

Supplemental Movie Legends, Figures, and Tables for:

Shrivastava, A, JJ Johnston, JM van Baaren, and MJ McBride. "*Flavobacterium johnsoniae* GldK, GldL, GldM, and SprA are required for secretion of the cell-surface gliding motility adhesins SprB and RemA"

Supplemental Movie Legends.

Movie S1. Movement of cells of wild-type, *gldK* deletion mutant, and complemented strains of *F. johnsoniae* on glass cover slips. Cells in MM were introduced into tunnel slides, incubated for 5 min, and cells on the cover slip were examined using a Photometrics CoolSNAP_{cf}² camera mounted on an Olympus BH-2 phase-contrast microscope with a heated stage at 25°C. Three 15-second sequences are shown. 1) Wild-type *F. johnsoniae* CJ1827 (*rpsL2*). 2) CJ2122 (Δ *gldK*). 3) CJ2122 complemented with pTB99 that carries *gldK*. CJ1827 and CJ2122 carried the control vector pCP23 so that all cells could be treated the same and grown in the presence of the tetracycline. Movements seen in segment 2 (Δ *gldK*) appear to be Brownian motion. Bar indicates 10 μ m.

Movie S2. Movement of cells of wild-type, *gldL* deletion mutant, and complemented strains of *F. johnsoniae* on glass cover slips. Cells in MM were introduced into tunnel slides, incubated for 5 min, and cells on the cover slip were examined using a Photometrics CoolSNAP_{cf}² camera mounted on an Olympus BH-2 phase-contrast microscope with a heated stage at 25°C. Three 15-second sequences are shown. 1) Wild-type *F. johnsoniae* CJ1827 (*rpsL2*). 2) CJ2157 (Δ *gldL*). 3) CJ2157 complemented with pTB81a that carries *gldL*. CJ1827 and CJ2157 carried the control vector pCP23 so that all cells could be treated the same and grown in the presence of the tetracycline. Movements seen in segment 2 (Δ *gldL*) appear to be Brownian motion. Bar indicates 10 μ m.

Movie S3. Movement of cells of wild-type, *gldM* deletion mutant, and complemented strains of *F. johnsoniae* on glass cover slips. Cells in MM were introduced into tunnel slides, incubated for 5 min, and cells on the cover slip were examined using a Photometrics CoolSNAP_{cf}² camera mounted on an Olympus BH-2 phase-contrast microscope with a heated stage at 25°C. Three 15-second sequences are shown. 1) Wild-type *F. johnsoniae* CJ1827 (*rpsL2*). 2) CJ2262 (Δ *gldM*). 3) CJ2262 complemented with pTB94a that carries *gldM*. CJ1827 and CJ2262 carried the control vector pCP23 so that all cells could be treated the same and grown in the presence of the tetracycline. Movements seen in segment 2 (Δ *gldM*) appear to be Brownian motion. Bar indicates 10 μ m.

Movie S4. Movement of cells of wild-type, *sprA* deletion mutant, and complemented strains of *F. johnsoniae* on glass cover slips. Cells in MM were introduced into tunnel slides, incubated for 5 min, and cells on the cover slip were examined using a Photometrics CoolSNAP_{cf}² camera mounted on an Olympus BH-2 phase-contrast microscope with a heated stage at 25°C. 15-second sequences are shown for wild-type and complemented strains, and a 30 second sequence is shown for the *sprA* deletion mutant. 1) Wild-type *F. johnsoniae* CJ1827 (*rpsL2*). 2) CJ2302 (Δ *sprA*). 3) CJ2302 complemented with pSN48 that carries *sprA*. CJ1827 and CJ2302 carried the control vector pCP23 so that all cells could be treated the same and grown in the presence of the tetracycline. Bar indicates 10 μ m.

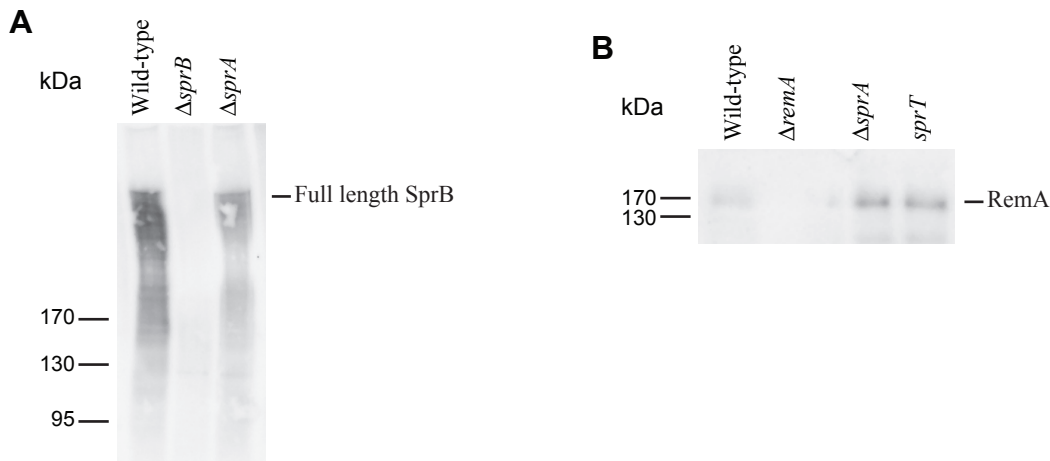


Figure S1. Immunodetection of SprB and RemA in cells of wild-type and mutant *F. johnsoniae* strains. (A) Cell extracts (15 μ g of protein) of wild type (CJ1827), $\Delta sprB$ (CJ1922), and $\Delta sprA$ (CJ2302), were examined by Western blotting using antiserum against SprB. (B) Cell extracts (15 μ g of protein) of wild type (CJ2083), $\Delta remA$ (CJ1984), $\Delta sprA$ (CJ2317), and *sprT* disruption mutant (CJ2327), were examined by Western blotting using antiserum against RemA. All strains in panel B except $\Delta remA$ (CJ1984) were derived from CJ2083 and thus expressed the myc-tagged version of RemA.

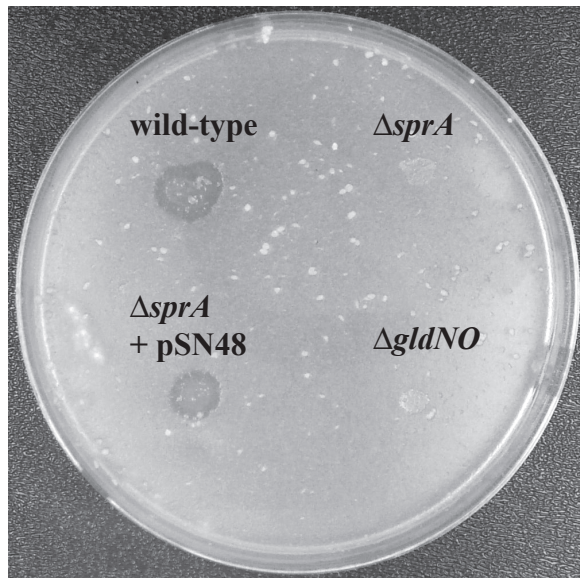


Figure S2. Effect of deletion of *sprA* on ability to utilize chitin. Approximately 4×10^7 cells of wild-type *F. johnsoniae* CJ1827, $\Delta sprA$ mutant CJ2302, CJ2302 complemented with pSN48 which carries *sprA*, and $\Delta gldNO$ mutant CJ2090, were spotted on MYA-chitin medium and incubated for 2 d at 25°C.

GldK

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Table of amino acid sequences for GldK from F. johnsoniae to P. melaninogenica, columns 10-60.

Table of amino acid sequences for GldK from F. johnsoniae to P. melaninogenica, columns 70-120.

Table of amino acid sequences for GldK from F. johnsoniae to P. melaninogenica, columns 130-180.

