
Supplementary information

***Staphylococcus epidermidis* clones express *Staphylococcus aureus*-type wall teichoic acid to shift from a commensal to pathogen lifestyle**

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1 Supplementary Information

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3 Supplementary Table 1. | List of *tarI/ILM*-positive *S. epidermidis* and other CoNS isolates

Strain	Collection	Year	Country	Host	Source	MLST	<i>mecA</i>	<i>tarI/ILM</i>	Accession no.
<i>S. epidermidis</i>									
IRL01	Lee et al. ¹	2016	Republic of Ireland	Human	Bacteraemia	2	+	2	SAMN09103952
US06	Lee et al.	2010	United States	Human	Prosthetic joint infection	5	+	4	SAMN09103969
AUS27	Lee et al.	2017	Australia	Human	Colonising isolate	23	+	2	SAMN09093632
AUS28	Lee et al.	2017	Australia	Human	Colonising isolate	23	-	2	SAMN09093633
AUT01	Lee et al.	2016	Austria	Human	Unknown	23	+	2	SAMN09103856
BEL02	Lee et al.	2015	Belgium	Human	Bacteraemia	23	+	2	SAMN09103858
BEL03	Lee et al.	2015	Belgium	Human	Bacteraemia	23	+	2	SAMN09103859
BEL05	Lee et al.	2016	Belgium	Human	Bacteraemia	23	+	2	SAMN09103861
BEL17	Lee et al.	2017	Belgium	Human	Bacteraemia	23	+	2	SAMN09103873
BPH0666	Lee et al.	2012	Australia	Human	Bacteraemia	23	+	2	ERS1019850
BPH0695	Lee et al.	2007	Australia	Human	Bacteraemia	23	+	2	ERS1019876
BPH0703	Lee et al.	2007	Australia	Human	Bacteraemia	23	+	2	ERS1019883
BPH0713	Lee et al.	2008	Australia	Human	Bacteraemia	23	+	2	ERS1019893
BPH0715	Lee et al.	2008	Australia	Human	Bacteraemia	23	-	2	ERS1019895
DEN02	Lee et al.	2001	Denmark	Human	Unknown	23	+	2	SAMN09103876
DEN09	Lee et al.	2001	Denmark	Human	Unknown	23	+	2	SAMN09103883
DEN11	Lee et al.	2001	Denmark	Human	Unknown	23	+	2	SAMN09103885
DEN12	Lee et al.	2012	Denmark	Human	Colonising isolate	23	+	2	SAMN09103886
DEN13	Lee et al.	2012	Denmark	Human	Colonising isolate	23	+	2	SAMN09103887
DEN14	Lee et al.	2013	Denmark	Human	Colonising isolate	23	+	2	SAMN09103888
DEN16	Lee et al.	2014	Denmark	Human	Colonising isolate	23	+	2	SAMN09103890
DEN18	Lee et al.	2015	Denmark	Human	Colonising isolate	23	+	2	SAMN09103892
DEN19	Lee et al.	2015	Denmark	Human	Colonising isolate	23	+	2	SAMN09103893
DEN20	Lee et al.	2016	Denmark	Human	Central venous catheter	23	+	2	SAMN09103894
DEN21	Lee et al.	2016	Denmark	Human	Central venous catheter	23	+	2	SAMN09103895
DEN22	Lee et al.	2016	Denmark	Human	Colonising isolate	23	+	2	SAMN09103896

