

Supplementary Information for

Synergistic inhibition of MRSA by chenodeoxycholic acid and carbapenem antibiotics

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Supplementary Text

Figure S1#

Tables S1 and S2#

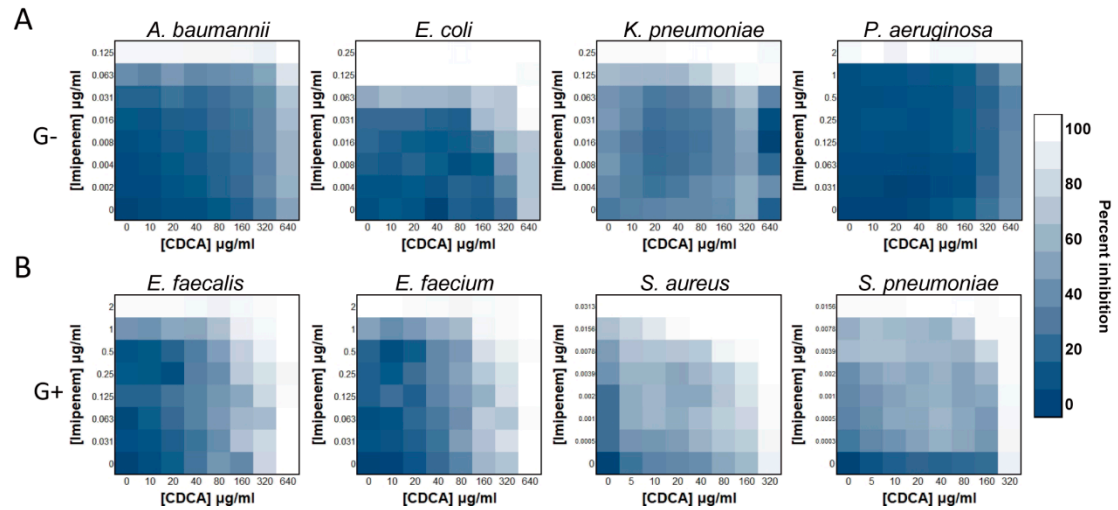


Figure S1. CDCA combined with imipenem against common pathogens.

(A) The combination of CDCA and imipenem, evaluated against four G⁻ bacteria, *Acinetobacter baumannii*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*.

(B) The combination of CDCA and imipenem, evaluated against four G⁺ bacteria, *Enterococcus faecium*, *Enterococcus faecium*, *Staphylococcus aureus*, and *Streptococcus pneumoniae*.

Table S1. Strains used in this study.

Strain name	Features	References
ATCC 43300	MRSA	Lab collection
ATCC 25923	MSSA	Lab collection
MU50	VISA	Lab collection
150907015	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
151010052	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
180410023	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
180211022	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
180126042	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
171213054	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
171116025	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
171031048	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
170911060	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
170807024	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
170714063	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
161019014	Antibiotics resistance: penicillin-G, oxacillin; Intermediate: amikacin	Clinical laboratory of Guanganmen Hospital
161008022	Antibiotics resistance: penicillin-G, oxacillin; Intermediate: amikacin	Clinical laboratory of Guanganmen Hospital
160919055	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
151009009	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
151020006	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
160115091	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Guanganmen Hospital
160123012	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Guanganmen Hospital
1611017	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Dongzhimen Hospital
1611078	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Dongzhimen Hospital
1611099	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Dongzhimen Hospital
1610057	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Dongzhimen Hospital
1702123	Antibiotics resistance: penicillin-G, oxacillin, amikacin	Clinical laboratory of Dongzhimen Hospital
1703118	Antibiotics resistance: penicillin-G, oxacillin	Clinical laboratory of Dongzhimen Hospital
ATCC 25922	<i>Escherichia coli</i>	Lab collection
ATCC 27853	<i>Pseudomonas aeruginosa</i>	Lab collection
ATCC 4352	<i>Klebsiella Pneumoniae</i>	Lab collection
ATCC 22933	<i>Acinetobacter baumannii</i>	Lab collection
ATCC 29212	<i>Enterococcus faecalis</i>	Lab collection
ATCC 19434	<i>Enterococcus faecium</i>	Lab collection
ATCC 49619	<i>Streptococcus pneumoniae</i>	Lab collection

Table S2. CDCA-treated MRSA differential proteins in exponential growth phase.