190 200 210 220 230 240

F. johnsoniae GldK T A Y D K Y M - Y D N Y Y S V G T K D D P Y A G R R K L N K K V - - - K L I R D T K A Y P D E Y Y A E V M - D S M Y L P
F. psychrophilum GldK S V Y D K Y M - Y D N Y Y S V G S G D D P Y A G R R K L N H K V - - - D L K W K T G Q Y P D A H Y A E V M - D S M Y I P
C. canimorsus GldK S V Y D K Y M - Y D N Y Y S V D G - - - E K A R R K L N P K A - - - Q I I W D K N K Y P D E N Y A E V M - D K M Y I P
C. ochracea GldK N A Y Q Q Y L - Q N T Y G D - - - Q K A R R K L N K K V - - - A L I W D T N K F P D E Y Y S E V M - D K M Y L P
C. algicola GldK S A Y D K Y M - L D N Y S G M G A T G - - - Y E G R A L N K D E - - - D L V W E T S E F P D E Y Y V E V M - D K L Y I S
C. lytica GldK S E Y D K Y M - M D N Y G G G P L G - - - Y E G R A L N K D E - - - K L I W D T S E F P D E Y Y V E V M - D K L Y I P
Maribacter sp. GldK S V Y D K Y M - L D N Y S G M G E T G - - - Y E G R A L N K K D I - - - D L I W D V S E Y P D E Y Y T E V M V D S L Y I P
R. biformata GldK S V Y D K Y M - L D N Y A G F G E D Y - - - Y E G R A L N K D E - - - D L I W D T R D Y P D E Y Y A E V M - D S M Y L P
C. atlanticus GldK T P Y E Q Y M - L D N Y A G L G E T G - - - Y E G R A L N R E I - - - D L I W E T E E Y P D E Y Y V E V M - D T M Y L P
G. forsetii GldK T P Y E E Y M - L N S Y G Q G P T D D - - - Y A N R K L N K D I - - - D I V W D T N D Y P D V Y A E V M - D S M Y I P
Z. profunda GldK T P Y Q E Y M - L E T Y G T G S E M D A - - - Y A N R K L N K D V - - - D I I W D T E D Y P D V A Y A R V M - D Q L Y I P
W. virosa GldK T P Y D E Y L Q M N S T G R E G S A T T N A D A R K L N W D I - - - P L V W E K Y E Y P D V D Y A E V M - E G L Y Y P
R. anatepistifer GldK T P Y Q E Y L - - - - D S K G G R D G Y D E S K R L D W G V - - - P L K W N T S D Y P D V Q Y A E V T - E S M Y L P
C. hutchinsonii GldK
L. byssofilia GldK
S. linguale GldK
D. fermentans GldK
M. tractuosa GldK
P. heparinus GldK A A L - - - - - G A N R N I D W R K I G N G S A L W S K K N N G L G N K L - - - T D M Y Y S
P. saltans GldK A T F - - - - - I D W K K V Q S G K G I W G D K - - - A L V E E L N - - - K N M Y Y Q
C. pinensis GldK
P. propionigenes GldK - - - - - P E T A R L N W K T - - - Y I D W K K K I N Y R D K S T M D Q L E S M T Y A
P. gingivalis PorK T P H - - - - - L D W S K - - - P I P S E K R A T E E E I A A I - - - N S V Y Y T
P. distasonis GldK T P H - - - - - L D W N R - - - P I P W - R R A N E D E Q R A I - - - E S V Y Y T
P. ruminicola GldK S T V - - - - - L N W K K - - - P L P R R - - - P S E D E Q E I I - - - D A M Y V T
P. melaninogenica GldK T P H - - - - - L D W S K - - - R L P R K - - - P N E D E Q R A F - - - E S L Y V T

250 260 270 280 290 300

F. johnsoniae GldK I E E S Y N G L R T I D V N K L K F R Y S W M D I Q A A A K A K V - - - - - - - - - - - - - - - - - -
F. psychrophilum GldK S E E A Y N G L R T I D V D K L K F R Y S W M D I Q A A A K A K K - - - - - - - - - - - - - - - - - -
C. canimorsus GldK M D E A Y N G K R P L D V E Q L V F R Y Q Y M D M E K A A R K R - - - - - - - - - - - - - - - - - -
C. ochracea GldK E E E A Y N G K R I M D V Q K F E F K Y Q W L D M D K A A R T R - - - - - - - - - - - - - - - - - -
C. algicola GldK E E E S Y N G Q R T I D V T Q L K Y K Y S W M D I E A A A R A K G K - - - - - - - - - - - - - - - - - -
C. lytica GldK E E E A Y N G Q R T I D V T Q L I Y K Y S W M D I D A A A R S K T - - - - - - - - - - - - - - - - - -
Maribacter sp. GldK E E E S Y N G Q R T F D V T K L K Y K Y S W M D I E A A A R S R T - - - - - - - - - - - - - - - - - -
R. biformata GldK E E E T Y N G Q R T I D V T K L N Y K Y T W M D I E A A A R A K E - - - - - - - - - - - - - - - - - -
C. atlanticus GldK Q E E S Y N G Q R T M D V S K F E F Q Y T W M D I Q A A A R A K K - - - - - - - - - - - - - - - - - -
G. forsetii GldK M D E V Y N G Q R T I D V K K L K F R Y S Y M D I Q S A A K T Q - - - - - - - - - - - - - - - - - -
Z. profunda GldK Q E D A Y N G T R T I D V K N L K F K Y S W M D V E A A V K G K - - - - - - - - - - - - - - - - - -
W. virosa GldK P E E R F N G E R L I D T R K L N Y S Y V W V D Q E A A A K K Q G - - - - - - - - - - - - - - - - - -
R. anatepistifer GldK P A E R I N G E R I I D T R K L K Y A Y K W E D I E S A V K D G - - - - - - - - - - - - - - - - - -
C. hutchinsonii GldK
L. byssofilia GldK
S. linguale GldK E I M S K Y
D. fermentans GldK E I M A K Y
M. tractuosa GldK
P. heparinus GldK G A D A L P G R D E I D I R K L R Y A Y S Y V S S D L A V E G R K D - - - - - - - - - - - - - - - - - -
P. saltans GldK D N E R F F G K K E L N V R K L K Y D Y E W J D Y R R K A A D M R G A R D P N R N K N G L G V T - - - - - - - - - - - - - - - - - -
C. pinensis GldK P E D R L Y G R K E F D V R K L V Y H A E T F N W E Q A K K R E N A N - - - - - - - - - - - - - - - - - -
P. propionigenes GldK N E N G L H G K R Q I D P G K L Q Y K Y E W I N Y D Q A L P R N K Y N V N T G A Y P A N A K A R V D T S Y V - - - - - - - - - - - - - - - - - -
P. gingivalis PorK - - - N P V T H D R K L N P D Q M V Y R S Y D Y R S A A L R E H Q L K A A K R N L N T D I K V D P N A V V M I S K D T
P. distasonis GldK - - - N P V T G E K G L D P K Q M I Y K Y E W Y D Y T A A A L R K N Q L N P A D R V R N T D I Q V D P N E V V M I S K D T
P. ruminicola GldK - - - N P V T G D K M L D F R Q L N Y R Y E V Y D Y T A A A L R R N R L N P Q E R N L N T D L T V D P D E Q V W I S K D T
P. melaninogenica GldK - - - N P V T G E K S I D G R Q L N Y R Y E I Y D Y T S A A L R R N R L N P Q E R N L N T D I T V D P N E M V M I S K D T

