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Supplementary Information for

Outer membrane permeability: antimicrobials and diverse nutrients bypass porins in *Pseudomonas aeruginosa*

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Supplementary Information Text

Secondary mutations in strain PA14 Δ40. Whole-genome sequencing of parental PA14 and PA14 Δ40 confirmed accurate deletion of 40 porin genes and identified nine secondary mutations in PA14 Δ40 (SI, Supplementary Table S2).

Specifically, we identified:

i) loss of a duplicate tRNA-asp gene (PA14_24120, identical copy of the adjacent PA14_24130);

ii) two non-synonymous mutations: PA14_02870 D16N (affecting a non-conserved residue in the HTH domain of a probable transcriptional regulator), PA14_72090 R26H (affecting a residue outside of recognizable domains in a hypothetical protein),

iii) two synonymous mutations in codon 538 of PA14_28710 (encoding the β subunit of phenylalanyl-tRNA synthetase) and in codon 1,172 PA14_33610 (encoding pyochelin synthetase PchF);

iv) four intergenic mutations upstream of PA14_16990 (encoding a hypothetical protein), PA14_55640 (encoding exonuclease SbcD), and PA14_66490 (encoding the transcriptional regulator DhcR).

None of the associated genes show a link to altered antimicrobial susceptibility in comprehensive transposon library screens, with the exception of PA14_33610 *pchF*. Transposon inactivation of *pchF* results in two-fold higher MIC (the smallest detectable change) for ciprofloxacin (1), but the impact of the synonymous mutation in codon 1,172 of *pchF* in PA14 Δ40 is likely small compared to full gene inactivation. LpxC and other genes that might affect barrier function were not mutated.

Together, these data suggest no major impact of the secondary mutations in PA14 Δ40 on phenotypes relevant for this study. This was consistent with the unaltered susceptibility PA14 Δ40 to a large diversity of antimicrobials.

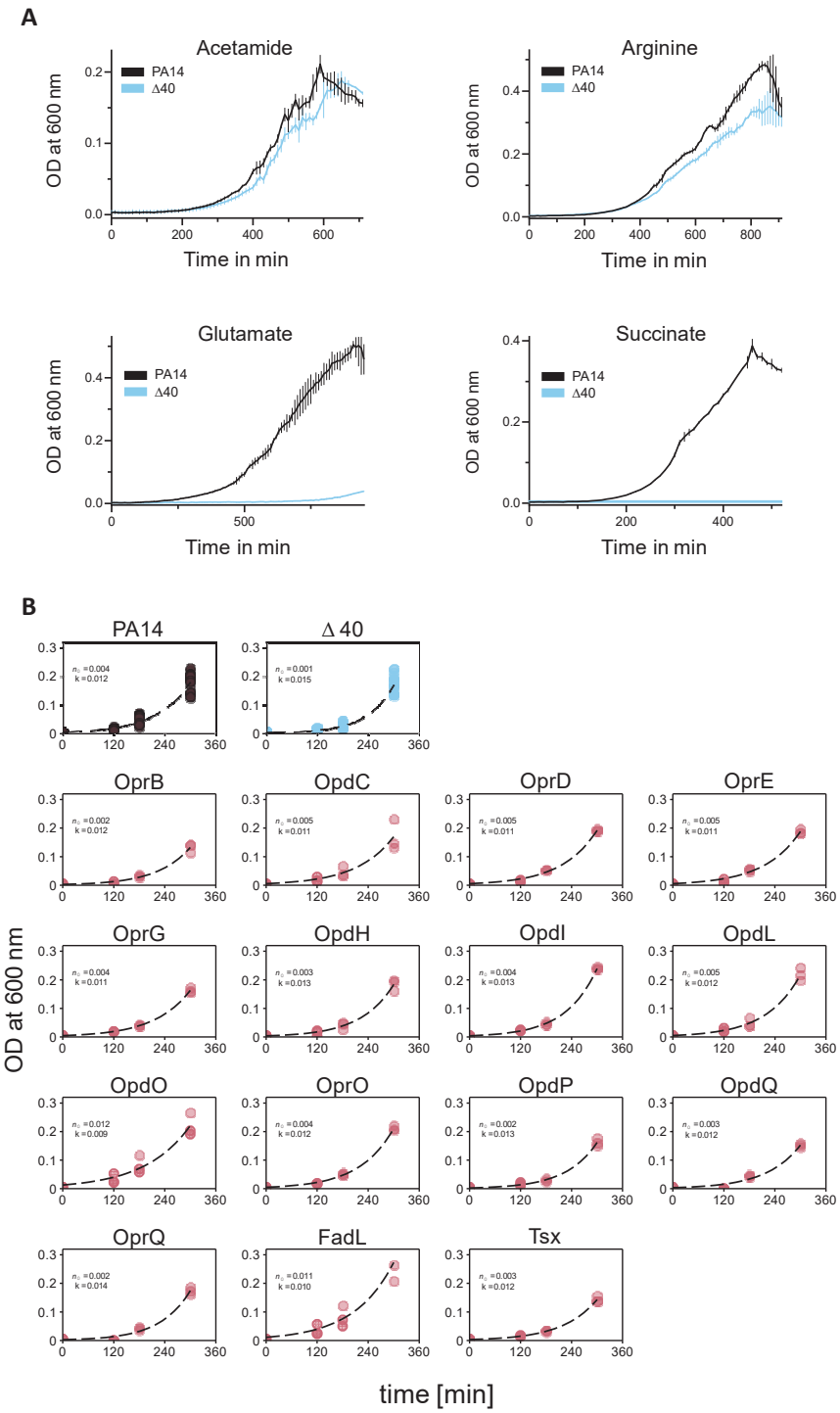

Fig. S1. Growth of porin-free PA14 Δ40 on single carbon/energy sources (A) and growth of PA14, PA14 Δ40, and 15 single-porin strains on medium containing 16 different carbon/energy sources (B).

