

Table 4. Location of the various genes Modified  
 March 2011  
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Gene	Number	Genera
<b>METHYLASES</b>		
<i>erm</i> (A)	8	<i>Aggregatibacter</i> <sup>L</sup> , <i>Bacteriodes</i> , <i>Enterococcus</i> <sup>e</sup> , <i>Haemophilus</i> <sup>f</sup> , <i>Peptostreptococcus</i> <sup>a</sup> , <i>Prevotella</i> <sup>a</sup> , <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Helcococcus</i>
<i>erm</i> (B)	34	<i>Aggregatibacter</i> <sup>l</sup> , <i>Acinetobacter</i> , <i>Aerococcus</i> , <i>Arcanobacterium</i> , <i>Bacillus</i> , <i>Bacteriodes</i> <sup>a</sup> , <i>Citrobacter</i> , <i>Corynebacterium</i> , <i>Clostridium</i> <sup>a</sup> , <i>Enterobacter</i> , <i>Escherichia</i> , <i>Eubacterium</i> <sup>a</sup> , <i>Enterococcus</i> , <i>Fusobacterium</i> <sup>a</sup> , <i>Gemella</i> , <i>Haemophilus</i> , <i>Klebsiella</i> , <i>Lactobacillus</i> , <i>Micrococcus</i> , <i>Neisseria</i> , <i>Pantoeae</i> , <i>Pediococcus</i> , <i>Peptostreptococcus</i> <sup>a</sup> , <i>Porphyromonas</i> <sup>a</sup> , <i>Proteus</i> , <i>Pseudomonas</i> , <i>Ruminococcus</i> <sup>a</sup> , <i>Rothia</i> , <i>Serratia</i> , <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Ureaplasma</i> <sup>o</sup> , <i>Wolinella</i> <sup>a</sup> , <i>Treponema</i> <sup>b</sup>
<i>erm</i> (C)	20	<i>Aggregatibacter</i> <sup>L</sup> , <i>Actinomyces</i> , <i>Arcanobacterium</i> <sup>n</sup> , <i>Bacillus</i> , <i>Bacteriodes</i> <sup>a</sup> , <i>Clostridium</i> <sup>a,n</sup> , <i>Corynebacterium</i> , <i>Escherichia</i> <sup>n</sup> , <i>Eubacterium</i> <sup>a</sup> , <i>Enterococcus</i> <i>Haemophilus</i> <sup>f</sup> , <i>Lactobacillus</i> , <i>Macrococcus</i> , <i>Micrococcus</i> , <i>Neisseria</i> , <i>Prevotella</i> <sup>a</sup> , <i>Peptostreptococcus</i> <sup>a</sup> , <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Wolinella</i> <sup>a</sup>
<i>erm</i> (D)	2	<i>Bacillus</i> , <i>Salmonella</i>
<i>erm</i> (E)	7	<i>Bacteroides</i> <sup>a</sup> , <i>Eubacterium</i> <sup>a</sup> , <i>Fusobacterium</i> <sup>a</sup> , <i>Ruminococcus</i> <sup>a</sup> , <i>Saccharopolyspora</i> <sup>n</sup> , <i>Shigella</i> , <i>Streptomyces</i>
<i>erm</i> (F)	24	<i>Aggregatibacter</i> <sup>L</sup> , <i>Actinomyces</i> , <i>Bacteroides</i> <sup>a</sup> , <i>Clostridium</i> <sup>a</sup> , <i>Corynebacterium</i> , <i>Eubacterium</i> <sup>a</sup> , <i>Enterococcus</i> , <i>Fusobacterium</i> <sup>a</sup> , <i>Gardnerella</i> , <i>Haemophilus</i> <sup>f</sup> , <i>Lactobacillus</i> , <i>Mobiluncus</i> <sup>a</sup> , <i>Neisseria</i> , <i>Porphyromonas</i> <sup>a</sup> , <i>Prevotella</i> <sup>a</sup> , <i>Peptostreptococcus</i> <sup>a</sup> , <i>Ruminococcus</i> <sup>a</sup> , <i>Shigella</i> , <i>Selenomonas</i> <sup>a</sup> , <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Treponema</i> <sup>b</sup> , <i>Veillonella</i> <sup>a</sup> , <i>Wolinella</i> <sup>a</sup>
<i>erm</i> (G)	7	<i>Bacillus</i> , <i>Bacteroides</i> <sup>a</sup> , <i>Catenibacterium</i> <sup>a</sup> , <i>Lactobacillus</i> , <i>Prevotella</i> <sup>a</sup> , <i>Porphyromonas</i> <sup>a</sup> , <i>Staphylococcus</i>