Protein	Description	Gene	UP&DOW N
A0A0H3JRU9	Pyruvate carboxylase	<i>pycA</i>	down
Q6GC82	Inosine-5-monophosphate dehydrogenase	<i>guaB</i>	down
P99161	Transketolase	<i>tkt</i>	down
Q6GFV0	Putative dipeptidase SAR1836	<i>SAR1836</i>	down
A7WYT1	Pyridoxal 5-phosphate synthase subunit PdxS	<i>pdxS</i>	down
Q6GFZ6	Acetate kinase	<i>ackA</i>	down
P63871	Cysteine synthase	<i>cysK</i>	down
Q5HKH9	Formate acetyltransferase	<i>pflB</i>	down
Q6GAV6	Coenzyme A disulfide reductase	<i>cdr</i>	down
Q6GID1	Ornithine aminotransferase 2	<i>rocD2</i>	down
Q6GJB4	Probable branched-chain-amino-acid aminotransferase	<i>ilvE</i>	down
Q5HRM8	ATP-dependent Clp protease ATP-binding subunit ClpC	<i>clpC</i>	down
Q5HCV0	L-lactate dehydrogenase 2	<i>ldh2</i>	down
Q6GDH2	Clumping factor B	<i>clfB</i>	down
A7WXP7	L-lactate dehydrogenase 1	<i>ldh1</i>	down
P63513	Probable branched-chain-amino-acid aminotransferase	<i>ilvE</i>	down
Q2FXL6	Putative universal stress protein SAOUHSC_01819	<i>SAOUHSC_01819</i>	down
Q5HL19	Probable malate:quinone oxidoreductase 4	<i>mgo4</i>	down
Q7A742	Alcohol dehydrogenase	<i>adh</i>	down
Q6GKB1	Type-1 restriction enzyme R protein	<i>hsdR</i>	down
Q6GGY2	DegV domain-containing protein SAR1438	<i>SAR1438</i>	down
Q2FWX9	4,4-diaponeurosporen-aldehyde dehydrogenase	<i>aldH1</i>	down
Q6GI15	Phosphoribosylformylglycinamide synthase subunit PurL	<i>purL</i>	down
Q6GFB8	Protein map	<i>map</i>	down
Q2G1C2	Teichoic acid ribitol-phosphate polymerase TarK	<i>tarK</i>	down
Q2YXC5	Glutamate racemase	<i>murI</i>	down
Q6GGW9	Alanine dehydrogenase 1	<i>ald1</i>	down
Q6GIR8	Histidinol-phosphate aminotransferase	<i>hisC</i>	down
Q2FWZ8	Bacterial non-heme ferritin	<i>ftnA</i>	down
Q6GI14	Amidophosphoribosyltransferase	<i>purF</i>	down
Q6GK53	Iron-sulfur cluster repair protein ScdA	<i>scdA</i>	down
Q99W83	Pyridoxal 5-phosphate synthase subunit PdxT	<i>pdxT</i>	down
Q5HRR5	Methionine--tRNA ligase	<i>metG</i>	down
Q6GH18	Phosphate-binding protein PstS	<i>pstS</i>	down
Q6GEY7	Cardiolipin synthase 2	<i>cls2</i>	down
Q6GB81	DegV domain-containing protein SAS0714	<i>SAS0714</i>	down
Q6GI16	Phosphoribosylformylglycinamide synthase subunit PurQ	<i>purQ</i>	down

