

Additional file 3. General features of putative ORFs from methicillin resistant *S. aureus* phage UPMK\_1 with best matches in the NCBI nr database

| ORF | Position(nt) bp |       | Gene length | direction | Representative similarity to proteins in database | Identity % | E-value   | Accession no. |
|-----|-----------------|-------|-------------|-----------|---------------------------------------------------|------------|-----------|---------------|
|     | Start           | Stop  |             |           |                                                   |            |           |               |
| 1   | 842             | 1408  | 567         | forward   | Hypothetical protein                              | 100        | 4.00E-128 | WP_001092763  |
| 2   | 1882            | 2580  | 699         | reverse   | Lantibiotic ABC transporter protein               | 100        | 2.00E-172 | WP_000581552  |
| 3   | 2577            | 3338  | 762         | reverse   | Hypothetical protein                              | 100        | 4.00E-162 | BAF67983      |
| 4   | 3335            | 4027  | 693         | reverse   | Lantibiotic immunity protein F                    | 100        | 0         | WP_000691541  |
| 5   | 4050            | 5423  | 1374        | reverse   | Peptidase S8                                      | 53.5       | 4.00E-63  | P30197        |
| 6   | 5433            | 5951  | 519         | reverse   | Epidermin decarboxylase                           | 100        | 0         | WP_000566596  |
| 7   | 5967            | 7211  | 1245        | reverse   | Lanthionine synthetase                            | 100        | 0         | WP_045176870  |
| 8   | 7204            | 10197 | 2994        | reverse   | Bacteriocin biosynthesis protein                  | 59         | 9.00E-11  | P21838        |
| 9   | 10262           | 10405 | 144         | reverse   | Lantibiotic gallidermin                           | 100        | 3.00E-14  | JQ655767      |
| 10  | 10819           | 11046 | 227         | reverse   | Hypothetical protein                              | 99         | 0         | Q6G8A9        |
| 11  | 11267           | 12250 | 984         | reverse   | Leucotoxin LukDv                                  | 100        | 0         | Q2FXB0        |
| 12  | 12252           | 13172 | 920         | reverse   | Leucotoxin LukEv                                  | -          | -         | Not available |
| 13  | 14084           | 14182 | 99          | forward   | Hypothetical protein                              | 100        | 0         | WP_045176868  |
| 14  | 14552           | 15340 | 789         | forward   | Hypothetical protein                              | 94.4       | 3.00E-14  | ABX29824      |
| 15  | 16793           | 17137 | 344         | forward   | Hypothetical protein USA300HOU_1821               | -          | -         | Not available |
| 16  | 17134           | 17253 | 119         | forward   | Hypothetical protein                              | 100        | 6.00E-17  | YP_003857112  |
| 17  | 17247           | 17621 | 374         | reverse   | Hypothetical protein SAP26_gp44                   | 100        | 1.00E-155 | YP_008320216  |
| 18  | 17815           | 17973 | 158         | forward   | Hypothetical protein SA13_16                      | 100        | 0         | WP_000190226  |
| 19  | 17952           | 18722 | 771         | forward   | Hypothetical protein                              | 100        | 0         | WP_000803028  |
| 20  | 18732           | 19505 | 773         | forward   | DNA replication protein DnaC                      | 100        | 3.00E-29  | EUS87615      |
| 21  | 19499           | 19657 | 158         | forward   | Hypothetical protein O278_02737, partial          | 100        | 2.00E-44  | WP_001123681  |
| 22  | 19671           | 19892 | 221         | forward   | Hypothetical protein                              | 100        | 7.00E-92  | WP_000049798  |
| 23  | 19996           | 20307 | 311         | forward   | Hypothetical protein                              | 100        | 2.00E-34  | WP_016028253  |
| 24  | 20312           | 20497 | 185         | forward   | Hypothetical protein                              | 100        | 4.00E-82  | WP_016028254  |

|    |       |       |      |         |                                                  |      |           |               |