310 320 330 340 350 360

F. johnsoniae GldK - - - - - G K R R K D F V K T E Q - - - - - V N V Y P D T T V W I K D F A Y S Y
F. psychrophilum GldK - - - - - G K R R K E F I R R K E E - - - - - V K I Y P D T T V W I K D F A Y S Y
C. canimorsus GldK - - - - - G A R R K D Y I R R E E L - - - - - V K I Y P D T T V W I R D F E Y S Y
C. ochracea GldK - - - - - G N R R K D F I K E E I - - - - - V K Y Y P D T T V W I R D F N Y S Y
C. algicola GldK - - - - - G S R R K D F I K Q E E - - - - - L E I Y P D T T V W I R D F E Y S Y
C. lytica GldK - - - - - G S R R K D F I K Q T E - - - - - L P I Y P D T T V W I K D F E Y S Y
Maribacter sp. GldK - - - - - G S R R K D F I I Q E E - - - - - L E I Y P D T T V W I R D F E Y S Y
R. biformata GldK - - - - - G R R K D F I R Q E I - - - - - T A I Y P D T T V W I R D F E Y S Y
C. atlanticus GldK - - - - - G K R S D F I K R E N - - - - - V K I Y P D T T V W I K D F S Y S Y
G. forsetii GldK - - - - - G K R S N F I K T E - - - - - V S I Y P D T T V W I K D F N Y S Y
Z. profunda GldK - - - - - G E R R N Y M K T E V - - - - - V E V Y P D T T V W I K D F N Y S Y
W. virosa GldK - - - - - A Y R I D F R R E E V - - - - - V N V Y P D T T V W I R D F N Y S Y
R. anatepistifer GldK - - - - - K R S S D Y L K K E S - - - - - L A V Y P D T T V W I K D F N Y A Y
C. hutchinsonii GldK - - - - - Y I M T E - - - - - L Y P D T T V W V R D F S H H M
L. byssofilia GldK - - - - - F I M T - - - - - N L Y P D T T V W R K D F T Y H N
S. linguale GldK -
D. fermentans GldK -
M. tractuosa GldK - - - - - Y I M K E L - - - - - Y P D T T V W M K D F T N H M
P. heparinus GldK - - - - - P S K R R Q D F I I T Y T D N P D P S N P N H P S V P V Y P D T L V W K V D Y S S Q
P. saltans GldK - - - - - R D Q F I V K E - - - - - V Y Y P D T L V W T S D F T Y A Q
C. pinensis GldK - - - - - V S R A K F I V K D - - - - - V A J Y P D T L C W N D F P N A R
P. propionigenes GldK - - - - - E N G I I V N K T I E R K L T T R R D L I S T R I - - - - - V N V Y P D T I M W L R D F Q F S Y
P. gingivalis PorK A F V D E S G N I I S E T I T R P L S S E Y D F L N T Y I - - - - - V P I Y P D E T C W V N D F P N A R
P. distasonis GldK A Y I D D E G R V I N E T I T R P L S S E W D F L N T R I - - - - - V N I Y P D E N C W V N D F K N A R
P. ruminicola GldK A Y V D D E G R I V R E S I N R P L S G P W D F L N T Y I - - - - - V N V F P D T T C W V N D F P N A D
P. melaninogenica GldK A Y V D E N G V I H S E T I N R P L T G P W D F L N T Y I - - - - - V N I Y P D T T C W V N D F R N S D

370 380 390 400 410 420
F. johnsoniae GldK
F. psychrophilum GldK
C. canimorsus GldK
C. ochracea GldK
C. algicola GldK
C. lytica GldK
Maribacter sp. GldK
R. biformata GldK
C. atlanticus GldK
G. forsetii GldK
Z. profunda GldK
W. virosa GldK
R. anatipestifer GldK
R. hutchinsonii GldK
L. byssophila GldK
S. linguale GldK
D. fermentans GldK
M. tractuosa GldK
P. heparinus GldK
P. salmans GldK
C. pinensis GldK
P. propionicigenes GldK
P. gingivalis PorK
P. distasonis GldK
P. ruminicola GldK
P. melaninogenica GldK

430 440 450 460 470 480
F. johnsoniae GldK
F. psychrophilum GldK
C. canimorsus GldK
C. ochracea GldK
C. algicola GldK
C. lytica GldK
Maribacter sp. GldK
R. biformata GldK
C. atlanticus GldK
G. forsetii GldK
Z. profunda GldK
W. virosa GldK
R. anatipestifer GldK
C. hutchinsonii GldK
L. byssophila GldK
S. linguale GldK
D. fermentans GldK
M. tractuosa GldK
P. heparinus GldK
P. salmans GldK
C. pinensis GldK
P. propionicigenes GldK
P. gingivalis PorK
P. distasonis GldK
P. ruminicola GldK
P. melaninogenica GldK

490 500 510 520 530 540
F. johnsoniae GldK
F. psychrophilum GldK
C. canimorsus GldK
C. ochracea GldK
C. algicola GldK
C. lytica GldK
Maribacter sp. GldK
R. biformata GldK
C. atlanticus GldK
G. forsetii GldK
Z. profunda GldK
W. virosa GldK
R. anatipestifer GldK
C. hutchinsonii GldK
L. byssophila GldK
D. fermentans GldK
M. tractuosa GldK
P. heparinus GldK
P. salmans GldK
C. pinensis GldK
P. propionicigenes GldK
P. gingivalis PorK
P. distasonis GldK
P. ruminicola GldK
P. melaninogenica GldK

GIdL Transmembrane 1

Transmembrane 2

Sequence alignment for Transmembrane 1 region (residues 10-60). Species include F. johnsoniae, F. psychrophilum, C. canimorsus, C. ochracea, C. algicola, C. lytica, Maribacter sp., R. biformata, C. atlanticus, G. forsetii, Z. profunda, W. virosa, R. anatipestifer, C. hutchinsonii, L. byssophila, S. linguale, D. fermentans, M. tractuosa, P. heparinus, P. saltans, C. pinensis, P. propionigenes, P. gingivalis, P. distasonis, P. ruminicola, and P. melaninogenica. Conserved motifs like 'GALFKI' and 'DFGG' are highlighted.

Sequence alignment for Transmembrane 2 region (residues 70-120). Residue 70 is marked with a star.

Sequence alignment for Transmembrane 2 region (residues 70-120). Species are the same as in the first table. Conserved motifs like 'VYPEL' and 'VYDFD' are highlighted.

Sequence alignment for Transmembrane 3 region (residues 130-180). Species are the same as in the first table. Conserved motifs like 'LDMK' and 'LDMK' are highlighted.

190 200 210 220 230 240

F. johnsoniae GldL N F E G A A K A I S P T V D S I A G Q K K Y A E E M S M A A A - - - - -

F. psychrophilum GldL N F E G A A K A I S P T V D S M A G Q K K Y A E E M T M A A A - - - - -

C. canimorsus GldL N F A G A A K E I A P V T D A M V S T H K Y Y G E E L S M A A A - - - - -

C. ochracea GldL N F A E A S K E I A P V A N T M V A T H K Y Y G E E L S A A A S - - - - -

C. algicola GldL N F E G A A K G I A P T V D A M E S T R K Y Y S D E M V Q A A S - - - - -

C. lytica GldL N F E G A A K G I A P T V D A M E S T R K Y Y S E E M V Q A A T - - - - -

Maribacter sp. GldL N F E G A A K G I A P T V D A M E S T Q K Y Y S E E M V H A A A - - - - -

R. biformata GldL N F E G A A K G I A P T A D A I E H T K K Y Y S E E L S Q A A S - - - - -

C. atlanticus GldL N F E G A A K N M S P P T V D A I S S Q K K Y Y S E E L T L A A A - - - - -

G. forsetii GldL N F E G A A K G I A P T V D S M A S Q K K Y Y S E E L S V A A A - - - - -

Z. profunda GldL N F E G A A K G I A P T V D A M A S Q K K Y Y S Q E L T T A A T - - - - -

W. virosa GldL K F G S A V S E L N T T S A V A S T E K Y Y G A E M L K A S E - - - - -

R. anatipestifer GldL K F S A S V D Q I N Q T V D V S S S T Q K Y Y N D Q L T L A A N - - - - -

C. hutchinsonii GldL S L S E N V S K M S D L S D A T V A S S E Y T S A I K G A T G S L N K M N D A Y S K T A E A M S G M A S - - - - -

L. byssophila GldL N L N Q S V S L N G E I T S T G V V T A E F N G K V K E A A A K I G E M N S S L G N A V G A M V S L G D - - - - -

S. linguale GldL N L N D T V S K L T D L T D A T V A A T N D Y A R N V K S A A S S I S E M N K S Y G T A I T A M N S M A D - - - - -

D. fermentans GldL N L S E T V G K I T D L T D A T V A A T N D Y A R N V K T A S T A I S D M N K S Y G V A I N A M T S M A D - - - - -

M. tractuosa GldL S M A D S A A Q M S N S L S N A A V A T N D Y A N N V K K Q A S K S L M E M N K S Y D T T A E A M K Q M A S - - - - -