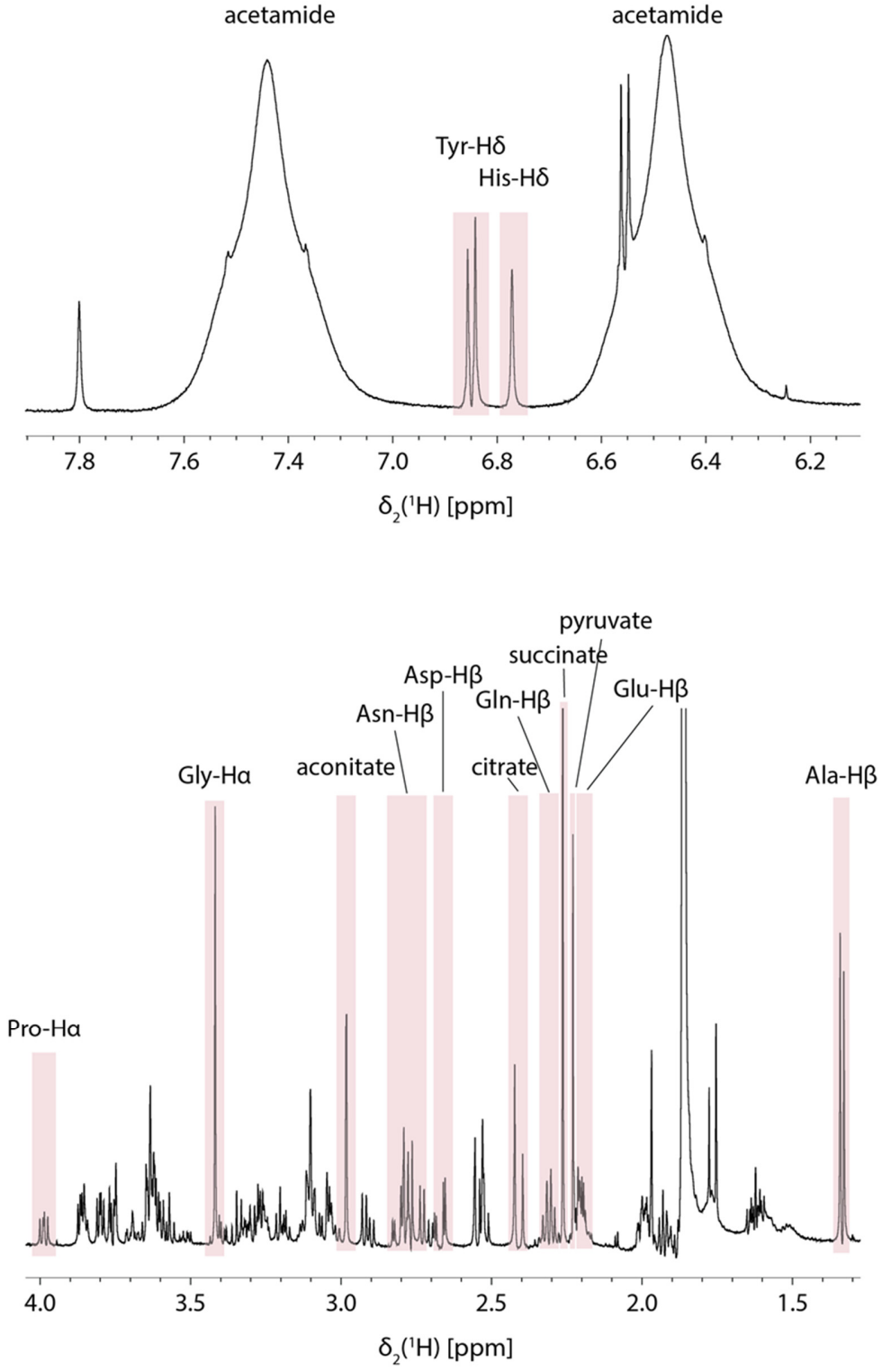

Fig. S2. 1D ^{1}H-NMR spectrum of BM2 medium supplemented with nutrients of interest. Peaks used for substrate quantification are highlighted with red boxes. The acetamide peaks at 7.45 and 6.45 ppm are broadened due to chemical exchange with water.

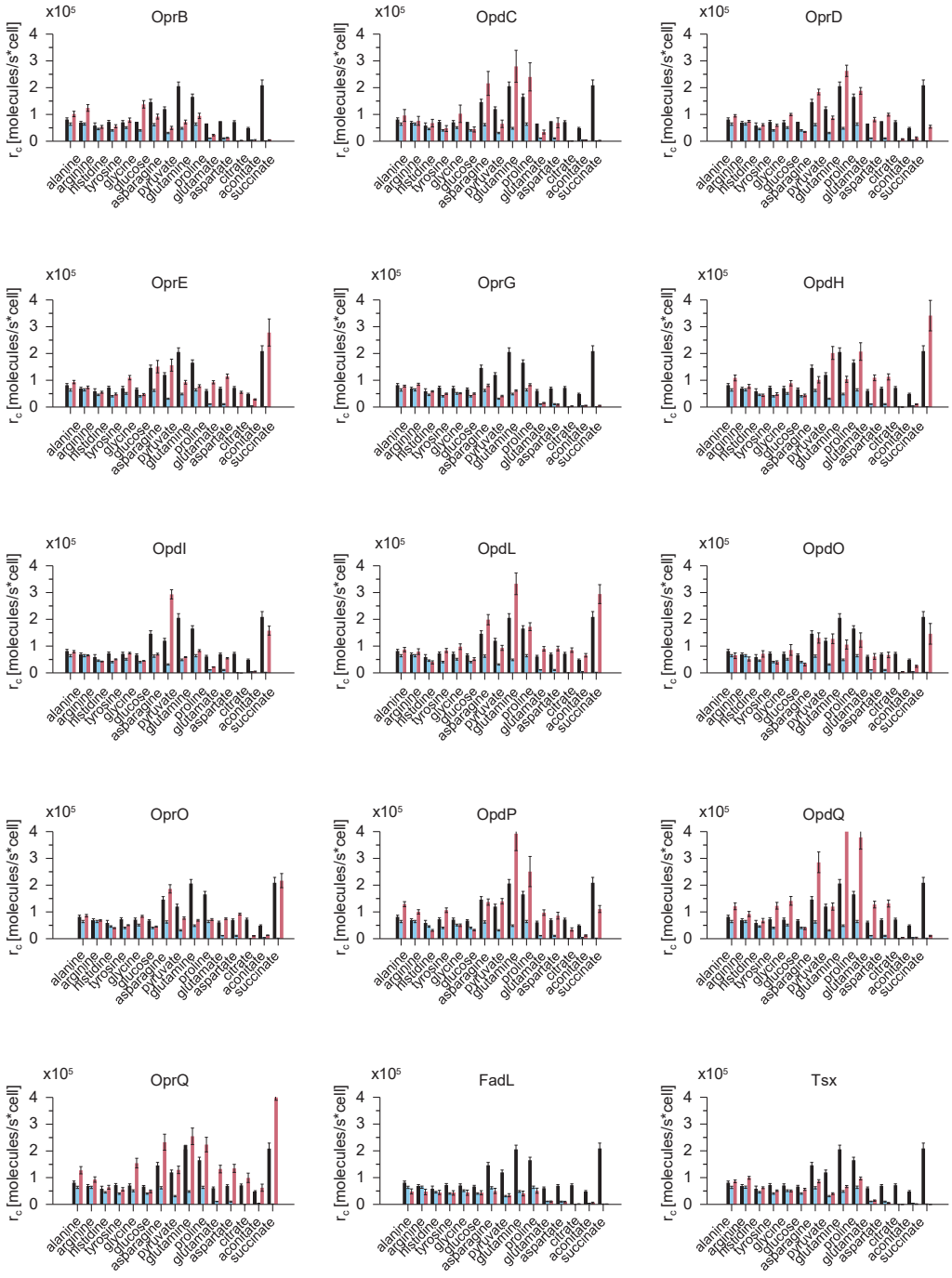

Fig. S3. Consumption rates of 15 single-porin strains for 16 nutrients individual porins (red) compared to PA14 (black) and PA14 Δ40 (blue). Means and standard deviations for three independent cultures are shown.

Table S1. Candidate outer-membrane porins encoded by UCPBPP-PA14.

PA14 locus	PAO1 locus	Gene name	Postulated substrates	PubMedIDs	Comments
PA14_01770	no ortholog			26578582	similar to *tsx*
PA14_02020	PA0162	*opdC, occD2*	arginine, histidine	16352820, 26578582	
PA14_02060	PA0165	*tsx*	nucleosides	26578582	based on similarity to *E. coli tsx*
PA14_02370	PA0189	*opdI, occD5*	arginine	26578582	
PA14_02890	PA0234			26578582	similar to *tsx*
PA14_02980	PA0240	*opdF, occK2*	benzoate, **carbenicillin**, **cefoxitin**, **gentamicin**, glucoronate, 4-nitrobenzoate, pyroglutamate, **temocillin**	16352820, 22272184, 26578582	
PA14_03800	PA0291	*oprE, occK8*	arabinose, ribose, glucose, galactose, mannose, N-acetylglucosamine	2539376	
PA14_09850	PA4179	*opdN, occK10*	5-aminolevulinate, glutamate	16352820, 17470813	
PA14_10440	PA4137	*opdL, occK4*	benzoate, glucuronate, phenylacetate, pyroglutamate	16352820, 17470813, 22272184	
PA14_10870	PA4099	*oprB3*		26578582	similar to *oprB*
PA14_11270	PA4067	*oprG*	alanine, glycine, hydrophobic molecules, iron (II), phtalate, serine, valine	16352820, 17470813, 21124774, 26655471, 26578582	
PA14_15280	PA3772	*qbdB*			similar to *sphA*
PA14_16630	PA3692	*lptF*			no outer membrane beta-barrel protein but OmpA-like peptidoglycan-binding domain
PA14_17890	PA3588	*opdR, occK11*	phenylacetate	16352820, 17470813	
PA14_18510	PA3544	*algE*	alginate (secretion)	23335756	
PA14_21610	PA3280	*oprO*	pyrophosphate	1370289, 26578582	
PA14_21620	PA3279	*oprP*	phosphate	1370289, 26578582	