|----|-------|-------|------|---------|--------------------------------------------------|------|-----------|---------------|
| 25 | 20498 | 20866 | 368  | forward | Hypothetical protein                             | 100  | 1.00E-51  | WP_000131389  |
| 26 | 20870 | 21112 | 242  | forward | Hypothetical protein                             | 100  | 1.00E-50  | BAB95284      |
| 27 | 21124 | 21378 | 254  | forward | Hypothetical protein                             | 100  | 5.00E-31  | CRI18598      |
| 28 | 21368 | 21541 | 173  | forward | Conserved hypothetical protein                   | 100  | 6.00E-27  | BAB95281      |
| 29 | 21824 | 21985 | 161  | forward | Hypothetical protein                             | 100  | 1.00E-125 | WP_001061841  |
| 30 | 22000 | 22533 | 533  | forward | Hypothetical protein                             | 100  | 2.00E-48  | WP_001282074  |
| 31 | 22579 | 22815 | 236  | forward | Hypothetical protein                             | 100  | 4.00E-36  | WP_000195817  |
| 32 | 22812 | 23000 | 188  | forward | Hypothetical protein                             | 100  | 1.00E-37  | NP_058494     |
| 33 | 22975 | 23175 | 200  | forward | Unnamed protein product                          | 95   | 3.00E-35  | Q03183        |
| 34 | 23163 | 23351 | 188  | forward | Transcriptional activator rinB                   | 100  | 3.00E-92  | WP_000286968  |
| 35 | 23352 | 23753 | 401  | forward | Hypothetical protein                             | 100  | 1.00E-63  | WP_029550564  |
| 36 | 24103 | 24414 | 311  | forward | Hypothetical protein                             | 99   | 3.00E-112 | WP_000594083  |
| 37 | 24831 | 24998 | 167  | forward | Terminase                                        | 100  | 0         | WP_031927907  |
| 38 | 24991 | 26199 | 1208 | forward | Terminase                                        | 100  | 0         | WP_001159672  |
| 39 | 26153 | 27631 | 1478 | forward | Portal protein                                   | 99   | 0         | ADL65886      |
| 40 | 27570 | 28550 | 980  | forward | Phage minor head protein                         | 100  | 2.00E-135 | WP_043044228  |
| 41 | 28648 | 29238 | 590  | forward | Capsid assembly scaffolding protein              | 100  | 0         | WP_043044229  |
| 42 | 29254 | 30066 | 812  | forward | Major capsid protein                             | 100  | 7.00E-70  | SBE97147      |
| 43 | 30083 | 30409 | 326  | forward | Rho termination factor domain-containing protein | 100  | 1.00E-69  | YP_240825     |
| 44 | 30409 | 30723 | 314  | forward | Head completion protein                          | 100  | 1.00E-74  | WP_000482986  |
| 45 | 30716 | 31051 | 335  | forward | Phage head-tail adapter protein                  | 99.3 | 3.00E-94  | WP_001151332  |
| 46 | 31101 | 31451 | 350  | forward | Hypothetical protein                             | 100  | 5.00E-101 | WP_015967254  |
| 47 | 31464 | 31901 | 437  | forward | Tail completion protein                          | 99.5 | 1.00E-132 | A9CRB8        |
| 48 | 31888 | 32448 | 560  | forward | Putative tail protein                            | 99.4 | 2.00E-114 | WP_000141084  |
| 49 | 32510 | 33004 | 494  | forward | Hypothetical protein                             | 100  | 2.00E-76  | EYF55880      |
| 50 | 33025 | 33366 | 341  | forward | Hypothetical protein                             | 100  | 0         | WP_031921309  |
| 51 | 33369 | 36338 | 2969 | forward | Putative tape measure protein                    | 100  | 0         | WP_031897669  |
| 52 | 36680 | 37288 | 608  | forward | Phage tail protein                               | 99.8 | 0         | WP_051121127  |
| 53 | 37299 | 39185 | 1886 | forward | Peptidase                                        | 99.7 | 0         | WP_042908142  |
| 54 | 39198 | 41096 | 1898 | forward | Hypothetical protein                             | -    | -         | Not available |

|    |       |       |      |         |                                                          |      |           |               |
|----|-------|-------|------|---------|----------------------------------------------------------|------|-----------|---------------|
| 55 | 41700 | 42680 | 980  | forward | Hypothetical protein                                     | 100  | 0         | P0A0B3        |
| 56 | 42682 | 44274 | 1592 | forward | Phosphoenolpyruvate carboxykinase                        | 100  | 0         | WP_000345609  |