P. heparinus GldL T L G D K V A K I S N V A D A S S A T N E F T G K L K T A S A S F D T L N G A F E K A T S Q L V E M G N - - - - -

P. saltans GldL N F S S K I A A I S N A A D A S V A A T A D F A N K I S S A S S K V E G L G Q A A E K A A S A G V L E V A Q - - - - -

C. pinensis GldL K L G S T V D K M R D I S D V V A A T E G D Y T Q K T R E A A T A I G S V A H A Y T T A A S A V S S F N S - - - - -

P. propionigenes GldL N L T A T A Q Q F S S L S S V I G A T E Q F V K N T D E A S A T T G K F I K S Q E S L N G A T G T L A T S Y Q G T S A - - - - -

P. gingivalis PorL K L A D S A G E Q L A R I G R T A A M T E S Y E Q M Q A D Q E G L - - - - -

P. distasonis GldL K L S G A A E Q I S K M A E L T E A T Q K Y L E Q L S G M S E N M E R F S Q V T H S L T N V S D T L L N S Y K S I T D - - - - -

P. ruminicola GldL S A V A V Q P T S V S A H P E L D A A T S T Y V E E L K H L T E T L S K V S A - - - - -

P. melaninogenica GldL D - - - - - A Q Q Q T P E M V E A Q T N Y V A A L Q N L T E M L G K V N D - - - - -

250 260 270 280 290 300

F. johnsoniae GldL - - - - - Q M E S L N S L Y K V Q L E S A S R N A Q A N S E I A E N - - - - -

F. psychrophilum GldL - - - - - H L E S S L N S L Y K V Q L E S A T R N A Q A N S E I A E N - - - - -

C. canimorsus GldL - - - - - H L E S S L N S L Y K V Q L E R T E N Q V S A Q A G V V D N - - - - -

C. ochracea GldL - - - - - N L E S L N S L Y K V Q L E R T E R Q V S A Q A G V V D N - - - - -

C. algicola GldL - - - - - Q M E S L N S L Y K V Q L E S A S K Q A S I N E E V V Q N - - - - -

C. lytica GldL - - - - - Q M E S L N S L Y K V Q L E S A S R Q A S I N E E V V Q N - - - - -

Maribacter sp. GldL - - - - - Q M E S L N S L Y K V Q L E S A S K Q A T V N E E V V Q N - - - - -

R. biformata GldL - - - - - Q M E S L N S L Y K V Q L E S A S R Q A S I N E E V V Q N - - - - -

C. atlanticus GldL - - - - - Q M E T L N N L Y K V Q V E S A A K Q S E A N T A A A E N - - - - -

G. forsetii GldL - - - - - Q M E T L N N I Y K V Q V E S A A K Q A E V N Q E V A D N - - - - -

Z. profunda GldL - - - - - Q M E T L N S I Y K V Q V E S A S R Q A E I N K A V A E N - - - - -

W. virosa GldL - - - - - N I S S L N T L Y A Q Q I E N S R R K Q V E L N K Q F I E E M Q K S S G S - - - - -

R. anatipestifer GldL - - - - - H L E S M N A L Y A L Q L E H G K A Q S E Y H Q K Y V S D L Q K S V A Q - - - - -

C. hutchinsonii GldL - - - A T V D A Q G Y H E Q V Q K I T K N L G A L N A V Y E M F L S D A N H L R A M N K F Y A N L S S A M E N M A D - - - - -

L. byssophila GldL - - - A T R D A Q E Y R N Q F H K I S Q N M G A L N A V Y E I E L E Q D T N R H L K S M N A F Y G N L S N V L N D M S D - - - - -

S. linguale GldL - - - A T T D A K D Y R D Q F Q K V T K N M G A L N A V Y E L E L Q D T N K H L K A M N A F Y G S L T A A M E N M S D - - - - -

D. fermentans GldL - - - A T K D A Q S Y R D Q F Q Q I T K N M G A L N A V Y E L E L Q D T T K H L K A M N A F Y G N L T A A M E N M A D - - - - -

M. tractuosa GldL - - - A T T D S K E Y H S Q V Q A V T K N L T A L N Q V Y E M E L Q D S S Q N H V K A M N K F Y K N L S T A L D S M T E - - - - -

P. heparinus GldL - - - S N T A S T A Y H D Q V N A L A K N L S A L N A V Y E L E L Q D S S A H L K S M N K F Y Q N L S L T M N N F N E - - - - -

P. saltans GldL - - - A S Q A S K E Y Y T Q V T N L G K N I S A L N A V Y E L E L Q D S N A H L K A M N K F Y Q N L S E T M Q N F N E - - - - -

C. pinensis GldL - - - A S E S T R S F H E Q M Q G M T K N L A S L N A V Y E L E L Q D T N N H L K A M N N F Y S N L L N V S Q A M T S - - - - -

P. propionigenes GldL S M D A V E K N T K L Y A G K V E D I N K N L A S I N S I Y E I Q L K N I Q A Q S E G L T Q Q T E R I R L V N E D L N V - - - - -

P. gingivalis PorL - - - R L N S Q S Y I Q Q M E S L S R N I S G L N T I Y E I Q L K G I S S Q I T E T I D R T N R G L A H I R D M Y D N - - - - -

P. distasonis GldL N S D G I S Q N S R G Y V H Q M E Q L N R N I S G L N T I Y E I Q L K S I S S Q I E S I E H I N S G L N R I R E M Y D G - - - - -

P. ruminicola GldL - - - Q N E K L A H D S E E M E N L N R T L T G I C K V Y E M Q L K S A S A Q I G T I D D I - - - - -

P. melaninogenica GldL - - - Q S Q R L T R D S E E M E N L N R T L T G I A K V Y E M Q L K S A S Q Q I G T I D Q I - - - - -

310 320 330 340 350 360

F. johnsoniae GldL - - - - - A A K L K E Q M A S M T A N I A S L N S V Y G G M L S A M S N K G - - - - -

F. psychrophilum GldL - - - - - A S K L K E Q M Q S M T S N I A S L N N V Y G G M L S A M S N K G - - - - -

C. canimorsus GldL - - - - - L N S L N E Q M M S F K D N L K S L N S V Y G G M L S A M S N K G - - - - -

C. ochracea GldL - - - - - L D S L N Q Q M L T F K D N L R S L N T J Y G G M L S A M G G A R - - - - -

C. algicola GldL - - - - - S T A L K D Q M A S L S T N L S S L N G V Y G G M L S A M T R N - - - - -

C. lytica GldL - - - - - S S A L K D Q M E S L A T N L S S L N G V Y G G M L S A M S K N - - - - -

Maribacter sp. GldL - - - - - A S A L K D Q M E S L A T N L S S L N G V Y G G M L T A M N K S - - - - -

R. biformata GldL - - - - - A G A L K E M E S L A S N L S S L N G V Y G G M L T A M N R N - - - - -

C. atlanticus GldL - - - - - A V A L K A Q M E S L T Q N L S S L N G V Y G N M L N A M G N R R A - - - - -

G. forsetii GldL - - - - - A G K L K T Q M D S L A N M A S L N N V Y G G M L T A M N G K P R V - - - - -

Z. profunda GldL - - - - - A G K L K A E M D S L T Q N L A S L N G V Y G G M L T A M H G Q R R A - - - - -

W. virosa GldL - - - - - S E Q F L K E M Q S L S E N I N A L N K V Y G G M L N A M R V N Q - - - - -

R. anatipestifer GldL - - - - - S E K F N Q E L D G L T A N L N L N R V Y G G M L N A M R K G - - - - -

C. hutchinsonii GldL A S R D - - - - - T Q S F K E E L G K L S K N L T S L N G V Y G N M L T A M R G - - - - -

L. byssophila GldL V S K D - - - - - S Q Q F K A E L K L T T N L A S L N N V Y G S M L S A M S K G S A S V - - - - -

S. linguale GldL A S R D - - - - - T Q Q F K A E L A K L T G N L A S L N N V Y G S M L T A M R G N G K - - - - -

D. fermentans GldL A T K E - - - - - S Q V F K S E M S R L T N N I S S L N G J Y G N M L T A M R G G N A - - - - -

M. tractuosa GldL A S K D - - - - - T Q F Q T E V K N L T T N L S Q L N K V Y G N M L S A M K G - - - - -

P. heparinus GldL S M E D - - - - - S K Q F K E E V G K L A K N L S S L N A J Y G N M L S A M N Q P R V - - - - -

P. saltans GldL S L D D - - - - - S K Q F K E E V G K L S K N L A S L N A V Y G N M L S A M N Q P R A - - - - -

C. pinensis GldL S V D D - - - - - A R K T Q Q Q S K L A H N L T S L N T V Y G N M L S A M Q S A R - - - - -

P. propionigenes GldL V V R D V Q K M K T A T T V A A E E T E N F K T G T S K L A K Q V A D L N Q V Y G N M L N A L S N - - - - -