PA14_23030	PA3186	*oprB*	arabinose, arginine, galactose, glucose, glucuronate, lysine, xylose	FEMS Microbiology Letters 8, 105-9 (1980), 9733092, 23066028	
PA14_24790	PA3038	*opdQ, occK6*	benzoate, glucoronate, nitrate, pyroglutamate	22369314, 22272184, 22824298	
PA14_28400	PA2760	*oprQ, occD6*	arginine, dipterpenoids	16352820, 17470813, 26578582	
PA14_29220	PA2700	*opdB, occD7*	arginine, proline	16352820, 26578582	
PA14_32270	PA2505	*opdT, occD4*	tyrosine	16352820	
PA14_32640	no ortholog			This study	similar to *sphA*
PA14_33380	no ortholog			This study	similar to *sphA*
PA14_33410	PA2420	*opdJ, occD8*	arginine, aromatic amino acids	16352820, 17470813, 26578582	
PA14_34960	PA2291	*opbA, oprB2*	glucose	26578582	similar to *oprB*
PA14_36090	PA2213	*opdG, occK9*		26578582	
PA14_37260	PA2113	*opdO, occK3*	benzoate, **cefotaxime**, glucoronate, pyroglutamate	16352820, 22272184, 26578582	
PA14_39000	PA1974			26578582	
PA14_39270	PA1951	*fapF*	amyloid (secretion)	23504942	
PA14_41570	PA1777	*oprF*	non-specific, ferri-siderophores, nitrate, toluene	12408810, 1322882, 1322952, 8611765, 26578582	structural role in outer membrane and link to peptdioglycan
PA14_41750	PA1764	*fadL2*		26578582	similar to *fadL*
PA14_47540	PA1288	*fadL*	fatty acids	23069386	
PA14_51070	PA1025	*opdD, occK7*	benzoate, glucoronate, **meropenem**, pyroglutamate	26578582	
PA14_51880	PA0958	*oprD, occD1*	arginine, arginine-arginine, gluconate, histidine, **imipenem**, lysine, **meropenem**, ornithine	1906263, 2109575, 2118530, 7639767, 8253668, 22272184	

PA14_54520	PA0755	*opdH, occK5*	benzoate, **ceftazidime**, cis-aconitate, glucoronate, pyroglutamate, tricarboxylates, vanillate	16352820, 17114261, 26578582	
PA14_55320	PA0696			9714719	similar to cyanobacterial porin *somB*
PA14_58410	PA4501	*opdP, occD3*	arginine, **doripenem**, glycine-glutamate, **imipenem**, **meropenem**	16352820, 16790014, 28440622, 25910245, 26578582	
PA14_60730	PA4589	*fadL3*		26578582	similar to *fadL*
PA14_64720	PA4898	*opdK, occK1*	adipate, benzoate, caproate, glucoronate, histidine, 4-nitrobenzoate, octanoate, pyroglutamate, vanillate	16352820, 18611376, 22272184, 26578582	
PA14_70300	PA5325	*sphA*	hydrophobic molecules, sphingosine	24465209, 26149193	

Table S2. Secondary mutations in UCPBPP-PA14 Δ40.

	Coordinates	Change	Locus PA14	PAO1 ortholog	Gene Product	Effect	AST* link	Comment
gene loss	2,092,561..2,092,751	Deletion	PA14_24120	PA3094.2	tRNA-Asp	Gene loss	No	Loss of duplicate tRNA gene, identical to adjacent PA14_24130
non-synonymous	252,705	G -> A	PA14_02870	PA0233	probable transcriptional regulator	D16N	No	Non-conserved residue in HTH domain
	6,425,382	G -> A	PA14_72090	PA5461	hypothetical protein	R26H	No	Outside of identified domains
synonymous	2,473,090	C -> T	PA14_28710	PA2739	phenylalanyl-tRNA synthetase, beta subunit	silent change in codon 538	No	
	2,960,130	G -> C	PA14_33610	PA4225	pyochelin synthetase PchF	silent change in codon 1,172	Yes	A transposon mutant has a two-fold increased MIC for ciprofloxacin (ref. 32)
intergenic	1,455,338	A -> G	PA14_16990	PA3662	hypothetical protein	82 bp upstream	No	No motif identified in pseudomonas.com
	4,957,532	A -> G	PA14_55640	PA4281	exonuclease SbcD	318 bp upstream	No	No motif identified in pseudomonas.com
	4,957,549..4,957,550	GC -> AT	PA14_55640	PA4281	exonuclease SbcD	300 bp upstream	No	No motif identified in pseudomonas.com
	5,931,608	(T)6 -> (T)5	PA14_66490	PA1998	transcriptional regulator DhcR	27 bp upstream	No	The mutated position is part of an inverted repeat in PAO1, but the repeat is not conserved in PA14

* Impact of gene inactivation on antimicrobial susceptibility testing

Table S3. Strains and plasmids used in this study.

Strain	Description	Resistance	Reference
E. coli SM10	Cloning strain	KAN	
P. aeruginosa PA14	UCBBP-PA14 clinical strain	None	14983043
PA14 Δ*occD1*	PA14 lacking *occD1 / oprD*	None	This study
PA14 Δ*oprF*	PA14 lacking *oprF*	None	This study
PA14 *oprF K*188*	PA14 with *oprF* truncated after serine 187	None	This study
PA14 *oprF V*315*	PA14 with *oprF* truncated after arginine 314	None	This study
PA14 Δ40	PA14 lacking 40 porin genes	None	This study
PA14 Δ40 / pJBOC-*occD1*	PA14 Δ40 expressing only *occD1* / *oprD*	GEN	This study
PA14 Δ40 / pJBOC-*occD2*	PA14 Δ40 expressing only *occD2* / *opdC*	GEN	This study
PA14 Δ40 / pJBOC-*occD3*	PA14 Δ40 expressing only *occD3* / *opdP*	GEN	This study
PA14 Δ40 / pJBOC-*occD5*	PA14 Δ40 expressing only *occD5* / *opdI*	GEN	This study
PA14 Δ40 / pJBOC-*occD6*	PA14 Δ40 expressing only *occD6* / *oprQ*	GEN	This study
PA14 Δ40 / pJBOC-*occK4*	PA14 Δ40 expressing only *occK4* / *opdL*	GEN	This study
PA14 Δ40 / pJBOC-*occK5*	PA14 Δ40 expressing only *occK5* / *opdH*	GEN	This study
PA14 Δ40 / pJBOC-*occK6*	PA14 Δ40 expressing only *occK6* / *opdQ*	GEN	This study
PA14 Δ40 / pJBOC-*occK7*	PA14 Δ40 expressing only *occK7* / *opdD*	GEN	This study
PA14 Δ40 / pJBOC-*occK8*	PA14 Δ40 expressing only *occK8* / *oprE*	GEN	This study
PA14 Δ40 / pJBOC-*oprG*	PA14 Δ40 expressing only *oprG*	GEN	This study
PA14 Δ40 / pJBOC-*oprO*	PA14 Δ40 expressing only *oprO*	GEN	This study
PA14 Δ40 / pJBOC-*tsx*	PA14 Δ40 expressing only *tsx*	GEN	This study
PA14 Δ40 / pJBOC-*oprB*	PA14 Δ40 expressing only *oprB*	GEN	This study
PA14 Δ40 / pJBOC-*fadL*	PA14 Δ40 expressing only *fadL*	GEN	This study
Plasmid	**Description**	**Resistance**	**Reference**
pAD6	derivative of low copy-number plasmid PK2	AMP	20300602
pEXG2	suicide vector for gene deletion in *P. aeruginosa*	GEN	15911752
pEXG2 Δ*occD1*	suicide vector for deleting *occD1*	GEN	This study
pEXG2 Δ*occD2*	suicide vector for deleting *occD2*	GEN	This study
pEXG2 Δ*occD3*	suicide vector for deleting *occD3*	GEN	This study