| 57 | 44527 | 45273 | 746  | reverse | Dipeptidyl aminopeptidase                                | 100  | 3.00E-127 | EES95489      |
| 58 | 45278 | 45811 | 533  | reverse | Nucleoside triphosphatase YtkD                           | 100  | 3.00E-57  | P67305        |
| 59 | 45817 | 46074 | 257  | forward | Hypothetical protein                                     | 100  | 0         | WP_045177246  |
| 60 | 46071 | 47072 | 1001 | reverse | O-succinylbenzoate synthase                              | 97.5 | 0         | P63526        |
| 61 | 47077 | 48555 | 1478 | reverse | 2-succinylbenzoate-CoA ligase                            | 100  | 8.00E-114 | WP_045177252  |
| 62 | 48714 | 49154 | 404  | reverse | Hypothetical protein                                     | 100  | 4.00E-110 | WP_049296628  |
| 63 | 49472 | 50122 | 650  | forward | Calcium-binding protein                                  | 100  | 0         | WP_049296627  |
| 64 | 50203 | 51198 | 995  | forward | Hypothetical protein (DUF4352 domain-containing protein) | 100  | 7.00E-150 | WP_045177256  |
| 65 | 51274 | 51900 | 626  | forward | Hypothetical protein                                     | 100  | 1.00E-75  | WP_045177258  |
| 66 | 51941 | 52282 | 341  | forward | Hypothetical protein                                     | 100  | 3.00E-136 | WP_045177260  |
| 67 | 52779 | 52955 | 176  | forward | Hypothetical protein                                     | 100  | 3.00E-127 | WP_045177261  |
| 68 | 53153 | 53626 | 473  | reverse | Hypothetical protein                                     | 100  | 1.00E-169 | Q2FXC2        |
| 69 | 53992 | 54699 | 707  | forward | Serine protease SplA                                     | 100  | 3.00E-171 | Q6G8C2        |
| 70 | 54782 | 55546 | 764  | forward | Serine protease SplB                                     | 100  | 3.00E-170 | Q8NVX7        |
| 71 | 55604 | 56323 | 719  | forward | Serine protease SplC                                     | 99.5 | 2.00E-171 | Q7A2Q9        |
| 72 | 56444 | 57163 | 719  | forward | Serine protease SplD                                     | 100  | 3.00E-168 | Q5HEW4        |
| 73 | 57321 | 58037 | 716  | forward | Serine protease SplE                                     | 100  | 8.00E-172 | Q5HEW5        |
| 74 | 58188 | 58907 | 719  | forward | Serine protease SplF                                     | 100  | 0         | WP_000028669  |
| 75 | 59270 | 60826 | 1556 | forward | Type I restriction-modification system subunit M         | 100  | 0         | WP_000072624  |
| 76 | 60819 | 62018 | 1199 | forward | Specificity determinant HsdS                             | 100  | 8.00E-120 | KIX70484      |
| 77 | 63214 | 63732 | 518  | forward | Tail protein, partial                                    | -    | -         | Not available |
| 78 | 63738 | 63968 | 230  | forward | Hypothetical protein                                     | 100  | 2.00E-86  | WP_015978410  |
| 79 | 63958 | 64353 | 395  | forward | Hypothetical protein                                     | 100  | 1.00E-99  | EUK61875      |
| 80 | 64409 | 64846 | 437  | forward | Phage phi LC3 family holin, partial                      | 90.5 | 0         | P24556        |
| 81 | 64812 | 66272 | 1460 | forward | Phage lysin                                              | 100  | 3.00E-67  | WP_000344116  |
| 82 | 66669 | 66980 | 311  | forward | Hypothetical protein                                     | 100  | 1.00E-85  | WP_001251275  |
| 83 | 66967 | 67350 | 383  | forward | Hypothetical protein                                     | 42.5 | 2.00E-18  | P03015        |

|     |       |       |      |         |                                          |      |           |               |
|-----|-------|-------|------|---------|------------------------------------------|------|-----------|---------------|
| 84  | 67497 | 68882 | 1385 | reverse | Serine recombinase gin                   | 100  | 3.00E-160 | WP_000392109  |
| 85  | 69089 | 69769 | 680  | reverse | Hypothetical protein                     | 100  | 2.00E-171 | WP_000358224  |
| 86  | 69805 | 70524 | 719  | reverse | Transcriptional regulator                | 100  | 2.00E-44  | WP_001198672  |
| 87  | 70666 | 70884 | 218  | forward | Transcriptional regulator                | 100  | 3.00E-180 | WP_001573849  |