P. gingivalis PorL S V I D - - - - - S S S F R N E N E R M A R Q L T Q L N E V Y A R L L Q A L T T N V G L - - - - -

P. distasonis GldL S V V D - - - - - S S V F R N E T E K M A R Q L A E L N Q V Y S R L L Q A M T V N M G Y Q Q P A Q P Q - - - - -

P. ruminicola GldL - - - - - N E Q T K K M A A Q I A E L N K J Y S R M I E A M T A K M N A - - - - -

P. melaninogenica GldL - - - - - N D Q T R K M A Q Q I E Q L N S I Y A R M I E A M T V N M R V - - - - -

GldM Transmembrane

		10			20				30				40				50				60
<i>F. johnsoniae</i> GldM	--	M A G G K L T P	--	R Q K M I N L M Y L V F I	A M L A M N M V S K	E V I S A F G L M N E K F	E A A N T S S V T T N E														
<i>F. psychrophilum</i> GldM	--	M A G G K L T P	--	R Q K M I N L M Y L V F I	A M L A M N M V S K	E V L S A F G L M N E K F	E G A N T S S D A M N A														
<i>C. canimorsus</i> GldM	--	M A G G K L T P	--	R Q K M I N L M Y L V F I	S M L A L N M G K Q V L D A F G L M N E K F	E A S N K R A N E G T I S															
<i>C. ochracea</i> GldM	--	M A G G K L T P	--	R Q K M I N L M Y L V F I	A M I A L N M G K Q V L D A F G L M N E K F	E A S N K R A N E G T I S															
<i>C. algicola</i> GldM	--	M A G G K Q S P	--	R Q K M I N L M Y L V F I	C M L A L N M G K E V L A A F G L M N E K M	E V S N Q K T S D N N L															
<i>C. lytica</i> GldM	--	M A G G K Q S P	--	R Q R M I N L M Y L V F I	C M L A L N M G K E V L A A F G L M N E K M	E A S N Q K T T E N N V															
<i>Maribacter</i> sp. GldM	--	M A G G K Q T P	--	R Q K M I N L M Y L I F I	A M L A L N M S K E V L A A F G I M N E K L	E A S N I K T S E S N D															
<i>R. biformata</i> GldM	--	M A S G K Q T P	--	R Q K M I N L M Y L I F I	A M L A L N M S K E V L A A F G L M N E K L	E T S N S K A T E N N E															
<i>C. atlanticus</i> GldM	--	M A S G K Q S P	--	R Q K M I N L M Y L V F I	A M L A L N M S K E V L T A F G L M N E K L	E A S N A D T T Q R N Q															
<i>G. forsetii</i> GldM	--	M A S G K Q S P	--	R Q K M I N L M Y L V F I	A M L A L N M S K E V L T A F G L M N E K L	E A S N A D T T Q R N Q															
<i>Z. profunda</i> GldM	--	M A S G K Q S P	--	R Q K M I N L M Y L V F I	A M M A L N M S K E V L V A F G S M N E K L	E A S N A T T E Q R N V															
<i>W. virosa</i> GldM	--	M A G K R L T G	--	R Q K M I N L M Y L V F I	A M M A M N V D R E V L R S F E S I N I	T L E E S A K L T A D N N A															
<i>R. anatipestifer</i> GldM	--	M A K E K L S P	--	R Q K M I N L M Y L V F I	A M L A M Q I D Q E I T R S Y N D T R D T	S Q T T L T Q S K N K															
<i>C. hutchinsonii</i> GldM	--	M A S G K L S P	--	R Q K M I G M M Y L V L T A	L L A L Q V T S A I M E K F I F L D E S L	M Y A V G A A D K G N A															
<i>L. byssophila</i> GldM	--	M A G V K E S P	--	R Q K M I N M M Y L V L T A	L A L Q V T S A I L E K F M L L D S S L	D Q A N K A A D L S N K															
<i>S. linguale</i> GldM	--	M A G T K E T P	--	R Q K M I G M M Y L V L T A	L L A L Q V T S A I L E K F V L I N N S	L E Q S I G A V S K V N Q															
<i>D. fermentans</i> GldM	--	M A S G K E T P	--	R Q K M I G M M Y L V L T A	L L A L Q V T S A I I E K F I L I N N S	L E L S I G A A N K I N Q															
<i>M. tractuosa</i> GldM	--	M A G G K E T P	--	R Q K M I G M M Y L V L T A	L L A L N V S V T V L D K F I D I N N S	L E V S V D A A K E Q N G															
<i>P. heparinus</i> GldM	--	M A G G K E T T	--	R Q K M I J M M Y L V L T A	L A L L N V S V T J L N A F K N I N N	S L T S K T N V T N I D															
<i>P. saltans</i> GldM	--	M A G G K E T P	--	R Q K M I G I M M Y L V L M	A M L A L N V S D T I L N A F S T L N N S	L V T S T E Y V S Q S L D															
<i>C. pinensis</i> GldM	--	M A L P K D - P	--	R Q K M I N I M M Y L V L T A	M L A L N V S A I L N A F N I V N N S	I N T N K S I T D K N N															
<i>P. propionigenes</i> GldM	--	M A G K L N C P E T	P R Q K M I G M M Y L V L T A	L L A L N V S E I L N G F T M V D N S	L H K T I E S S D A R N N K																
<i>P. gingivalis</i> PorM	--	M A V G S N G N A N -	P R Q K M I N L M Y L V F I	A M M A L N V S S E V L D G F D K V D K S	L R T S I D G S D K R N N																
<i>P. distasonis</i> GldM	--	M A G I S N N S P N S	P R Q R M I N L M Y L V F I	A M M A L N V S S E V L D G F E I V E G S	L R T S I D N S S R R N K																
<i>P. ruminicola</i> GldM	M A I K K R P V S P	-	R Q R M I N L M Y V V L M	A M L A L N V S N E V L N G F S I V E E S	L N R T T G N S A K E N L																
<i>P. melaninogenica</i> GldM	M A I K K R K I S P	-	R Q K M I N L M Y V V L M	A M L A L N I S T E V L N G F S V V E E S	L N R T T G N S S K E N D																

