in Europe and the issue of antimicrobial resistance. *J Eur Acad Dermatol Venereol* 29:1485–1492. <http://dx.doi.org/10.1111/jdv.12989>.
2. Saint-Jean M, Frenard C, Le Bras M, Aubin GG, Corvec S, Dréno B. 2015. Testosterone-induced acne fulminans in twins with Kallmann's syndrome. *JAAD Case Rep* 1:27–29. <http://dx.doi.org/10.1016/j.jdc.2014.10.005>.
3. Portillo ME, Corvec S, Borens O, Trampuz A. 2013. *Propionibacterium acnes*: an underestimated pathogen in implant-associated infections. *BioMed Res Int* 2013:804391. <http://dx.doi.org/10.1155/2013/804391>.
4. Bémer P, Corvec S, Taniel S, Asseray N, Boutoille D, Langlois C, Tequi B, Drugeon H, Passuti N, Touchais S. 2008. Significance of *Propionibacterium acnes*-positive samples in spinal instrumentation. *Spine Phila Pa* 1976 33:E971–E976. <http://dx.doi.org/10.1097/BRS.0b013e31818e28dc>.
5. Aubin GG, Portillo ME, Trampuz A, Corvec S. 2014. *Propionibacterium acnes*, an emerging pathogen: from acne to implant-infections, from phylotype to resistance. *Med Mal Infect* 44:241–250. <http://dx.doi.org/10.1016/j.medmal.2014.02.004>.
6. Scholz CF, Jensen A, Lomholt HB, Brüggemann H, Kilian M. 2014. A novel high-resolution single locus sequence typing scheme for mixed populations of *Propionibacterium acnes* in vivo. *PLoS One* 9:e104199. <http://dx.doi.org/10.1371/journal.pone.0104199>.
7. Furustrand Tabin U, Corvec S, Betrisey B, Zimmerli W, Trampuz A. 2012. Role of rifampin against *Propionibacterium acnes* biofilm in vitro and in an experimental foreign-body infection model. *Antimicrob Agents Chemother* 56:1885–1891. <http://dx.doi.org/10.1128/AAC.05552-11>.
8. Furustrand Tabin U, Trampuz A, Corvec S. 2013. *In vitro* emergence of rifampicin resistance in *Propionibacterium acnes* and molecular characterization of mutations in the *rpoB* gene. *J Antimicrob Chemother* 68:523–528. <http://dx.doi.org/10.1093/jac/dks428>.
9. Corvec S, Aubin GG, Bayston R, Ashraf W. 2016. Which is the best treatment for prosthetic joint infections due to *Propionibacterium acnes*: need for further biofilm in vitro and experimental foreign-body in vivo studies? *Acta Orthop* 87:318–319. <http://dx.doi.org/10.3109/17453674.2016.1162037>.
10. Aubin GG, Kambarev S, Bémer P, Lawson PA, Corvec S. 2016. Draft genome sequence of highly rifampin-resistant *Propionibacterium namnetense* NTS 31307302<sup>T</sup> isolated from a patient with a bone infection. *Genome Announc* 4(4):e00819-16. <http://dx.doi.org/10.1128/genomeA.00819-16>.
11. Darling AE, Mau B, Perna NT. 2010. progressiveMauve: multiple genome alignment with gene gain, loss and rearrangement. *PLoS One* 5:e11147. <http://dx.doi.org/10.1371/journal.pone.0011147>.
12. 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 J Integr Biol* 12:137–141. <http://dx.doi.org/10.1089/omi.2008.0017>.
13. Lee I, Kim YO, Park S-C, Chun J. 2015. OrthoANI: an improved algorithm and software for calculating average nucleotide identity. *Int J Syst Evol Microbiol* 66:1100–1103. <http://dx.doi.org/10.1099/ijsem.0.000760>.
14. Aubin GG, Bémer P, Kambarev S, Patel NB, Lemenand O, Caillon J, Lawson PA, Corvec S. 2016. *Propionibacterium namnetense* sp. nov., isolated from a human bone infection. *Int J Syst Evol Microbiol*. [Epub ahead of print.] <http://dx.doi.org/10.1099/ijsem.0.001204>.
15. Scholz CF, Brüggemann H, Lomholt HB, Tettelin H, Kilian M. 2016. Genome stability of *Propionibacterium acnes*: a comprehensive study of indels and homopolymeric tracts. *Sci Rep* 6:20662. <http://dx.doi.org/10.1038/srep20662>.