| 88  | 70900 | 71637 | 737  | forward | Repressor protein                        | 100  | 5.00E-41  | WP_000455728  |
| 89  | 71650 | 71859 | 209  | forward | Hypothetical protein                     | 100  | 2.00E-27  | WP_000048126  |
| 90  | 71873 | 72034 | 161  | forward | Hypothetical protein                     | 100  | 2.00E-52  | WP_000291487  |
| 91  | 72127 | 72387 | 260  | forward | Hypothetical protein                     | 100  | 1.00E-44  | WP_000815400  |
| 92  | 72397 | 72618 | 221  | forward | Hypothetical protein                     | 100  | 2.00E-151 | WP_000139720  |
| 93  | 72611 | 73234 | 623  | forward | Hypothetical protein                     | 90.7 | 1.00E-72  | Q932A8        |
| 94  | 73234 | 73659 | 425  | forward | Single-stranded DNA-binding protein      | 100  | 4.00E-131 | WP_001004506  |
| 95  | 73670 | 74221 | 551  | forward | DNA endonuclease I-Hmul                  | 98.6 | 2.00E-165 | YP_240792     |
| 96  | 74222 | 74896 | 674  | forward | Hypothetical protein                     | 100  | 2.00E-78  | Q2FXE6        |
| 97  | 75356 | 75721 | 365  | forward | Putative fluoride ion transporter CrcB 1 | 99   | 4.00E-75  | Q2FXE5        |
| 98  | 75718 | 76071 | 353  | forward | Putative fluoride ion transporter CrcB 2 | 56.5 | 3.00E-97  | O32210        |
| 99  | 76454 | 77287 | 833  | reverse | Glyoxal reductase                        | 100  | 0         | BAB42875      |
| 100 | 77499 | 78407 | 908  | reverse | Hypothetical protein                     | 99.7 | 0         | Q8NVZ9        |
| 101 | 78532 | 79725 | 1193 | reverse | S-adenosylmethionine synthase            | 100  | 9.00E-68  | WP_000836465  |
| 102 | 80025 | 80336 | 311  | reverse | Rhodanese-like domain-containing protein | 99.8 | 0         | Q8NW17        |
| 103 | 80358 | 82667 | 2309 | reverse | Leucine-tRNA ligase                      | 54.9 | 9.00E-134 | O34546        |
| 104 | 83069 | 84250 | 1181 | reverse | Putative MFS-type transporter YttB       | 100  | 0         | WP_045177230  |
| 105 | 84632 | 85663 | 1031 | forward | Riboflavin biosynthesis protein RibD     | 100  | 6.00E-148 | WP_000493888  |
| 106 | 85670 | 86302 | 632  | forward | Riboflavin synthase subunit alpha        | 100  | 0         | Q6G8G1        |
| 107 | 86313 | 87494 | 1181 | forward | Riboflavin biosynthesis protein RibBA    | 100  | 1.00E-107 | P61595        |
| 108 | 87507 | 87971 | 464  | forward | 6,7-dimethyl-8-ribityllumazine synthase  | 100  | 0         | WP_001196345  |
| 109 | 88093 | 89094 | 1001 | reverse | Proline dehydrogenase                    | 95.7 | 1.00E-53  | SCU55093      |
| 110 | 90818 | 91102 | 284  | reverse | Hypothetical protein                     | -    | -         | Not available |
| 111 | 91261 | 93582 | 2321 | forward | Hypothetical protein                     | -    | -         | Not available |
| 112 | 93692 | 93853 | 161  | forward | Hypothetical protein                     | 100  | 5.00E-57  | EPX93583      |
| 113 | 93909 | 94184 | 275  | forward | Holin, partial                           | 99.7 | 0         | WP_001141518  |

|     |        |        |      |         |                                       |      |           |               |
|-----|--------|--------|------|---------|---------------------------------------|------|-----------|---------------|
| 114 | 94171  | 95583  | 1412 | forward | Amidase                               | 100  | 2.00E-124 | WP_001035623  |
| 115 | 95644  | 96201  | 557  | reverse | Hypothetical protein                  | 100  | 7.00E-40  | WP_000125170  |
| 116 | 96862  | 97068  | 206  | forward | Hypothetical protein                  | 100  | 9.00E-40  | WP_000498229  |
| 117 | 97082  | 97282  | 200  | forward | Hypothetical protein                  | 74   | 9.00E-53  | P30338        |
| 118 | 98128  | 98442  | 314  | forward | Arsenical resistance operon repressor | 99.7 | 0         | Q8NW09        |
| 119 | 98442  | 99734  | 1292 | forward | Arsenical pump m                      | 100  | 6.00E-94  | Q5HF01        |
| 120 | 99752  | 100147 | 395  | forward | Protein ArsC                          | 100  | 1.00E-40  | EEW44025      |
| 121 | 101346 | 101555 | 209  | reverse | Truncated transposase                 | 100  | 1.00E-40  | EEW44025      |
| 122 | 101758 | 101901 | 143  | reverse | Transposase                           | 100  | 4.00E-25  | WP_001549059  |