pEXG2 Δ*occD4*	suicide vector for deleting *occD4*	GEN	This study
pEXG2 Δ*occD5*	suicide vector for deleting *occD5*	GEN	This study
pEXG2 Δ*occD6*	suicide vector for deleting *occD6*	GEN	This study
pEXG2 Δ*occD7*	suicide vector for deleting *occD7*	GEN	This study
pEXG2 Δ*occD8*	suicide vector for deleting *occD8*	GEN	This study
pEXG2 Δ*occK1*	suicide vector for deleting *occK1*	GEN	This study
pEXG2 Δ*occK2*	suicide vector for deleting *occK2*	GEN	This study
pEXG2 Δ*occK3*	suicide vector for deleting *occK3*	GEN	This study
pEXG2 Δ*occK4*	suicide vector for deleting *occK4*	GEN	This study
pEXG2 Δ*occK5*	suicide vector for deleting *occK5*	GEN	This study
pEXG2 Δ*occK6*	suicide vector for deleting *occK6*	GEN	This study
pEXG2 Δ*occK7*	suicide vector for deleting *occK7*	GEN	This study
pEXG2 Δ*occK8*	suicide vector for deleting *occK8*	GEN	This study
pEXG2 Δ*occK9*	suicide vector for deleting *occK9*	GEN	This study
pEXG2 Δ*occK10*	suicide vector for deleting *occK10*	GEN	This study
pEXG2 Δ*occK11*	suicide vector for deleting *occK11*	GEN	This study
pEXG2 Δ*oprG*	suicide vector for deleting *oprG*	GEN	This study
pEXG2 Δ*oprO*	suicide vector for deleting *oprO*	GEN	This study
pEXG2 Δ*oprP*	suicide vector for deleting *oprP*	GEN	This study
pEXG2 Δ*algE*	suicide vector for deleting *algE*	GEN	This study
pEXG2 Δ*tsx*	suicide vector for deleting *tsx*	GEN	This study
pEXG2 Δ*oprB*	suicide vector for deleting *oprB*	GEN	This study
pEXG2 Δ*oprB2*	suicide vector for deleting *oprB2*	GEN	This study
pEXG2 Δ*oprB3*	suicide vector for deleting *oprB3*	GEN	This study
pEXG2 Δ*fadL*	suicide vector for deleting *fadL*	GEN	This study
pEXG2 Δ*fadL2*	suicide vector for deleting *fadL2*	GEN	This study
pEXG2 Δ*fadL3*	suicide vector for deleting *fadL3*	GEN	This study
pEXG2 Δ*sphA*	suicide vector for deleting *sphA*	GEN	This study
pEXG2 ΔPA14_01770	suicide vector for deleting PA14_01770	GEN	This study
pEXG2 ΔPA14_02890	suicide vector for deleting PA14_02890	GEN	This study
pEXG2 ΔPA14_15280	suicide vector for deleting PA14_15280	GEN	This study
pEXG2 Δ*lptF*	suicide vector for deleting *lptF*	GEN	This study
pEXG2 ΔPA14_32640	suicide vector for deleting PA14_32640	GEN	This study
pEXG2 ΔPA14_33380	suicide vector for deleting PA14_33380	GEN	This study
pEXG2 ΔPA14_39000	suicide vector for deleting PA14_39000	GEN	This study
pEXG2 ΔPA14_39270	suicide vector for deleting PA14_39270	GEN	This study
pEXG2 ΔPA14_55320	suicide vector for deleting PA14_55320	GEN	This study
pEXG2 Δ*oprF*	suicide vector for deleting *oprF*	GEN	This study
pEXG2 Δ*oprF* K188*	suicide vector for truncating *oprF* after codon 187	GEN	This study
pEXG2 Δ*oprF* V314*	suicide vector for truncating *oprF* after codon 314	GEN	This study
pJBOC	very low copy-number plasmid carrying the P_{oprD} promoter	GEN	This study

pJBOC P_{oprD}-*occD1*	*occD1*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occD2*	*occD2*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occD3*	*occD3*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occD5*	*occD5*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occD6*	*occD6*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occK4*	*occK4*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occK5*	*occK5*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occK6*	*occK6*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occK7*	*occK7*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*occK8*	*occK8*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*oprG*	*oprG*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*oprO*	*oprO*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*tsx*	*tsx*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*oprB*	*oprB*-expression plasmid	GEN	This study
pJBOC P_{oprD}-*fadL*	*fadL*-expression plasmid	GEN	This study

Table S4. Primers used in this study.