<i>erm</i> (H)	1	<i>Streptomyces</i>
<i>erm</i> (I)	1	<i>Streptomyces</i>
<i>erm</i> (N)	1	<i>Streptomyces</i>
<i>erm</i> (O)	1	<i>Streptomyces</i>
<i>erm</i> (Q)	6	<i>Aggregatibacter</i> <sup>L</sup> , <i>Bacteroides</i> <sup>a</sup> , <i>Clostridium</i> <sup>a</sup> , <i>Staphylococcus</i> , <i>Streptococcus</i> <i>Wolinella</i> <sup>a</sup>
<i>erm</i> (R)	2	<i>Arthrobacter</i> , <i>Aeromicrobium</i> <sup>n</sup>
<i>erm</i> (S)	1	<i>Streptomyces</i>
<i>erm</i> (T)	4	<i>Enterococcus</i> , <i>Lactobacillus</i> , <i>Streptococcus</i> , <i>Staphylococcus</i> <sup>m</sup>
<i>erm</i> (U)	1	<i>Streptomyces</i>
<i>erm</i> (V)	3	<i>Eubacterium</i> <sup>a</sup> , <i>Fusobacterium</i> <sup>a</sup> , <i>Streptomyces</i>
<i>erm</i> (W)	1	<i>Micromonospora</i>
<i>erm</i> (X)	4	<i>Arcanobacterium</i> , <i>Bifidobacterium</i> <sup>a</sup> , <i>Corynebacterium</i> , <i>Propionibacterium</i> <sup>a</sup>
<i>erm</i> (Y)	1	<i>Staphylococcus</i>
<i>erm</i> (Z)	1	<i>Streptomyces</i>
<i>erm</i> (30)	1	<i>Streptomyces</i>
<i>erm</i> (31)	1	<i>Streptomyces</i>
<i>erm</i> (32)	1	<i>Streptomyces</i>
<i>erm</i> (33)	1	<i>Staphylococcus</i>
<i>erm</i> (34)	1	<i>Bacillus</i>
<i>erm</i> (35)	1	<i>Bacteriodes</i> <sup>a</sup>
<i>erm</i> (36)	1	<i>Micrococcus</i>
<i>erm</i> (37)	1	<i>Mycobacterium</i>
<i>erm</i> (38)	1	<i>Mycobacterium</i>
<i>erm</i> (39)	1	<i>Mycobacterium</i>
<i>erm</i> (40)	1	<i>Mycobacterium</i>
<i>erm</i> (41)	1	<i>Mycobacterium</i>
<b><i>erm</i>(42)</b>	<b>3</b>	<b><i>Mannheimia</i>, <i>Pasteurella</i>, <i>Photobacterium</i></b>

## rRNA METHYLASES PhLOPS<sub>A</sub><sup>q</sup>

*cfr* 2

*Bacillus, Staphylococcus*

## ATP-BINDING TRANSPORTERS

*car*(A) 1

*Streptomyces*

*msr*(A) 8

*Corynebacterium, Enterobacter, Enterococcus, Gemella, Pseudomonas, Staphylococcus, Streptococcus, Ureaplasma*<sup>o</sup>

*msr*(C) 1

*Enterococcus*

*msr*(D)<sup>c</sup> 22

*Acinetobacter, Bacteroides*<sup>a,d</sup>, *Citrobacter, Clostridium*<sup>a</sup>, *Corynebacterium, Enterococcus, Enterobacter, Escherichia, Gemella, Fusobacterium*<sup>a</sup>, *Klebsiella, Morganella, Neisseria, Proteus, Providencia, Pseudomonas, Ralstonia, Staphylococcus, Streptococcus, Serratia, Stenotrophomonas, Ureaplasma*<sup>o</sup>

*msr*(E)<sup>s</sup> 6

*Acinetobacter, Citrobacter, Escherichia, Klebsiella, Pasteurella, Serratia*

*lsa*(A) 1

*Enterococcus*

*lsa*(B) 1

*Staphylococcus*

*lsa*(C) 1

*Streptococcus*<sup>p</sup>

*ole*(B) 1

*Streptomyces*

*ole*(C) 1

*Streptomyces*

*srm*(B) 1

*Streptomyces*

*tlr*(C) 1

*Streptomyces*

*vga*(A) 1

*Staphylococcus*

*vga*(A)<sub>LC</sub> 1

*Staphylococcus*

*vga*(B) 2

*Staphylococcus, Enterococcus*

*vga*(C)<sup>k</sup> 1

*Staphylococcus*

## MAJOR FACILITATORS

*lmr*(A) 1

*Streptomyces*

*mef*(A) 28

*Acinetobacter, Bacteroides*<sup>a</sup>, *Citrobacter, Clostridium*<sup>a</sup>, *Corynebacterium, Enterococcus, Enterobacter, Escherichia, Fusobacterium*<sup>a</sup>, *Gemella, Haemophilus*<sup>r</sup>, *Klebsiella, Lactobacillus, Micrococcus, Morganella, Neisseria, Pantoeae, Providencia, Proteus, Ralstonia, Rothia*