DEN24	Lee et al.	2016	Denmark	Human	Colonising isolate	23	+	2	SAMN09103898
DEN25	Lee et al.	2016	Denmark	Human	Central venous catheter	23	+	2	SAMN09103899
DEN26	Lee et al.	2016	Denmark	Human	Central venous catheter	23	+	2	SAMN09103900
DEN27	Lee et al.	2016	Denmark	Human	Central venous catheter	23	+	2	SAMN09103901
DEN29	Lee et al.	2017	Denmark	Human	Central venous catheter	23	+	2	SAMN09103903
DEN30	Lee et al.	2017	Denmark	Human	Central venous catheter	23	+	2	SAMN09103904
DEN31	Lee et al.	2017	Denmark	Human	Colonising isolate	23	+	2	SAMN09103905
DEN32	Lee et al.	2017	Denmark	Human	Colonising isolate	23	+	2	SAMN09103906
DEN33	Lee et al.	2017	Denmark	Human	Colonising isolate	23	+	2	SAMN09103907
DEN34	Lee et al.	2017	Denmark	Human	Colonising isolate	23	+	2	SAMN09103908
DEN35	Lee et al.	2017	Denmark	Human	Colonising isolate	23	+	2	SAMN09103909
DEN36	Lee et al.	2017	Denmark	Human	Skin and Soft Tissue Infection	23	+	2	SAMN09103910
DEN37	Lee et al.	2017	Denmark	Human	Colonising isolate	23	-	2	SAMN09103911
FRA01	Lee et al.	2005	France	Human	Bacteraemia	23	+	2	SAMN09103913
FRA07	Lee et al.	2010	France	Human	Septic arthritis	23	+	2	SAMN09103919
FRA14	Lee et al.	2015	France	Human	Bone and joint infection	23	+	2	SAMN09103926
FRA16	Lee et al.	2004	France	Human	Bacteraemia	23	+	2	SAMN09103928
FRA17	Lee et al.	2004	France	Human	Bacteraemia	23	+	2	SAMN09103929
GER08	Lee et al.	2015	Germany	Human	Bacteraemia	23	+	2	SAMN09103938
GER15	Lee et al.	2016	Germany	Human	Bacteraemia	23	+	2	SAMN09103945
GER19	Lee et al.	2017	Germany	Human	Osteomyelitis	23	+	2	SAMN09103949
US02	Lee et al.	2000		Human	Prosthetic joint infection	23	+	2	SAMN09103966
US03	Lee et al.	2004	USA	Human	Prosthetic joint infection	23	+	2	SAMN09103967
US04	Lee et al.	2007	USA	Human	Prosthetic joint infection	23	+	2	SAMN09103976
US07	Lee et al.	2012	USA	Human	Prosthetic joint infection	23	+	2	SAMN09103970

US09	Lee et al.	2014	USA	Human	Prosthetic joint infection	23	+	2	SAMN09103972
DEN23	Lee et al.	2016	Denmark	Human	Colonising isolate	87	+	2	SAMN09103897
UK04	Lee et al.	2016	UK	Human	Bacteraemia	87	+	2	SAMN09103956
DAR1907	NCBI	2007	USA	Human	Blood	2	+	3	CP013943, CP016969, CP016970, CP016971
ENVH150	NCBI	2004	Germany	-	-	2	+	3	NZ_LYVW000000000
VCU013	NCBI	-	-	-	-	2	+	4	NZ_JHTZ000000000
SAM-3	NCBI	2016	Lebanon	Human	Sputum	23	+	2	NZ_PYFN000000000
VCU126	NCBI	-	-	-	-	23	+	2	NZ_AHLG000000000
VCU117	NCBI	-	-	-	-	23	+	2 + 3	NZ_AHLA000000000
C3	NCBI	2013	Denmark	Human	Eye	87	+	2	NZ_OAOC000000000
SNUC_2569	NCBI	2007	Canada	Cattle	Herd 302	100	-	5	NZ_PYYU000000000
NIHLM003	NCBI	2008	USA	Human	Umbilicus	218	-	4	NZ_AKHB000000000
RJ4	This study	2016	China	Human	Catheter	2	+	2	SAMN11658252
RJ5	This study	2016	China	Human	Catheter	2	+	2	SAMN11658253
RJ6	This study	2016	China	Human	Blood	2	+	2	SAMN11658254
RJ7	This study	2016	China	Human	Catheter	2	+	2	SAMN11658255
RJ8	This study	2016	China	Human	Cerebrospinal fluid	2	+	3	SAMN11658256
RJ9	This study	2016	China	Human	Catheter	23	+	2	SAMN16093072
E51	This study	2014	Germany	Human	Ulcer	5	+	2	SAMN11658242
E56	This study	2014	Germany	Human	Wound	5	+	2	SAMN11658243
E22	This study	2014	Germany	Human	Wound	10	+	2	SAMN11658238
E42*	This study	2014	Germany	Human	Central venous catheter	10	+	2	SAMN11658239
PIA099	This study	2015	Germany	Human	Joint	10	+	2	SAMN11658248
E6	This study	2014	Germany	Human	Central venous catheter	23	+	2	SAMN11658236
E13	This study	2014	Germany	Human	Central venous catheter	23	+	2	SAMN11658237
E50	This study	2014	Germany	Human	Wound	23	+	2	SAMN11658241
E73	This study	2014	Germany	Human	Wound	23	+	2	CP035643
HD43	This study	2016	Germany	Human	Joint	23	+	2	CP040867
PIA017	This study	2015	Germany	Human	Joint	23	+	2	SAMN11658246
PIA062	This study	2015	Germany	Human	Joint	23	+	2	SAMN11658247
E1	This study	2014	Germany	Human	Wound	87	+	2	SAMN11658235
E45	This study	2014	Germany	Human	Wound	87	+	2	SAMN11658240
E94	This study	2014	Germany	Human	Wound	87	+	2	SAMN11658244
HD33	This study	2016	Germany	Human	Joint	87	+	2	CP040864
HD66	This study	2017	Germany	Human	Joint	87	+	2	CP040868
RJ1	This study	2014	China	Human	Abscess	SLV of ST23	+	2	SAMN11658249