Plasmid	Oligo	template	Sequence of relevant primers (5'-3')
pEXG2	JB-021 pEXG2 fw	pEXG2	ATAGTGAACGGCAGGTAAGC
	JB-022 pEXG2 rv	pEXG2	TCAACGACAGGAGCACGATC
pEXG2 ΔoccD1	JB OprD R1 f	PA14	CCAGTGCCAAGCTTACCGTCATTCATGGACAGC
	JB OprD R1 Rv	PA14	TTTCGTTGCCTGTCGGTCGATGTGATTGCTCCTTTGGTTTTG
	JB OprD R3 f	PA14	AAACCAAAGGAGCAATCACATCGACCGACAGGCAACG
	JB OprD R3 Rv	PA14	GTACCCGGGGATCCGTGTAGAGACCCGAGGCCAG
	JB-005 OprD R1 Fw	PA14	AAGTCGCCGAGCAACAGGGTG
	JB-006 OprD R3 Rv	PA14	CCGGCAGCGTTCATTTCCTCG
pEXG2 ΔoccD2	JB-023 OccD2 R1 f	PA14	tgtaaagcaagcttGAAGAGTCCTCGCTGATGACCAA
	JB-024 OccD2 R1 Rv	PA14	AAGGGCCCAGCGCGCGGGGCTGCGGTTGCTCCTTCTTACA
	JB-025 OccD2 R3 f	PA14	TGTAAGAAGGAGCAACCGCAGCCCCGCGCGCTGGGCCCTT
	JB-026 OccD2 R3 Rv	PA14	gagcccggggatccGCCTGGGTGCAGCTTTCCTACGC
	JB-047 OccD2 R1 check	PA14	CCAGATCCTTGCTGCCGCCATAC
	JB-048 OccD2 R3 check	PA14	ACCGCCCGATTCCCACCCTC
pEXG2 ΔoccD3	JB-027 OccD3 R1 f	PA14	tgtaaagcaagcttCGATGCCGGTGCAGCGTC
	JB-028 OccD3 R1 Rv	PA14	GGCCGCCGGTTGTCGCAGGTCTGATTGCTCCCTTTATTGTTGTCATGGC
	JB-029 OccD3 R3 f	PA14	ACAATAAAGGGAGCAATCAGACCTGCGACAACCGGCGG
	JB-030 OccD3 R3 Rv	PA14	gagcccggggatccCTTGGCGTAGCGCTTGAAGACG
	JB-049 OccD3 R1 check	PA14	TGACGAAACCATCAAGGACG
	JB-050 OccD3 R3 check	PA14	ATGGCGAACACCAGATTGTC
pEXG2 ΔoccD4	JB-031 OccD4 R1 f	PA14	tgtaaagcaagcttTGCCGCCTTCTTCCGCCAGG
	JB-032 OccD4 R1 Rv	PA14	GATGGGGCGGCGGCGCGCCTGGCGATTGCTCCAGATCGGTTCATGTCTG
	JB-033 OccD4 R3 f	PA14	ACCGATCTGGAGCAATCGCCAGGCGCGCCGCCGCCCCATC
	JB-034 OccD4 R3 Rv	PA14	gagcccggggatccTCGCCGGCCATCAGCCGCCAGC
	JB-051 OccD4 R1 check	PA14	GGGCATTGCAGGAGTAAGGTGG
	JB-052 OccD4 R3 check	PA14	CTGTCGTCGGCGTTCAGCAC
pEXG2 ΔoccD5	JB-035 OccD5 R1 f	PA14	tgtaaagcaagcttTATCTCGGCGTGCAGCCGGGCTC
	JB-036 OccD5 R1 Rv	PA14	CAGGTGGGAGAAAACAATAACGCCCCGGGCCGCGGCTC
	JB-037 OccD5 R3 f	PA14	CCGAGCCGCGGCCCGGGGCGTTATTGTTTTCTCCCACCTGAGTGCCAGG
	JB-038 OccD5 R3 Rv	PA14	gagcccggggatccGGACTCCCCCTCCGGCGGCG
	JB-053 OccD5 R1 check	PA14	GCGATCATCGGCAAGTCC
	JB-054 OccD5 R3 check	PA14	GGCCTTGAAGTAGCTGTCCATG
pEXG2 ΔoccD6	JB OprQ R1 f	PA14	AGGTCGACTCTAGACTGCATCATCACCCCGGAAGGC
	JB OprQ R1 Rv	PA14	CAACAACCAGGAACAATAAGTCAAACCTGCGAGCGCGACG
	JB OprQ R3 f	PA14	CGTCGCGCTCGCAGGTTTGACTTATTGTTCCTGGTTGTTGGC
	JB OprQ R3 Rv	PA14	GTACCCGGGGATCCCTCTTCCCTCTTCCTCGCG
	JB-013 OprQ R1 Fw	PA14	GGCAAGTGGGAGGTGAACTACG
	JB-014 OprQ R3 Rv	PA14	ATCGTTCTGCGGCCATCCTC
pEXG2 ΔoccD7	JB-039 OccD7 R1 f	PA14	tgtaaagcaagcttACCGCGCGCACCAACACCGA
	JB-040 OccD7 R1 Rv	PA14	CCTCGCCCGGAGTTTTCCCGCCATGACCGCACCCGCCGCC
	JB-041 OccD7 R3 f	PA14	GGCGGCGGGTGCGGTCATGGCGGGAAAACTCCGGGCGAGGCG
	JB-042 OccD7 R3 Rv	PA14	gagcccggggatccCCGCATGGCCTTCCAGGGCG
	JB-055 OccD7 R1 check	PA14	TTCGCCGCGCACGATCAGG
	JB-056 OccD7 R3 check	PA14	GCGCAACATCGAGCGGGTG
pEXG2 ΔoccD8	JB-043 OccD8 R1 f	PA14	tgtaaagcaagcttTCGCGTGCAGCGCCTG
	JB-044 OccD8 R1 Rv	PA14	AACGACTACGGACCGGACCCACCCACGGAACCAGAAAAAAGAGA
	JB-045 OccD8 R3 f	PA14	TTTTTTCTGGTTCCGTGGGTGGGTCCGGTCCGTAGTCGTT
	JB-046 OccD8 R3 Rv	PA14	gagcccggggatccGTTGCTGATCGACCACCAGAGC
	JB-057 OccD8 R1 check	PA14	GCGCTGATCTGTTTCAACTGG
	JB-058 OccD8 R3 check	PA14	GCCAACTTCAACGGCCAG
pEXG2 ΔoccK1	JB OpdK R1 f	PA14	CCAGTGCCAAGCTTGATGACCTTCAGCAACACCGACAG
	JB OpdK R1 Rv	PA14	AAAAACGGAGCACAATAACACGGACGCTGTCTCGCCGCTC
	JB OpdK R3 f	PA14	GAGCGGCGAGACAGCGTCCGTGTTATTGTGCTCCGTTTTT
	JB OpdK R3 Rv	PA14	GTACCCGGGGATCCCGATCAACCGTATCATCGTC
	JB-103 OccK1 R1	PA14	GCTGGCCTACTTCAACAACAC
	JB-104 OccK1 R3	PA14	CTGGAGCAGGCGGTGAATG
pEXG2 ΔoccK2	JB-059 OccK2 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaCTCGCGGTGATCCGCAC
	JB-060 OccK2 R1 Rv	PA14	AAGAACGAAGGGACACTCCCAGCCTACGCGCCGAC
	JB-061 OccK2 R3 f	PA14	ACGGGGTCGGCGCGTAGGCTGGGAGTGTCCCTTCGTTCTTGTTCTCTAGG
	JB-062 OccK2 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggAGGAGCCGCCCGC
	JB-105 OccK2 R1	PA14	CCAAGTTCCTTTCCGGTTTC
	JB-106 OccK2 R3	PA14	GTGGCGCAACTACTACAACC