		70			80				90				100				110			120
<i>F. johnsoniae</i> GldM	S L L T S L D -	Q K A A E A K G E	--	F A K A A E T A H K V Q	A S K E F Y D Y I G T L K	Q T Q A V -	- K G F E V D K E T													
<i>F. psychrophilum</i> GldM	Q M L T S L D -	S K A A E A K G E	--	F L V A S Q T A H K V Q	E I T K K F Y D Y I A T L K	G T V L -	- E G V E K D K E T													
<i>C. canimorsus</i> GldM	N A I Q A L E -	Q N A A E N P D Q	--	F A E A F Q K S R K V K E	L S D S F Y N Y I E G I	K G V M -	- N Q V G E - - -													
<i>C. ochracea</i> GldM	N A L A E L A -	N K A A E N Q A Q	--	Y G E I J Y E Q S K Q I K	E L S D G L Y S Y I Q D	I K T K V E -	- D V I G Q K D I													
<i>C. algicola</i> GldM	A F L D G L E -	T K A S E D A A K	--	Y A E D Y K K A Q S V Q	K L S Q E Y Y D Y L E A	L K K G M T -	- V G V E - - - -													
<i>C. lytica</i> GldM	A F L E G L G -	T K A S E N A A K	--	Y A E D Y K K A Q S V Q	A I S Q E Y Y D Y L E G	L K K E M T -	- K N V E - - - -													
<i>Maribacter</i> sp. GldM	A F L G S L E -	T K A S E D A A K	--	Y G E L Y Q N G Q K I K	S M S Q E Y F D Y L E G	I K T G M T -	- E G L E - - - -													
<i>R. biformata</i> GldM	A F L A S L E -	T K A S E D A A K	--	Y A E Y Q D A Q Q I K	Q L S Q E Y Y T Y L E D	L K A S M V -	- E D I E - - - -													
<i>C. atlanticus</i> GldM	L A M A G L A -	E K A S E Q P A K	--	Y A P L K E A Q D Q I N	A L T E E L V G Y I D G	V K A S M V -	- A E M D - - - -													
<i>G. forsetii</i> GldM	A L M A G L A -	T K V E E Q P A K	--	Y T S I K A D A D K I H	E L S N F T N Y V E G V	N D E L K -	- T V S D - - - -													
<i>Z. profunda</i> GldM	A A M Q G L K -	S K A N E Q A A K	--	Y A E L A Q K A E T I N	Q L S Q E Y Y T Y L E D	T Y I Q G V	N D L T - S S L D - - - -													
<i>W. virosa</i> GldM	T F Y Q Q I K -	K K A E E D P A	--	Y Q V T D E K A G L V	K A K T N E F V N F I	D S L K K E	L I G T D Y I A G A -													
<i>R. anatipestifer</i> GldM	I F E T L R -	Q K A E N S P E S	--	F S Q P Y E Q Y K L K	D K I D A L V K F I E	V S K E M Q -	- K F A G Q D M T S													
<i>C. hutchinsonii</i> GldM	E T V A K I D -	K A V A D G G G K	--	D K A V S D K A I Q	V R T K T A E M I K T	M N D L R E	E M T - M K S G R R E -													
<i>L. byssophila</i> GldM	R T L D S M N -	D A V D K S G N R	P E Y R A L Y N N A	V D V R K K T S E L	I S Y M D G L K E	D I L R -	- N E A G G G I D P													
<i>S. linguale</i> GldM	S T F D N I R -	G T V E K S G N R	A A D L A I V K Q A D	E V R K L S A E V S	G E L D K K E Q I V -	- E S S G R R D -														
<i>D. fermentans</i> GldM	E T V L K I K -	A A V E K S G N R	A A D V A V I K E A	E Q V R K V T S D	I N N Q L N A L K	Q E I I -	- T R A G G G F N -													
<i>M. tractuosa</i> GldM	N T L R R I E -	N A V E K S G S R	P D V Q K I L D K A	K E I R E K T S A M	I A E L K T Y K	D T F I -	- E I T G G Y - N -													
<i>P. heparinus</i> GldM	Q L F S S F Q N	T K L K D E P A R	--	A V Q I W E K A K A Y A	D E L N S Y V Q Q L K	D K F V -	- T A G E G I - N E													
<i>P. saltans</i> GldM	Q A V N A F E Q	T K M K E N P E R	--	A K P I L D K I N Q A K	T V A G E L F A Y V	D N L K K T	L E - T E G G G R - N P													
<i>C. pinensis</i> GldM	D T Y A A F E	Q K M S E D A A K	--	T G P F K K A E V V R	T A S A E M Y T F L	D S L K E R R I	V - R E S G G L D -													
<i>P. propionigenes</i> GldM	S T Y A D F E	A L N A D N P Q K	--	V K E W L D K K A K V	Q K S D E E I Y K Y I E	D F K K I I -	- K L A D S D E A													
<i>P. gingivalis</i> PorM	L V L S E L N -	T A Y R T N P E K	--	V K V W Y E R S L V	Q K E A D S L C T F I	D D L R A I A	- R E S D G K - D A													
<i>P. distasonis</i> GldM	I V A D E M E -	A Y Y Q E N P Q K	--	V G W E A L K A R V E	K R A D S L Y T Y I	Q D L K I A	- K V A D G E - N A													
<i>P. ruminicola</i> GldM	A I Y K T F E -	Q Q L K A N P Q K	--	T R E W Y G K A Q Q	V R Q M S D S L Y N F	A A S L K Q A	I V - V E A D G K - D G													
<i>P. melaninogenica</i> GldM	A I F G E L D -	Q M M R K N P Q K	--	V K Q W F M M A S T	V R E M S D S L Y N Y A	Q A L K V A I V	- R E A D G E - K G													

		130			140				150				160				170			180
<i>F. johnsoniae</i> GldM	--	G - - - K M P Y E A M D R G D	N I D D - W F T -	G D G Y T K -	- K G N E I I A K I I E K Y K	S D I K A A L G T -	D K													
<i>F. psychrophilum</i> GldM	--	G - - - K L P Y E A M D K S D	Y I D N A W F V -	G D G Y S P -	- K G K E I V A T I E N K Y K	A D M K A A C P G D K -	-													
<i>C. canimorsus</i> GldM	--	D - - - K L P Y E A M D K S D	Y L D Q K F F V -	G D N Y K P -	- E G E E F V R Q I I E N K Y K	T D L V E L L G G K E G	-													
<i>C. ochracea</i> GldM	P V N - - -	Q R N Y Q A M D Q S D	F T D N Y F F A E	G A Q A K A -	- H A S E F I E K M K T Y R E	G V L K V L G D N P -	-													
<i>C. algicola</i> GldM	--	D - - - P K D Y Q V M D K S	D F L D Q K F F A -	G D N L A E -	- G K E F M K R I I E Y R	T K V S S V L V P A -	-													
<i>C. lytica</i> GldM	--	D - - - P T D Y Q V M D K S	D Y L D Q K F F S -	G E N L A P -	- G G K E F M K R I I E Y R	E Q V S S L V P D -	-													
<i>Maribacter</i> sp. GldM	--	D - - - K K D Y A R M D K S	D Y L D Q M L F Q -	G D N L S K -	- K G K D F M K R I T D Y R	T Q V A I A P E -	-													
<i>R. biformata</i> GldM	--	D - - - P T D Y T V M D K S	D Y L D Q K F F E Q -	G D N L A P -	- Q G K E F M R E I E A Y R	T D L V G I L G D -	-													
<i>C. atlanticus</i> GldM	--	D - - - P T D Y E T M D K S	N D L D E L W Y K -	G G K V T P -	- E G Q E F I D K M D T Y R	N G V V S V I G A -	-													
<i>G. forsetii</i> GldM	--	D - - - P K N Y E T M D Q S	S A M D E M F F Q -	S G R I S P -	- R R G E E F L A Q I E T F	R N G V S E I L D D -	-													
<i>Z. profunda</i> GldM	--	D - - - P Q D Y Q A M D K T	D I L D E K F F K -	G G K I S P -	- E G Q E F V A K I E T E	Y R N G V I N T L G E -	-													
<i>W. virosa</i> GldM	--	E - - - - D T D Y N S L Q N T	E P I V S L L F K G K A D N	G N Q K G Q E	L V K R I N E F Q K F L L G	Y V G N D Q -	-													
<i>R. anatipestifer</i> GldM	--	K - - - - E F N F N A L N T	T D A S T L Y F F D K A	N E A S P S K N A	E K L K T L M G E I K S	L T L Q I Y F P K T P -	-													
<i>C. hutchinsonii</i> GldM	--	A - - - - D G S Y K G A K E E E	A T A G L M V G T E G A	K N G -	- K A Y A L Q T S L N K Y G	Q E V I P G I V G -	-													
<i>L. byssophila</i> GldM	--	E - - - - T N Q I K N L A E E E	K V A N I F V K -	- - - N K -	- K G Y E L K Q K L D N E	Y V A Y L Q K H A P N -	-													
<i>S. linguale</i> GldM	--	E - - - - S G N I K N L S E E E	S V A Q M I I G T -	- - - N R N G -	- A A F K L D Q L D N E Y	V E L S R L S G N -	-													
<i>D. fermentans</i> GldM	--	E - - - - E G A I K N P E E E T	K V G E M M I -	- - - G V G K R G -	- K A Y E L Q K T L N G	Y V A E L N K V S P N -	-													
<i>M. tractuosa</i> GldM	--	E - - - - E G E M E G K T D Y	D K V G N Y M M P E -	- - - N Q N -	- N I K L K S L N E Y A K Y	V D E T V A D D -	-													
<i>P. heparinus</i> GldM	--	E - - - - T G D I K L R E N M D	I A Q G T M I N -	- - - Q K -	- E G F K K A K I N E T R	E K L I T D L D D E -	-													
<i>P. saltans</i> GldM	--	E - - - - T G E L N K R D D L	D V S P R I M I N -	- - - Q K -	- K G E L K K K I N K T	R E K L L A L V D P -	-													
<i>C. pinensis</i> GldM	--	E - - - - H G E L K S K D N L	D A P T R V M E N -	- - - Q K -	- Q G P L E K K L T D L R	A N L L T F V Y D -	-													
<i>P. propionigenes</i> GldM	--	N D S A Y V K Q I A I A K	D N L D K A A E Y G I	N - - - N G -	- N G K I L Q K K I E D Y	R D F L I K L S A D -	-													
<i>P. gingivalis</i> PorM	--	K - - - - V N D I R R K D N L	D A S S V M L S P -	- - - I N G -	- K G S T L R K E V D K	F R E L V A T L M I T D -	-													
<i>P. distasonis</i> GldM	--	N - - - - V N S I E H K D D L	E A S R V M L S P -	- - - V S G -	- E G K K L R A E I D K	F R I W M G F L M I E D -	-													
<i>P. ruminicola</i> GldM	--	D - - - - V T N I R N K E D	Q E P A N Y V M L S P -	- - - T N G -	- Q Q K L Y K A I N S	F R E R M L T M V T D -	-													
<i>P. melaninogenica</i> GldM	--	D - - - - P L N I E G K D N	I E A S Y I M L N P -	- - - A N G -	- Q G H K L Y E A I N S	Y R A R I L Q F V T D -	-													