Q6GI18	Phosphoribosylaminoimidazole-succinocarboxamide synthase	<i>purC</i>	down
Q2YY67	L-threonine dehydratase catabolic TdcB	<i>tdcB</i>	down
P56740	Dihydroneopterin aldolase	<i>folB</i>	down
Q99VJ0	Thermonuclease	<i>nuc</i>	down
Q5HQW4	Thioredoxin reductase	<i>trxB</i>	down
Q2FZZ2	Methionine import ATP-binding protein MetN 2	<i>metN2</i>	down
P0A0N7	Ribosomal RNA large subunit methyltransferase H	<i>rlmH</i>	down
A5ISF7	30S ribosomal protein S15	<i>rpsO</i>	down
Q2YYA2	Ribonuclease Z	<i>rnz</i>	down
Q6GI30	Putative acetyltransferase SAR1027	<i>SAR1027</i>	down
Q6GI19	N5-carboxyaminoimidazole ribonucleotide synthase	<i>purK</i>	down
A0A0H3JUG6	Epoxyqueuosine reductase QueH	<i>queH</i>	down
Q2YVB1	N-acetylneuraminate lyase	<i>nanA</i>	down
Q6GEM5	Uncharacterized hydrolase SAR2294	<i>SAR2294</i>	down
Q6G816	Sodium-dependent dicarboxylate transporter SdcS	<i>sdcS</i>	down
Q6GAE1	Phosphoribosylglycinamide formyltransferase	<i>purN</i>	down
Q99SE4	UPF0340 protein SAV2114	<i>SAV2114</i>	down
O32421	Probable cell wall amidase LytH	<i>lytH</i>	down
Q6GJM1	UPF0753 protein SAR0453	<i>SAR0453</i>	down
Q2YX68	UPF0637 protein SAB0972c	<i>SAB0972c</i>	down
Q2YX52	Phosphoribosylformylglycinamide cyclo-ligase	<i>purM</i>	down
Q99S97	Multidrug efflux pump SdrM	<i>sdrM</i>	down
Q2YV56	Transcriptional regulatory protein HptR	<i>hptR</i>	down
Q2FJJ9	Uncharacterized lipoprotein SAUSA300_0416	<i>SAUSA300_0416</i>	down
Q5HL85	Putative ribose uptake protein RbsU	<i>rbsU</i>	down
Q6G6I7	Uncharacterized protein SAS2374	<i>SAS2374</i>	down
Q6GI31	Bifunctional autolysin	<i>atl</i>	up
A8Z4B9	Chaperone protein DnaK	<i>dnaK</i>	up
Q6GES3	Glutamine--fructose-6-phosphate aminotransferase [isomerizing]	<i>glmS</i>	up
Q6GIK4	Clumping factor A	<i>clfA</i>	up
Q6GEV3	Putative aldehyde dehydrogenase	<i>SAR2210</i>	up
Q6GI01	Phosphoenolpyruvate-protein phosphotransferase	<i>ptsI</i>	up
Q99V14	Phosphoenolpyruvate-protein phosphotransferase	<i>ptsI</i>	up
Q6GHI9	Succinate--CoA ligase [ADP-forming] subunit alpha	<i>sucD</i>	up
Q6GIE7	Type II NADH:quinone oxidoreductase	<i>SAR0903</i>	up
Q6GGZ6	Dihydrolipoyllysine-residue succinyltransferase component of 2-oxoglutarate dehydrogenase complex	<i>odhB</i>	up
Q6GIA3	3-oxoacyl-[acyl-carrier-protein] synthase 2	<i>fabF</i>	up
Q2G0P0	50S ribosomal protein L1	<i>rplA</i>	up
Q6GEX5	UDP-N-acetylglucosamine 1-carboxyvinyltransferase 1	<i>murA1</i>	up
Q8NX10	Phosphate acyltransferase	<i>plsX</i>	up
Q6GE17	2,3-bisphosphoglycerate-dependent phosphoglycerate	<i>gpmA</i>	up