RJ2	This study	2014	China	Human	Abdominal dropsy	SLV of ST23	+	2	SAMN11658250
RJ3	This study	2014	China	Human	Catheter	SLV of ST23	+	2	SAMN11658251
<i>S. hominis</i>									
SNUC_3404	NCBI	2007	Canada	Cattle	Herd 323	NA	-	5 (- <i>tarM</i>)	NZ_PZHY00000000
SNUC_5746	NCBI	2008	Canada	Cattle	Herd 324	NA	-	5 (- <i>tarM</i>)	NZ_PZHW00000000
SNUC5748	NCBI	2008	Canada	Cattle	Herd 324	NA	-	5 (- <i>tarM</i>)	NZ_QXVQ00000000
<i>S. warneri</i>									
SNUC_194	NCBI	2007	Canada	Cattle	Herd 102	NA	-	3	NZ_PZFE00000000
<i>Staphylococcus</i> sp.									
HMSC061F01	NCBI	-	-	Human	Vaginal/rectal	NA	+	5	NZ_LTNM01000000
HMSC069E07	NCBI	-	-	Human	Vaginal	NA	+	4 (- <i>tarM</i>)	NZ_LTPB01000000

- 4 MLST, multi-locus sequence type; SLV, single-locus variant; NA, not applicable. *, E42 was excluded in
- 5 further functional analysis because it was found in only a single instead of in two samples from the
- 6 same patient and therefore did not meet the strict definition of a clinical isolate.

7 **SupplementaryTable 2. | List of *S. epidermidis* genomes representing 71 multi-locus sequence**
8 **types**

MLST	Total no. of isolates	Representative strain	Collection	Accession no.
1	2	VCU081	NCBI	NZ_AHLU01000000
2	367	BPH0662	Lee et al. ¹	NZ_LT571449
4	1	VCU036	NCBI	NZ_JHUA01000000
5	56	BPH0723	Lee et al.	ERS1019903
7	8	BPH0690	Lee et al.	ERS1019871
8	3	ATCC12228	Lee et al.	ERS1019847
10	5	RP62A	Lee et al.	ERS1019921
16	5	US11	Lee et al.	SAMN09103974
17	5	1296_SEPI	NCBI	NZ_JVVA00000000
19	1	VCU071	NCBI	NZ_AGUB00000000
20	4	FRA09	Lee et al.	SAMN09103921
21	1	US10	Lee et al.	SAMN09103973
22	6	FRA02	Lee et al.	SAMN09103914
23	63	BPH0666	Lee et al.	ERS1019850
35	4	SCH-22	NCBI	NZ_PEKK02000000
46	1	BPH0707	Lee et al.	ERS1019887
57	2	SNUC 1209	NCBI	NZ_PYZC00000000
59	25	BPH0667	Lee et al.	ERS1019851
60	1	644_SEPI	NCBI	NZ_JUYV00000000
65	1	NLAE-zl-G239	NCBI	NZ_FOPD00000000
69	5	91_SEPI	NCBI	NZ_JUOJ00000000
72	2	NIHLM087	NCBI	NZ_AKGK00000000
73	9	NIHLM039	NCBI	NZ_AKGS01000000
83	7	SCH-12	NCBI	NZ_PEJB00000000
86	4	BPH0700	Lee et al.	ERS1019880
87	8	DEN23	Lee et al.	SAMN09103897
88	4	SCH-20	NCBI	NZ_PEJJ00000000
89	3	BPH0697	Lee et al.	ERS1019878
100	4	SNUC_2569	NCBI	NZ_PYYU00000000
101	2	SCH-11	NCBI	NZ_PEJA00000000
114	1	8400	NCBI	NZ_JMIF00000000
130	9	SCH-17	NCBI	NZ_PEJG00000000
136	1	VCU127	NCBI	NZ_AHLH00000000
143	1	FRA08	Lee et al.	SAMN09103920
153	2	ScI25	NCBI	NZ_ATDC02000000
170	2	NIHLM040	NCBI	NZ_AKGR00000000
184	4	PM221	Lee et al.	HG813242
185	1	NIH051668	NCBI	NZ_AKHK00000000
188	2	BPH0693	Lee et al.	ERS1019874
210	4	BPH0699	Lee et al.	ERS1019879
218	3	NIHLM003	NCBI	NZ_AKHB00000000
225	2	BPH0677	Lee et al.	ERS1019862
290	3	SCH-15	NCBI	NZ_PEJE00000000
297	2	SNUC 2400	NCBI	NZ_PYYY00000000
323	1	NIHLM001	NCBI	NZ_AKHC00000000
324	1	NIHLM008	NCBI	NZ_AKHA00000000