190 200 210 220 230 240

F. johnsoniae GldM K Y A G I I S E V E K K F D V S D V K - - - - N K E G I K E K Y L A Y H F - K G F P A I A S A A K L S A W Q N D V K K
F. psychrophilum GldM K Y A N I I S E I A N K F D L S D V A - - - - N K D G V V K I K Y L E Y H F - D K F P A V I A S V A K L S M M Q Q S D V K K
C. canimorsus GldM T Y G E L V G K I D G N F N T N D D V V - - - - D R E G V V T R K W L N Y N F - E G F P Y I A S V L A K L S M M Q Q S D I R A
C. ochracea GldM A Y K A L A D K V S V N F N T D D V K - - - - N R E G R T V K W L N F N F - E G F P Y V A T L A K L S M M Q Q S D I L T
C. algicola GldM - - - K L K S S V I A R F E T G D A N G K V E - K K D K T K Q D W I N Y H Y - E G F P L I A S L T K I T A L Q Q S D I K S
C. lytica GldM - - - K I K G S V K A R F E T G D A N G K V E - K K D K T K Q D W I N Y H Y - E G F P L I A S L T K I T A L Q Q S D I K A
Maribacter sp. GldM - - - S L K E N V L V R F K T G D E N G K V E - K R D G T K Q D W I N Y H Y - E G Y P L V A S L A K L T A L Q Q S D V K S
R. biformata GldM G F P E V Q D A V K T R F K T G D E N G K V E - R R D G V K V D W I N Y H Y - E G F P L I A S L T K I T S Q Q S D I K A
C. atlanticus GldM D L P K V R A E V E K D F S T A P E K - - - - R R D G V E K D W I N Y N Y - V G F P L V A S I T K L T Q I Q A D A K T
G. forsetii GldM G Y N T I S Q K V N L Q K E F G T E P E - - - - N V E G A K V P W L K Y R F - E G F P L V A S I T Q L T Q M Q A D I K S
Z. profunda GldM G F S T L N N E I E R K F N T G E R E - - - - D S E G T K K P W L T Y N F - E G F P L I A S I T Q L T Q J Q S D I K T
W. virosa GldM - - - S S R N S I L S F F N T - - - - - E S K S K K Q N W L N E K F - Y D Q P M V A A L T N F T K L Q V D A R T
R. anatipestifer GldM Q N E A I I E R A N S S F S T A V S T - - - - S S V K K D W L I S K F - Y N Q P L V A A L A N L E V L Q S E A R N
C. hutchinsonii GldM - - - K D M P A I K I A M D G K E D P K Y D K - K P D Q K K D F G K L N F - A E T P L V A A L A V M A T F E S E V K K
L. byssophila GldM - - - - - L K F Q P L A L D A K D D P A M Q D A D P M T K R K D F A E L L F - A Q T P V P A A L A G I S Q K Q S V I R R
S. linguale GldM - - - - - K Y G P L A L D G K R D P I A S L - S P D Q K R K D F A E L N F - A Q T P V P A A L A V L S Q K Q Q T D V R R
D. fermentans GldM - - - - - K F A G L A L D G R E D P V A K G - N K D Q K R K D F A E L N F - E S T P V A A A L A V L S Q K Q Q T D V R R
M. tractuosa GldM - - - S V S F A P L A L D A N E N P R F K D - D P N Q K G K D W A T L E F - M G A P T P A A L A T I S D Y I N K V M A
P. heparinus GldM - - - K D R A G V T F S L E A K D A V - - - - K V N G K K E W A D I N F G E G T P L T A A A T I S K J Q S D V K N
P. salmans GldM - - - K D K A S V A F S L E A V D P A K P - - - - A N D G T R K N W E Q S N F G D G T P L T A T T I L S K I Q T D V K N
C. pinensis GldM - - - K D K A K F E K S L P L H I E I G K S H - G S H G P A K D W T S Y H F - N M V P T I A V T I L S K F Q N D I K N
P. propionigenes GldM - N P S K K K M Y E A I F S T - - - - - K K T K D G K P W D V A L F - E G M P L S A A V V T I L T K Y Q S D I R T
P. gingivalis PorM - - - K A K L K L T E Q A L N T - - - - - E S G T K G K S W E S S L F - E N M P T V A A V I T L T K M Q S D V R Y
P. distasonis GldM - - - S A K T A V L E A N L S T P P H - - - - - K A G I N T R T W E E A L F - E N M P V A A V I T L T K M Q S D V R Y
P. ruminicola GldM - - - E K Q R Q I I A S N L T T Q V - - - - - P K R A M G K N W A E Y M F - E S M P A A A V T L S K L Q S D V R Y
P. melaninogenica GldM - - - P G Q K K I I A S N L S T E V P H - - - - - H S M G K N W E E Y M F - E N M P V A A A V T L S K L Q S D V R Y