pEXG2 ΔoccK3	JB-063 OccK3 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaGGTGGTGCGTCGGCT
	JB-064 OccK3 R1 Rv	PA14	AGGTCATTGCTCGCCGGACCGCTGGGGTTTCCTCGGT
	JB-065 OccK3 R3 f	PA14	TCGACCGAGGAAACCCCAGCGGTCCGGCGAGCAATGAC
	JB-066 OccK3 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggGTCTGCGCCTCCAGCG
	JB-107 OccK3 R1	PA14	CCGCCATCCTCTACTCGCTG
	JB-108 OccK3 R3	PA14	GTTGGCTCATGCCGCCTC
pEXG2 ΔoccK4	JB-067 OccK4 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaGGCTGCACCCTGCAAC
	JB-068 OccK4 R1 Rv	PA14	AACAACCAAGGGAAGAATCGAGCGCGGCCCCT
	JB-069 OccK4 R3 f	PA14	CGGCCCCAAGGGGCCGCGCTCGATTCTTCCCTTGGTTGTTGTTCTTGTAGG
	JB-070 OccK4 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggCACCCTCAGCAGGACCAG
	JB-109 OccK4 R1	PA14	GTTCGGCTACACCCTGCTGC
	JB-110 OccK4 R3	PA14	AACGGATAGAGGTCGCGCAC
pEXG2 ΔoccK5	JB-071 OccK5 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaGGGCGATCATCGCTTCCAG
	JB-072 OccK5 R1 Rv	PA14	TGTGGAGTTCTTGTTCTGGCGCAGTGGTCTCCGATTCTTGTT
	JB-073 OccK5 R3 f	PA14	CAAGAATCGGAGACCACTGCGCCAGAACAAGAACTCCACAGG
	JB-074 OccK5 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggAGGCGCATGTCGCC
	JB-111 OccK5 R1	PA14	GATCTCGATGGCGTCGGCGCTGG
	JB-112 OccK5 R3	PA14	ACCCGCGAACTACCGGCCAGAC
pEXG2 ΔoccK6	JB-075 OccK6 R1 f	PA14	tatacgagccggaagcataaatgtaaagcaGGGGTCAGCGGGCTG
	JB-076 OccK6 R1 Rv	PA14	GAGGAGACAATAACACGGCAGGCCCCG
	JB-077 OccK6 R3 f	PA14	CGCGGGGCCTGCCGTGTTATTGTCTCCTCGAGCGCTTGGG
	JB-078 OccK6 R3 rv	PA14	taaggtaccgaattcgagctcgagcccgggCGATCGCATCCTGCTGTCC
	JB-015 OpdQ R1 Fw	PA14	CGTCGAGCATCCCGTTCCTG
	JB-016 OpdQ R3 Rv	PA14	TCGCTTACCAGAAAGTCGTCC
pEXG2 ΔoccK7	JB-079 OccK7 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaTACCTGGCCGCCGG
	JB-080 OccK7 R1 Rv	PA14	ACGACGAAGAGACAACAACAAGCGGACTTGAGTTTCCCG
	JB-081 OccK7 R3 f	PA14	TCGGGAAACTCAAGTCCGCTTGTTGTTGTCTCTTCGTCGTCAGTGGATAGACAC
	JB-082 OccK7 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggCCACAAGTGCACCGCC
	JB-113 OccK7 R1	PA14	GAAGAGAACGTCGCCGAGAAC
	JB-114 OccK7 R3	PA14	CGTGCAGCCATCATCGAGG
pEXG2 ΔoccK8	JB OprE R1 f	PA14	CCAGTGCCAAGCTTGAGGGGCTCGGTGCCCTCTAC
	JB OprE R1 Rv	PA14	TTCCATGCCTGGCCGGCGCCTGGTCTTTTCCCCATTGGTATTGC
	JB OprE R3 f	PA14	TACCAATGGGGAAAAGACCAGGCGCCGGCCAGGCATGGAAAAG
	JB OprE R3 Rv	PA14	GTACCCGGGGATCCATCACCACCGAGGAATGCCTGCTC
	JB-007 OprE R1 Fw	PA14	TTCCAGGAGGGCGAACAAAG
	JB-008 OprE R3 Rv	PA14	GCTACCGCACCGACGACTTC
pEXG2 ΔoccK9	JB-083 OccK9 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaTGGAACTCCAGCAGCCAG
	JB-084 OccK9 R1 Rv	PA14	TGGGAAAAGGAAAAACAACAGCGCAGGGCCGT
	JB-085 OccK9 R3 f	PA14	CAGCGAGAACGGCCCTGCGCTGTTGTTTTTCCTTTTCCCAGGCCGAAGC
	JB-086 OccK9 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggGACGACCTCTGGACCTCGCG
	JB-115 OccK9 R1	PA14	AGGCCCTCGGTGACGAACAG
	JB-116 OccK9 R3	PA14	GTTGCACTGGTTCGCCGAGC
pEXG2 ΔoccK10	JB-087 OccK10 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaCTGGGACTTCACCCGCC
	JB-088 OccK10 R1 Rv	PA14	CCGCTGTCGAGAGTCACCGCGCCGTCGCGCCGGAACG
	JB-089 OccK10 R3 f	PA14	GTGCGTTCCGGCGCGACGGCGCGGTGACTCTCGACAGCGGG
	JB-090 OccK10 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggCTTCCAGGTGGACGAGCC
	JB-117 OccK10 R1	PA14	GCGACATCGCCAACGCCATC
	JB-118 OccK10 R3	PA14	ATGCTCGACCTCGCCCGAC
pEXG2 ΔoccK11	JB-091 OccK11 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaTCCCAGGCGCGCTAC
	JB-092 OccK11 R1 Rv	PA14	GCCGCCAAGGGCTGAGCGGCACGCACTCCGAACGGG
	JB-093 OccK11 R3 f	PA14	GGCGCCCGTTCGGAGTGCGTGCCGCTCAGCCCTTGG
	JB-094 OccK11 R3 rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggTGCGCACCGCCGAGC
	JB-119 OccK11 R1	PA14	GAGACCGGCGACAACGTGG
	JB-120 OccK11 R3	PA14	AGCCGGTACGCTTCACCAG
pEXG2 ΔoprG	JB OprG R1 f	PA14	CCAGTGCCAAGCTTATTTCCTGGTCCAGGCGCTG
	JB OprG R1 Rv	PA14	TACAAGGAATGGAGCTCATCGTCGTAGACTGTCGCGGGGC
	JB OprG R3 f	PA14	GCCCCGCGACAGTCTACGACGATGAGCTCCATTCCTTGTATTAG
	JB OprG R3 Rv	PA14	GTACCCGGGGATCCTGTCGATCCGCCTATGAC
	JB-011 OprG R1 Fw	PA14	AGACCCGCGACTTCATCTAC
	JB-012 OprG R3 Rv	PA14	CTATGAGTGGAGCCTGCTCG
pEXG2 ΔoprO	JB-298 OprO R1 F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaAGCTTGGCCACCATCGA
	JB-299 OprO R1 R	PA14	gagcagatcgttgtcgcttccgaagatttccc
	JB-300 OprO R3 F	PA14	ccattaaggggaaatcttcggaagcgacaacg
	JB-301 OprO R3 R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccGTATTGCCGTTG
	JB-306 OprO F	PA14	gcgcctgtacctggcgccgg
	JB-307 OprO R	PA14	agtcacggtagacggtgccgcc
pEXG2 ΔoprP	JB-302 OprP R1 F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaAGCTTTCTACCCATATC

	JB-303 OprP R1 R	PA14	ccggacggggcccgagcgcccaggtaagtccc
	JB-304 OprP R3 F	PA14	ccgaacaggggacttacctgggcgctcgggcc
	JB-305 OprP R3 R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccTTCGTTGACGTC
	JB-308 OprP F	PA14	cggcgccggcaagtggctt
	JB-309 OprP R	PA14	acgctgggtgaagccatcgccac
pEXG2 ΔalgE	JB-292 AlgE R1 F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaAGCTTCAGGCCGGCTCC
	JB-293 AlgE R1 R	PA14	gaagaagagccagaaagcctgccccgcgagga
	JB-294 AlgE R3 F	PA14	gtccggtttcctcgcggggcaggctttctggc
	JB-295 AlgE R3 R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccGGGTCGACTCGG
	JB-296 AlgE F	PA14	tacacctcggcgccgcccca
	JB-297 AlgE R	PA14	agaaggccctgctcgaacag
pEXG2 Δtsx	JB-127 TsX R1 F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaGCACCGATTCGCAGATCG
	JB-128 TsX R1 Rv	PA14	GGCAGCCCCGCGCGACGGACTGAAACGCTCCTGGAGTGAATAGCTTTTTTTCTAGTGG
	JB-129 TsX R3 F	PA14	TTCACTCCAGGAGCGTTTCAGTCCGTCGCGCGG
	JB-130 TsX R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggGACGATGCCGGTGACCAG
	JB-131 TsX R1	PA14	CGGCCAGATCGTCCTGC
	JB-132 TsX R3	PA14	GCCGAGGTCGGTGATGC
pEXG2 ΔoprB	JB-172 OprB R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttAAGCTGCGGGTGGAAATGCG
	JB OprB R1 Rv	PA14	CGGAGCAGGCAACGCGACGGTTCCAGCGTCCTCGTGGTTG
	JB OprB R3 f	PA14	CAACCACGAGGACGCTGGAACCGTCGCGTTGCCTGCTCCG
	JB-173 OprB R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccGGGCTGCAGGGCGAAGCTG
	JB-095 OprB R1	PA14	GCGGCCCAAGGTCTACCTG
	JB-096 OprB R3	PA14	CTCCAGCTCCATGCCGTGC
pEXG2 ΔoprB2	JB-174 OprB2 R1 f	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttGCGGGTCGCCGAAGGCGAC
	JB OprB2 R1 Rv	PA14	CGGTTGTCCGAAGCAACAGCGCGAACGCTTCCTCGTTGCGAATGG
	JB OprB2 R3 f	PA14	CGCAACGAGGAAGCGTTCGCGCTGTTGCTTCGGACAACCGC
	JB-175 OprB2 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccAGTAGCGGTCGCCGAACTCGGTG
	JB-097 OprB2 R1	PA14	GCCATCCCATCGGCAACCTG
	JB-098 OprB2 R3	PA14	GTACGGATGCGCCAGGCTTC
pEXG2 ΔoprB3	JB-166 OprB3 R1 f	PA14	ggaagcataaatgtaaagcaagcttGAAGTCGGCGTTGTACGGC
	JB-167 OprB3 R1 Rv	PA14	GCCTTGCCCGCGCCACCTGGCA
	JB-168 OprB3 R3 f	PA14	TGGCGCGGGCAAGGCACTCGTCTTG
	JB-169 OprB3 R3 Rv	PA14	gagctcgagcccggggatccCGTCGCCCTCGGCC
	JB-099 OprB3 R1	PA14	GTTCGCCGTTGACCTGGGTG
	JB-100 OprB3 R3	PA14	AGCAGGTGCTGGTCACTGG
pEXG2 ΔfadL	JB FadL R1 f	PA14	CCAGTGCCAAGCTTTTGCGCGAGGCCGTCATG
	JB FadL R1 Rv	PA14	TTTTTCGTTGGCGCGTGCGATGTTGGAGCAACTCCTGTGTATAACGG
	JB FadL R3 f	PA14	ACACAGGAGTTGCTCCAACATCGCACGCGCCAACGAAAAAG
	JB FadL R3 Rv	PA14	GTACCCGGGGATCCGCTGCTGGAACTGGGCATGG
	JB-017 FadL R1 Fw	PA14	GGGCCATCGGAATAGAAGCTGC
	JB-018 FadL R3 Rv	PA14	CTGCTGGGACTCGCCTGGTG
pEXG2 ΔfadL2	JB-121 FadL2 R1 F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaTTGCAGGTCCTGGTAGAGATCG
	JB-122 FadL2 R1 Rv	PA14	ACCCGCGAGCGAGGCCTGTTGGGCTGGAGCATGATGCG
	JB-123 FadL2 R3 F	PA14	CGCGCATCATGCTCCAGCCCAACAGGCCTCGCTCGCGG
	JB-124 FadL2 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccgggTTCGACTACGGGATCTGGGACAAC
	JB-125 FadL2 R1	PA14	TCGGCATCCAGTTCGGTGAAATC
	JB-126 FadL2 R3	PA14	AAGACCAGCGGCGGCAC
pEXG2 ΔfadL3	JB FadL3 R1 f	PA14	CCAGTGCCAAGCTTGCCCTTCGGATCGAAGTCGGAG
	JB FadL3 R1 Rv	PA14	GCCTGTTTGCCAGAAAACCAACCCGGCCGTAGGCAGAGAAAG
	JB FadL3 R3 f	PA14	TTCTCTGCCTACGGCCGGGTTGGTTTTCTGGCAAACAGGC
	JB FadL3 R3 Rv	PA14	GTACCCGGGGATCCCTGAGCGTTTCGTCCATGGC
	JB-101 FadL3 R1	PA14	CGGTACAGCTCGCTCATG
	JB-102 FadL3 R3	PA14	GCCAACTCACTGGAAGGATAC
pEXG2 ΔsphA	JB-330 PA14_70300 R1 Fw	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttacaccagcaggctggcgaagaactcctcga
	JB-331 PA14_70300 R1 Rv	PA14	tgccgcttcgttccgatgccgggcgggctcttattattgtttgg
	JB-332 PA14_70300 R3 Fw	PA14	acaataataagagcccgcccggcatcggaacgaagcgg
	JB-333 PA14_70300 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccatgggctacgacccct
	JB-334 PA14_70300 R1 check	PA14	agcggcatggatgagttcgatg
	JB-335 PA14_70300 R3 check	PA14	ctgggtgaattgctggcgct
pEXG2 ΔPA14_01770	JB-492 PA14_01770 R1F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttGCCGCTGGCCGAAGGCAAC
	JB-493 PA14_01770 R1R	PA14	TTCCCATGCGCAAAGCCCTGGGCTACGCGTTCTGAGCG
	JB-494 PA14_01770 R3F	PA14	CGCGCTCAGAACGCGTAGCCCAGGGCTTTGCGCATGGGAAGTCCT

	JB-495 PA14_01770 R3R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccCCGGCATCCTGGGGGGA
	JB-496 PA14_01770 R1 check	PA14	CCGCCGACGTACACGGCA
	JB-497 PA14_01770 R3 check	PA14	CCTGGCATGTCGCTTGCTG
pEXG2 ΔPA14_02890	JB-318 PA14_02890 R1 Fw	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttggcgcggtcgacct
	JB-319 PA14_02890 R1 Rv	PA14	tagggcggcggcgcatcgccgctgtgtgtcct
	JB-320 PA14_02890 R3 Fw	PA14	caaccagcaggacacacagcggcgatgcgccgc
	JB-321 PA14_02890 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatcccgccggcaccctgct
	JB-322 PA14_02890 R1 check	PA14	cggacatcaccgtcggcgtcacc
	JB-323 PA14_02890 R3 check	PA14	agcagacggtgcaggcccgc
pEXG2 ΔPA14_15280	JB-498 PA14_15280 R1F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttTGATATAGAAGGTGAGCACGGCGAGG
	JB-499 PA14_15280 R1R	PA14	GTCACATGACCCACCGCACCGTCCATGTGTTCTGAGGAGGCG
	JB-500 PA14_15280 R3F	PA14	CCTCCTCAGAACACATGGACGGTGCGGTGGGTCA
	JB-501 PA14_15280 R3R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccTCGCCCTCTATCGCACGC
	JB-502 PA14_15280 R1 check	PA14	ACCGATCCCCGCGCC
	JB-503 PA14_15280 R3 check	PA14	GACATCGGTGAGCTGCTCTGC
pEXG2 ΔPA14_16630	JB-360 PA14_16630 R1 Fw	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagctttggtgctgttcgacaccgagcagaaggg
	JB-361 PA14_16630 R1 Rv	PA14	cgtgattaaggatgacccctaagccctacggaagcccaaaag
	JB-362 PA14_16330 R3 Fw	PA14	ttgggcttccgtagggcttaaggggtcatccttaatcacgaat
	JB-363 PA14_16630 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccacggcgttccgcgaccacgccgg
	JB-364 PA14_16630 R1 check	PA14	gtgaagctgtccctggagcc
	JB-365 PA14_16630 R3 check	PA14	ccgtggttgcccgcttca
pEXG2 ΔPA14_32640	JB-504 PA14_32640 R1F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttCCGGGCAGATCAACCGC
	JB-505 PA14_32640 R1R	PA14	CGCCCATGACCACCCGCATCCGCTACTCGCAGGTCTTCTG
	JB-506 PA14_32640 R3F	PA14	CAGAAGACCTGCGAGTAGCGGATGCGGGTGGTCAT
	JB-507 PA14_32640 R3R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccTGCAGCTCTACAGCTTCTTCAACAG
	JB-508 PA14_32640 R1 check	PA14	GCAACTGCTGCCCTGGGG
	JB-509 PA14_32640 R3 check	PA14	CCGGGCCAGGCCTTCTT
pEXG2 ΔPA14_33380	JB-510 PA14_33380 R1F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttCTGGTTTGTGGTTAGCGGGT
	JB-511 PA14_33380 R1R	PA14	CCCTCATGCGTGCAGCCCTGCTGCTGGCGTTCTGAATCGG
	JB-512 PA14_33380 R3F	PA14	CCGATTCAGAACGCCAGCAGCAGGGCTGCACG
	JB-513 PA14_33380 R3R	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccGCCGATGACCGAACTGCG
	JB-514 PA14_33380 R1 check	PA14	GACGATTCTGTTACCTCGGGGTTGGA
	JB-515 PA14_33380 R3 check	PA14	ACGCCGCCATGTTGCTGATC
pEXG2 ΔPA14_39000	JB-324 PA14_39000 R1 Fw	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttccagccaggtgttgaccag
	JB-325 PA14_39000 R1 Rv	PA14	ttcacctcgcggagtgcgcctaccgctactttcgaaggaccccg
	JB-326 PA14_39000 R3 Fw	PA14	gtccttcgaaagtagcggtaggcgcactccgcg
	JB-327 PA14_39000 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccgcctgcacgaaccgg
	JB-328 PA14_39000 R1 Check	PA14	gcgggtcaccaccaacttttcg
	JB-329 PA14_39000 R3 check	PA14	tgttctgtccgctgccctcg
pEXG2 ΔPA14_39270	JB-516 PA14_39270 R1F	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttGTTGCGCGGGCGCTAC
	JB-517 PA14_39270 R1R	PA14	GCCCCTCAGAAGTAGTAGGGGAGTGTCTGGGTCATGTTTGCC
	JB-518 PA14_39270 R3F	PA14	CAAACATGACCCAGACACTCCCCTACTACTTCTGAGGGGC
	JB-519 PA14_39270 R1F	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccCACGAACACTTGCTGGAGC
	JB-520 PA14_39270 R1 check	PA14	CCGCCAGCGACCTCTTCG
	JB-521 PA14_39270 R3 check	PA14	ACGCCATCGTCATCGTCGC