325	1	NIHLM015	NCBI	NZ_AKGZ000000000
326	1	NIHLM031	NCBI	NZ_AKGX000000000
327	3	1340_SEPI	NCBI	NZ_JVSY000000000
328	1	NIHLM023	NCBI	NZ_AKGU000000000
329	3	NIHLM037	NCBI	NZ_AKGT000000000
330	1	NIHLM049	NCBI	NZ_AKGQ000000000
331	1	NIHLM057	NCBI	NZ_AKGO000000000
332	1	NIHLM061	NCBI	NZ_AKGN000000000
333	1	NIHLM067	NCBI	NZ_AKGM000000000
351	1	MIT 14-1777-C6	NCBI	NZ_NXMC000000000
358	1	SCH-23	NCBI	NZ_PEKJ000000000
368	1	BPH0704	Lee et al.	ERS1019884
384	1	VCU125	NCBI	NZ_AHLF000000000
430	1	NIH04003	NCBI	NZ_AKHJ000000000
439	1	NGS-ED-1109	NCBI	NZ_JZUL000000000
487	4	BPH0684	Lee et al.	ERS1019866
520	1	971_SEPI	NCBI	NZ_JULN000000000
570	2	SNUC 2450	NCBI	NZ_PYYX000000000
595	1	UC7032	NCBI	NZ_ARWU000000000
626	1	PEI-B-P-06	NCBI	NZ_FUVD000000000
631	1	643_SEPI	NCBI	NZ_JUYW000000000
673	1	SNUT	NCBI	NZ_LQRB000000000
679	1	ATCC12228	NCBI	NZ_CP022247
702	10	CIM40	NCBI	NZ_ATCW020000000
723	2	785_SEPI	NCBI	NZ_JUTA010000000
ND	58	-	-	-

The list includes 497 *S. epidermidis* genomes present in the NCBI Reference Sequence Database (accessed 3 July 2018), a global collection of 227 *S. epidermidis* isolates originating from 96 institutions across 24 countries¹, and 25 *tarIILM*-positive clinical *S. epidermidis* isolates collected in this study. MLST, multi-locus sequence type; ND, not determinable by the existing MLST scheme.

13 **Supplementary Table 3. Oligonucleotides used in this study.**

Name	Sequence
For <i>tarL</i> screening PCR	
tarL1-up	GACTTTAGAGGAGTTAAGAGATTACAACCTCAC
tarL1-dn	GAAGTTTATATATCATCGGATGATAATCATCAACC
tarL2-up	CTTAACGTTTCGGTTAGGATACCAACTC
tarL2-dn	CAACTGTGTTATTACTTTCACAATAAATTGTC
tarL3-up	GTGGTGGTTAAAGGAAATAATTTTAAATGTAG
tarL3-dn	CCATTTATAATTGGCAATAATTGTTCCATTCC
tarL4-up	CTTGTAAGATTTAACGTTGCAATATTAGATAATG
tarL4-dn	GGTTTAAATAAACTGTGGATTTTATATTTATCATC
For <i>tarI/JLM2</i> knock out	
IJLM-1up BASE	CATGAGATCTCCTCTATTGTTCAGTGTAGAACGATCATGG
IJLM-1dn BASE	CTTCTTCCTCATTATCCTTCTCTAAGTATTGC
IJLM-2up BASE	GAAGGATAATGAGGAAGAAGTAAAGTATCCATTTTTCTATTATTCAGTTTCTATG
IJLM-2dn BASE	GTCAGTCGACACCATAAATCCTGTTCCCATACTATC
For <i>tarI/JLM2</i> complementation	
IJLM2_F	GTCGGATCCAAAGGAGGTTATATAATGAAATATGCTGGAATACTTGCGGG
IJLM2_R	CCGATGAATTCTTAGTTAAACAATTGTTCCATTTCCACCATCA
For qRT-PCR	
tarL_1_f	TGCTAATCGTGTTAATATTCAAGGATC
tarL_1_r	GTTGTAATCTCTTAACTCCTCTAAAGTC
tarL_1_probe	FAM-ACCGACAAGAAGATGAATACGTCTGCCA-BHQ1
tarL_2_f	CGAAAGCATTTGTGTCATCAGCA
tarL_2_r	CCCCTAAAAGTTGGCGCAAACA
tarL_2_probe	FAM- GAGCAGAATGTAATTCCAACAGGAGTACCT-BHQ1

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16 **References:**

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19 epidermidis. *Nat Microbiol* **3**, 1175-1185 (2018).

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