<sup>i</sup>,*Pseudomonas*, *Salmonella*, *Serratia*, *Staphylococcus*, *Streptococcus*, *Stenotrophomonas*,  
*Ureaplasma*<sup>o\*</sup>

*mef*(B) 1

*Escherichia*

#### ESTERASES

*ere*(A) 11

*Citrobacter*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Pantoeae*, *Providencia*, *Pseudomonas*, *Serratia*,  
*Staphylococcus*, *Stenotrophomonas*, *Vibrio*

*ere*(B) 8

*Acinetobacter*, *Citrobacter*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Proteus*, *Pseudomonas*,  
*Staphylococcus*

#### LYASES

*vgb*(A) 2

*Enterococcus*, *Staphylococcus*

*vgb*(B) 1

*Staphylococcus*

#### TRANSFERASES

*lnu*(A) 3

*Staphylococcus*, *Clostridium*<sup>a</sup>, *Lactobacillus*<sup>g</sup>

*lnu*(B) 4

*Enterococcus*, *Staphylococcus*, *Clostridium*<sup>a</sup>, *Streptococcus*<sup>h</sup>

*lnu*(C) 2

*Streptococcus*, *Haemophilus*<sup>L</sup>

*lnu*(D) 1

*Streptococcus*

*lnu*(F) 2

*Escherichia*, *Salmonella*

*vat*(A) 1

*Staphylococcus*

*vat*(B) 2

*Enterococcus*, *Staphylococcus*

*vat*(C) 1

*Staphylococcus*

*vat*(D) 1

*Enterococcus*

*vat*(E) 2

*Enterococcus*, *Lactobacillus*

*vat*(F) 1

*Yersinia*

#### PHOSPHORYLASES

*mph*(A) 11

*Aeromonas*, *Escherichia*, *Citrobacter*, *Enterobacter*, *Klebsiella*, *Pantoeae*, *Pseudomonas*, *Proteus*  
*Serratia*, *Shigella*<sup>i</sup>, *Stenotrophomonas*

*mph*(B) 4

*Escherichia*, *Enterobacter*, *Pseudomonas*, *Proteus*

*mph*(C) 2

*Staphylococcus*, *Stenotrophomonas*

*mph*(D) 6

*Escherichia*, *Klebsiella*, *Pantoeae*, *Proteus*, *Pseudomonas*, *Stenotrophomonas*

*mph*(E)<sup>s</sup> 6

*Acinetobacter*, *Citrobacter*, *Escherichia*, *Klebsiella*, *Pasteurella*, *Serratia*

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Blue indicates new since last update.

<sup>1</sup>*Actinobacillus actinomycetemcomitans* is now *Aggregatibacter actinomycetemcomitans*

<sup>a</sup> Anaerobic genus; <sup>b</sup> *T. denticola* anaerobic but not all species in genus are anaerobes; <sup>c</sup> *msr(D)* linked to *mef(A)*; <sup>d</sup> the *msr(D)* may not be functional in the *Bacteroides* isolated described (Wang et al., App Env Microb. 2003); <sup>e</sup> Schwaiger, & Bauer, 2008, AAC 52:2994; <sup>g</sup> Rosander, Connolly & Roos AEM in press; <sup>h</sup> Achard et al., AAC, 49:2716; <sup>i</sup> Boumghar-Bourtchai, Emg Infect Dis 14:1297, 2008; <sup>j</sup> Villedieu et al., AAC, 51:2195, 2007; <sup>k</sup> Kadlec, AAC 53:3589, 2009; <sup>L</sup> Chen et al, JAC 2010 65:2256, <sup>m</sup> Kadlec & Schwarz. 2010 AAC 54:915; <sup>n</sup> Koike et al., Microbiol Ecol 3:487. 2009; <sup>o</sup> Lu et al., Curr Microbiol 61:44, 2010; <sup>p</sup> ICAAC2010 abstract Malbruny et al.; <sup>q</sup> [resistance to phenicols, lincosamides, oxazolidinones, pleuromutilins, and streptogramin A but not macrolides; Long et al.,2006, AAC 50:2500](#); <sup>r</sup> Roberts et al., J. Antimicrob. Chemother. 66:100-104, 2011, ; <sup>s</sup> *msr(E)* and *mph(E)* usually linked

\* The authors did not test for *mef(A)* but *msr(D)* has always been associated with *mef(A)* in a single element and thus the ureaplasma with *msr(D)* most likely carries the *mef(A)* gene