pEXG2 ΔPA14_55320	JB-366 PA14_55320 R1 Fw	PA14	ttccacacattatacgagccggaagcataaatgtaaagcaagcttatttcactgggcgagcgc
	JB-367 PA14_55320 R1 Rv	PA14	accttaggagccgtacacaggcgctcctcgaggcag
	JB-368 PA14_55320 R3 Fw	PA14	tggtctgcctcgaggagcgcctgtgtacggctcctaaggtcct
	JB-369 PA14_55320 R3 Rv	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccgcgctgctgctcgccggc
	JB-370 PA14_55320 R1 check	PA14	gacggaaaggtgttcgatcaggg
	JB-371 PA14_55320 R3 check	PA14	ctgtccatcgacggccaccc
pEXG2 ΔoprF	JB OprF R1 f	PA14	CCAGTGCCAAGCTTATTTGGTCAACCCGAGCATACTGG
	JB OprF R1 Rv	PA14	TCAAGATGGGGATTTAACGGTCGGCTGAGCCTCTAAGGAAAAAC
	JB OprF R3 f	PA14	TTCCTTAGAGGCTCAGCCGACCGTTAAATCCCCATCTTGATGG
	JB OprF R3 Rv	PA14	GTACCCGGGGATCCCTTGAATAAGCCTCACCCCCTG
	JB-009 OprF R1 Fw	PA14	TTGACCCTGAAGGCAGTTCG
	JB-010 OprF R3 Rv	PA14	TAATGGACGTGGCTGCTCTG
pEXG2 oprF187t	JB-282a OprF 187t F	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccCGAAAAGTTTTCAGATGCGA
	JB-283 OprF 187t R	PA14	AGCCGGGTTTTTCCTTAGAGGCTCAGCCGATTACGAACCACCGAAGTTGAAGCC
pEXG2 oprF314t	JB-284a OprF 314t F	PA14	ggaaattaattaaggtaccgaattcgagctcgagcccggggatccCGAAACCGGCAACAAGAAGG
	JB-285 OprF 314t R	PA14	CCTGAGCCGGGTTTTTCCTTAGAGGCTCAGCCGATTAGCGACCACCTTCTACACCGTAC
pJBOC	oJBOC-001	pOPC	cgccgttggatacaccaaggggttctgcttcggca
	oJBOC-002	pOPC	cccctcaagtgtcaatgaaagtttccaacgcgagccattcTCAGTGAAGCATCAAGACTAACAAATCGTATAATCC
	oJBOC-003	pEXG2	ttgtctgccgaagcagaaccccttggtgtatccaacggc
	oJBOC-004	pEXG2	ATTGCAAACGCTAGGGCCTTGTGTCGAGGTCCCAATACGCgctagcttattacgcgtaattctcgaattg
	oJBOC-005	pAD6	gaatggctcgcgttggaaactt
	oJBOC-006	pAD6	GCGTATTGGGACCTCGACACA
	JB-462 Stop pOprD	PA14	TTCTTAAATCTAGAGGATCctcatgcggaaaccgccagtgca
	oJBOC-036	PA14	gagccattcTCAGTGAAGCATCAAGACTAACAAATCctacgccccataagatgccggt
	oJBOC-045	pJBOC	tgaaagtttccaacgcgagccattcTCAGT
	oJBOC-046	pJBOC	GCGCTACTGCCGCCAGGC
	oJBOC-038	pJBOC	GAATTAGCTTGGCTGTTTTGGCGG
	oJBOC-057	pJBOC	ATGTATATCTCCTTCTTAAATCTAGAGGATCctca
pPoprD-occD1	JB-464 OccD1 Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATAATGAAAGTGATGAAGTGGAGCGC
	JB-465 OccD1 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTTACAGGATCGACAGCGGATAGTCG
pPoprD-occD2	JB-176 OccD2 f	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgaggaatctgttcgccttgacgccg
	JB-177 OccD2 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCtcagaacacgtcgatgggg
pPoprD-occD3	JB-178 OccD3 f	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATtcaggtgatgagataccaacgagtgacc
	JB-179 OccD3 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCgtttacagcaggttgaaggggaag
pPoprD-occD5	JB-182 OccD5 f	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCtcaccagatcgagcgggagt
	JB-183 OccD5 Rv	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgcaaaatctcagacgcgc
pPoprD-occD6	JB-466 OccD6 fw	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTCAGAACACGCTGAACGGGTACT
	JB-467 OccD6 Rv	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGTTGAAGAAAAGGATTTGCCTGCT
pPoprD-occK4	JB-196 OccK4 f	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCtcaccagagctttagcgtgtaattgacgatgaag
	JB-197 OccK4 Rv	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgatcacggcatgcccc
pPoprD-occK5	JB-198 OccK5 f	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgtcgacttccctgccgc
	JB-199 OccK5 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCttaccagatcggcagggtatagct
pPoprD-occK6	JB-478 OccK6 Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGAGCATGACCCCGATCG
	JB-479 OccK6 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTTACCAGAGCGGCAGCGTGTA
pPoprD-occK7	JB-202 OccK7 f	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCtcaccacagcggcaacgc
	JB-203 OccK7 Rv	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgaaaattcttcccgttccgatgc
pPoprD-occK8	JB-474 OccK8 Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGAAGAGTCGCAAGATCAACAAGTC
	JB-475 OccK8 Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTTACAGCAGCGGCAGGG
pPoprD-oprG	JB-470 OprG Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGCGTAAGTCCTGGCTTACC
	JB-471 OprG Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTCAGAACTTGTAGCCGAAACCGA
pPoprD-oprO	JB-220 OprO f	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgatccgtaagcactcgct
	JB-221 OprO Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCttagaacacgtactgcaaacggg
pPoprD-tsx	JB-468 Tsx Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGAGCCGCACACTCGC
	JB-469 Tsx Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTCAGAAGTGGTACTTGACCAGGAAG
pPoprD-oprB	JB-224 OprB f	PA14	tttccgcagGATCCTCTAGATTTAAGAAGGAGATATACATatgtacaagaacaagaaaaccagaccg
	JB-225 OprB Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCtcagaacaccgtctggatcttgatcc
pPoprD-fadL	JB-476 FadL Fw	PA14	ccgcatgagGATCCTCTAGATTTAAGAAGGAGATATACATATGAAAACAATATGGTTTAAAACCTCTCTCG
	JB-477 FadL Rv	PA14	GAAAATCTTCTCTCATCCGCCAAAACAGCCAAGCTAATTCTCAGAAGCGATAGGTGACCTGGG

SI References

1. Breidenstein EB, Khaira BK, Wiegand I, Overhage J, & Hancock RE (2008) Complex ciprofloxacin resistome revealed by screening a *Pseudomonas aeruginosa* mutant library for altered susceptibility. *Antimicrob Agents Chemother* 52(12):4486-4491.