| 123 | 102832 | 104844 | 2012 | reverse | Hypothetical protein                  | -    | -         | Not available |
| 124 | 105968 | 106234 | 266  | reverse | Hypothetical protein                  | 100  | 2.00E-56  | WP_050003995  |
| 125 | 106701 | 106916 | 215  | forward | Hypothetical protein                  | -    | -         | Not available |
| 126 | 106942 | 108333 | 1391 | forward | Acetyl-coenzyme A synthetase          | 73.2 | 0         | P39062        |
| 127 | 108743 | 109264 | 521  | forward | RNA polymerase sigma factor SigS      | 100  | 3.00E-81  | Q6G8F3        |
| 128 | 109807 | 110250 | 443  | reverse | Hypothetical protein                  | 100  | 3.00E-97  | WP_001030463  |
| 129 | 110678 | 111115 | 437  | forward | TIGR01212 family radical SAM protein  | 98.9 | 6.00E-140 | KAG35383      |
| 130 | 111112 | 111675 | 563  | forward | Putative rRNA methylase YtqB          | 52   | 4.00E-58  | O34614        |
| 131 | 112018 | 112245 | 227  | reverse | Hypothetical protein                  | -    | -         | Not available |
| 132 | 112574 | 113197 | 623  | reverse | Hypothetical protein                  | -    | -         | Not available |
| 133 | 113471 | 113761 | 290  | forward | Phage terminase small subunit         | 100  | 3.00E-62  | SCT09172      |
| 134 | 113864 | 114745 | 881  | forward | Hypothetical protein                  | -    | -         | Not available |
| 135 | 114682 | 115941 | 1259 | reverse | Hypothetical protein                  | -    | -         | Not available |
| 136 | 116429 | 116602 | 173  | reverse | Uncharacterised protein               | 100  | 1.00E-31  | SCU35234      |
| 137 | 116908 | 117264 | 356  | forward | Hypothetical protein                  | -    | -         | Not available |
| 138 | 117241 | 118020 | 779  | reverse | Antirepressor                         | 100  | 0         | WP_031916499  |
| 139 | 118020 | 118136 | 116  | reverse | Hypothetical protein                  | -    | -         | Not available |
| 140 | 123353 | 123652 | 299  | reverse | Hypothetical protein                  | 98.9 | 1.00E-61  | WP_061737271  |
| 141 | 123652 | 123879 | 227  | reverse | Hypothetical protein                  | -    | -         | Not available |
| 142 | 123919 | 124092 | 173  | reverse | Hypothetical protein                  | 100  | 2.00E-31  | WP_000977107  |
| 143 | 124096 | 124473 | 377  | reverse | Hypothetical protein                  | 100  | 3.00E-83  | WP_000705896  |

|     |        |        |     |         |                                                             |      |           |               |
|-----|--------|--------|-----|---------|-------------------------------------------------------------|------|-----------|---------------|
| 144 | 124759 | 125409 | 650 | reverse | D-3-phosphoglycerate dehydrogenase, partial                 | 99.6 | 3.00E-170 | KMR60721      |
| 145 | 125641 | 126225 | 584 | forward | Tail fiber protein                                          | 99.5 | 9.00E-136 | CUG85000      |
| 146 | 126330 | 126536 | 206 | forward | Hypothetical protein                                        | -    | -         | Not available |
| 147 | 126644 | 126826 | 182 | reverse | Hypothetical protein                                        | 100  | 3.00E-34  | WP_000411343  |
| 148 | 126827 | 127204 | 377 | reverse | Hypothetical protein                                        | 100  | 1.00E-83  | WP_000705919  |
| 149 | 134936 | 135151 | 215 | forward | Pyridine nucleotide-disulfide oxidoreductase family protein | 100  | 1.00E-92  | CYB54786      |
| 150 | 136685 | 137017 | 332 | forward | NAD(FAD)-utilizing dehydrogenase                            | 100  | 2.00E-73  | SCU54614      |
| 151 | 137253 | 137672 | 419 | reverse | Hypothetical protein                                        | -    | -         | Not available |
| 152 | 138255 | 138404 | 149 | reverse | Hypothetical protein                                        | -    | -         | Not available |
| 153 | 138692 | 138988 | 296 | reverse | Hypothetical protein                                        | 100  | 5.00E-61  | WP_029051944  |
| 154 | 144457 | 144588 | 131 | forward | Hypothetical protein                                        | -    | -         | Not available |
| 155 | 146216 | 146428 | 212 | reverse | Hypothetical protein                                        | -    | -         | Not available |