	mutase		
Q6GA75	Phenylalanine--tRNA ligase beta subunit	<i>pheT</i>	up
Q2YSF6	Epimerase family protein SAB0724c	<i>SAB0724c</i>	up
A8Z425	Cell cycle protein GpsB	<i>gpsB</i>	up
Q6GB45	Clumping factor A	<i>clfA</i>	up
Q5HNL1	Isocitrate dehydrogenase [NADP]	<i>icd</i>	up
Q99UA7	Aminoacyltransferase FemA	<i>femA</i>	up
Q6GEV1	UDP-N-acetylglucosamine 1-carboxyvinyltransferase 2	<i>murA2</i>	up
A6U089	3-oxoacyl-[acyl-carrier-protein] synthase 3	<i>fabH</i>	up
A5ISB7	Acyl carrier protein	<i>acpP</i>	up
Q6GGE2	Probable endonuclease 4	<i>nfo</i>	up
Q6G664	Oxygen-dependent choline dehydrogenase	<i>betA</i>	up
Q2FXZ3	Chaperone protein DnaJ	<i>dnaJ</i>	up
Q6GFH7	UPF0435 protein SAR1970	<i>SAR1970</i>	up
Q5HE93	ATP synthase subunit b	<i>atpF</i>	up
P95695	Capsular polysaccharide type 5 biosynthesis protein cap5A	<i>cap5A</i>	up
Q6GHQ2	UDP-N-acetylmuramoylalanine--D-glutamate ligase	<i>murD</i>	up
P0C1S0	HTH-type transcriptional regulator MgrA	<i>mgrA</i>	up
A7X5E9	50S ribosomal protein L14	<i>rplN</i>	up
Q5HM31	50S ribosomal protein L13	<i>rplM</i>	up
Q2YYL3	50S ribosomal protein L18	<i>rplR</i>	up
Q5HPY8	Carbamoyl-phosphate synthase large chain	<i>carB</i>	up
Q7A6L9	UPF0337 protein SA0772	<i>SA0772</i>	up
Q6GJG1	Hypoxanthine-guanine phosphoribosyltransferase	<i>hpt</i>	up
A8Z2R5	Aspartyl/glutamyl-tRNA(Asn/Gln) amidotransferase subunit C	<i>gatC</i>	up
Q7A0Y4	Regulatory protein MsrR	<i>msrR</i>	up
Q6GEA0	Lysostaphin resistance protein A	<i>lyrA</i>	up
Q2FXZ1	Protein GrpE	<i>grpE</i>	up
P0C600	6,7-dimethyl-8-ribityllumazine synthase	<i>ribH</i>	up
Q6G789	50S ribosomal protein L30	<i>rpmD</i>	up
Q2G2P5	Nickel-binding protein NikA	<i>nikA</i>	up
Q2YSG0	Probable cell division protein WhiA	<i>whiA</i>	up
Q6GK35	Glycyl-glycine endopeptidase LytM	<i>lytM</i>	up
Q2G2P8	ADP-dependent (S)-NAD(P)H-hydrate dehydratase	<i>nnrD</i>	up
Q6GEX9	Probable transglycosylase SceD	<i>sceD</i>	up
P0A059	Potassium-transporting ATPase KdpC subunit 2	<i>kdpC2</i>	up
A0A0H3JT43	Glycine cleavage system H-like protein	<i>SAV0324</i>	up
Q6GI27	Teichoic acid D-alanine hydrolase	<i>fmtA</i>	up
P60074	UPF0291 protein SAV1341	<i>SAV1341</i>	up
Q5HQ35	Phenylalanine--tRNA ligase beta subunit	<i>pheT</i>	up
Q6G6U7	Ferredoxin--NADP reductase	<i>SAS2264</i>	up
Q6GDM3	HTH-type transcriptional regulator SAR2658	<i>SAR2658</i>	up

A8Z334	50S ribosomal protein L36	<i>rpmJ</i>	up
Q2G1T3	Organic hydroperoxide resistance protein-like	<i>SAOUHSC_0083</i> <i>l</i>	up
Q5HMZ0	10 kDa chaperonin	<i>groS</i>	up
Q8NXW9	Putative proline/betaine transporter	<i>proP</i>	up
P39853	Capsular polysaccharide biosynthesis protein CapD	<i>capD</i>	up
Q7A805	N-acetylmuramic acid 6-phosphate etherase	<i>murQ</i>	up
A6U223	50S ribosomal protein L33 3	<i>rpmG3</i>	up
Q6GH76	Homoserine kinase	<i>thrB</i>	up
A6TZ11	50S ribosomal protein L33 1	<i>rpmG1</i>	up
Q6GDN4	Glycosyl-4,4-diaponeurosporenoate acyltransferase	<i>crtO</i>	up
Q5HM15	50S ribosomal protein L18	<i>rplR</i>	up
Q2YYQ7	Urease subunit beta	<i>ureB</i>	up
A5IU61	DNA polymerase IV	<i>dinB</i>	up
Q5HQ10	Phospho-N-acetylmuramoyl-pentapeptide-transferase	<i>mraY</i>	up
A6QGZ7	UPF0398 protein NWMN_1357	<i>NWMN_1357</i>	up
Q6GJ90	Protein VraX	<i>vraX</i>	up
Q2YX16	Probable quinol oxidase subunit 3	<i>qoxC</i>	up
Q5HQV8	Epimerase family protein SERP0438	<i>SERP0438</i>	up
Q99TA0	Riboflavin biosynthesis protein RibBA	<i>ribBA</i>	up
Q6GF11	Protein SprT-like	<i>SAR2150</i>	up
Q8NYB7	Protein-ADP-ribose hydrolase	<i>MW0302</i>	up
Q99SN8	Uncharacterized leukocidin-like protein 1	<i>SAV2004</i>	up
Q6GH70	30S ribosomal protein S14	<i>rpsN</i>	up
Q2FDE7	Ribonuclease P protein component	<i>rnpA</i>	up
Q2YY57	Holliday junction resolvase RecU	<i>recU</i>	up