250 260 270 280 290 300

F. johnsoniae GldM T E A D V Y N S A L G K A A V A A A S Y S N Y Q A I V V L D K N A Y F Q G E K V T G K V V L G R Y R D E N T K P T - - -
F. psychrophilum GldM A E S D V Y S A A L G K A A V A A A S Y S N Y Q A I V V L D K N A Y F Q G E T V K G K V V L G R Y R D E N T K P T - - -
C. canimorsus GldM T E Q E V Y A E M L K G Q L K S Q A I S M T N Y T T L L E Q G K G A Y Y Q G E S F D G A I V L G R K D A T T R P N E V E L
C. ochracea GldM T Q Q E F F D T A L A G S L K S Q V S M T N Y T T L L E Q G K G A Y Y Q G E K F D G S I V L G R K D A T T R P N E V D I
C. algicola GldM T E E D A L K S M L E G N L T D Q V S L T N F K T S L F G S K S A F Y S G E K Y D G K I I I S K T D N S S T P V R A E L
C. lytica GldM T E E D A L K A M L E G N L T D Q V S L T N F K T S L F G S K S A F Y A G E K Y D G K I I I S K T D D T S T P V R A E L
Maribacter sp. GldM T E E D A L K S M L E G E L T S Q V S L T N F R T S L A A S K S A F Y S G E K Y D G K I I I S K T D D T S T P V R A E L
R. biformata GldM T E E A L K A M L Q G E L T S Q V S L T N F S T L L E S E K S A F Y A G E K F N G S I V L G K T D K T A K P V R A E L
C. atlanticus GldM V E S E I L S D L L A G Q L K S D V S M T N Y Q A I V V P E K T A F F N G E N F K G K V V L G R F D N S L N F D - - K V V
G. forsetii GldM T E S E I L S S M L S G Q L Q S D V S L S N Y Q A I V V P P K P A F F S G E N F S G K V V L G R F D N S L N F D - - K V V
Z. profunda GldM T E N D V L S A M L A G Q L Q E E V S M T N Y T T L L E A P D K S A Y Y Q G E T F D G A I V L G R F D D E T L K P N K I N L
W. virosa GldM L E G N I V R D L L S G K L K E K I E L N A F E G L F L S P - G I V E Q G S D V A L N V V L G A Y D N - - - - -
R. anatipestifer GldM L Q S D A L A N M L K E K V D A D I K F N A F E A I V A A P - T V V L Q G D K A E A K V I V G T Y A S S V - P G - - M
C. hutchinsonii GldM I E T Q A L D L L A S Q V G A A D L K F D Q V F A V A T A K S G V V A A G T D Y E A E L F L A A S S A V N P I - - M
L. byssophila GldM Y E A E V L D Y L A Q Q V G A K E I K F D K L I A V V I P D S R T V V A G Q T Y K A E I A I G A Y S S I S P S - - I
S. linguale GldM L E G E V L D V L A S K V G A Q D V F D K I J I A M L S M D K S V V V A G T K F K G Q M F I A A S S S G I T P R - - M
D. fermentans GldM M E G E V L N Y L A S K V G A A D I K F D R V L A M V S A D A K T V V A G T K F K G Q M F I A A S S S G I T P R - - M
M. tractuosa GldM Y E S R A L D V L L A R R V G A G L V L K F D L I Q D L V A V A P E S S V V A A G A K Y K A D L I V A A S S S A E D P E - - M
P. heparinus GldM A E A E V V K K L F G N M D K A L N L D Q F D V A V A P E S S V V I Q G Q P Y T A Q D V F L T A S S S R S N P V - - I
P. salmans GldM A E A V V V R K F L S K M D E A L V T L D A F A A V A V A P T S Y V I Q G Q P Y S A E V F L T A Y D S K Q N P E - - I
C. pinensis GldM S E A L I I D D L Y A Q I G K R D F H F D K I R P F V S L N S K N L M E Q Q T L T A A I A V G A Y S S T V N P E - - I
P. propionigenes GldM S E A E V V Q D L L K G Q T D A L D F R V N K I T A L V V P N S R Y V I R G G K Y S S R I V L S A V D S T K T P E - - Y
P. gingivalis PorM A Q G E V L A D L V K S V D V G D Y R V N S I T A Q V I P Q S Q I V M R G S D T Y K A N I V L S A S V D T T Q R P D - - V
P. distasonis GldM A E G E V L N L N S V D V G D Y R V N S I T A Q V I P E S Q I V M R G S Q Y K A N I V L S A S V D T T K R P D - - I
P. ruminicola GldM A E G E V L H T L V Q N I D V K D V R V N L L D A F V I P N S K T I V R G D R F S A R I V M A A V D T T Q V P D - - I
P. melaninogenica GldM A E G E V L H T L V A N V G L K D I R V N K L Q A F V V P S Q T R L Y P G E T M T A Q M F M G A V D S T Q Q P Q - - V

310 320 330 340 350 360

F. johnsoniae GldM S F Q G P G Q - - - - - J V N G Q A V I S L T A G G V V G - - - - - E Q D I N G Q F T - - F L E - D G K N I P L K
F. psychrophilum GldM S F Q G P G R - - - - - L E N G G Q A V I S L T A G G V V G - - - - - E Q K I N G Q F T - - F L E - D G K T I P L K
C. canimorsus GldM M L D D Q R R K L - S A S E F J I E D G K V K L K V G A G N A G - - - - - E H K I T G N L Y - - F D Q - D G K R I A V P
C. ochracea GldM A J D G R K L - G T S E Y T I E D G R V K L N I S A G N T G - - - - - D H K I T G N L Y - - F D Q - D G K R I A V P
C. algicola GldM T L D G R K L T A D T D Y K L E A G G V K M L I N T G N P G - - - - - D H V V A G T I F - - F M Q - D G T E V P V E
C. lytica GldM T L D G R K L K E G T D Y Q L E A G G V K M L I N T G N P G - - - - - D H E V A G T L F - - F K Q - D G E E V P V E
Maribacter sp. GldM T L D G R K L S E G K D Y A L E A G G I K M L I S A G S A G - - - - - D H E V A G T M F - - F M Q - D G E E I P V E
R. biformata GldM T L D G R K L A E G K D Y Q L K E G G V E M L I G A G S P G - - - - - D H E I A G T L I - - Y M Q - D G E E T E V P
C. atlanticus GldM T V N G K D L - - - - - E K T V G G Q V V L D F P A G N V G - - - - - E Q E I K G E L Q - - F K E - G D S L V S I P
G. forsetii GldM V I N G K K I L - - - - - E N T Q A G Q V V L E F P A G N V G - - - - - E Q K I S G E L Q - - Y M E - N D S L K S I S
Z. profunda GldM K L D G R T L - S D N D Y S L Q G G K V V L N V P V G N A G - - - - - D H S I T G K L I - - F N E - G E E P I E V P
W. virosa GldM S L T G S V A T S A G N A Q J I V N G K A T L K L N T G S I G - - - - - I H K L T G S L T - - Y R D A D G E N K T V Q
R. anatipestifer GldM S I S G V D R - - - - - T A N G G Q G F K S L N T G S V G - - - - - D F K F N G E I T - - F L D A N Q K Q I R L P
C. hutchinsonii GldM S R N G A P L - - - - - A V E N G R G K V K F K A S A T N Y D A E G N S K Q N W K G Q I K - - J N N - K G K D T I F S
L. byssophila GldM S T N G S A L - - - - - P V K E G G K V Y E V R A G G T F D N N G Q L K R S Y T A T I S - - Y P K P D G T R E T V T
S. linguale GldM S L N G A A V - - - - - R M Q D G Q G I I E F T A Q G G A Y D K N G L A R R T L T G S I A - - Y Q T A A G - L K T V P
D. fermentans GldM S L N G S P V - - - - - K V E N G G V G V I E F T A Q G G G Y N A E G L A K R E L R G Q I T - - J P T P S G K D T T Y T
M. tractuosa GldM T L N G N P I - - - - - E V E N G S G K I E F T A - - T P G - - - - - A Y G E D G T V R K T F E A T A K L K D S V Y
P. heparinus GldM T V N G S S L - - - - - A V K D G K G T Y T G G T G S V G - - - - - V F K W S G V I R - - V K Q T D D G V K E Y K
P. salmans GldM T V N G S K L - - - - - S T K D G R G V Y T I N T N S E I G - - - - - E F K W K G T I R - - V Q Q T D D G V K T Y E
C. pinensis GldM V I V N G S G V - - - - - T A K E G L G E Y S M V V S G I G - - - - - E K T I S G A V K - - M T D P S G Q V I N M
P. propionigenes GldM Y I G S T R I - - - - - K D G I Y D I N C A K S G - - - - - S F N Y S G F I K - - L P M T D G S I K T Y P
P. gingivalis PorM F V N G K L L - - - - - S P E N M G L F T A T A G A P G - - - - - T Y P V K G Y I E - - M M G N D G V K I R R D
P. distasonis GldM Y V N G K E L - - - - - P Y E N M G V F T A T A G A A G - - - - - T F P I K G Y I E - - M P N S D G V K I M R R D
P. ruminicola GldM F I G G Q K V - - - - - N L Q N G - - - - - L Y E T V C G K T G - - - - - D F T L K G Y M E - - M V N G N G D R I R R E
P. melaninogenica GldM F V N G Q L I - - - - - K G N Q I T V K A G A P G - - - - - K H T L S G Y I L - - I K D L T G N V L R R N

Sequence alignment for amino acids 370-420. Species listed on the left include F. johnsoniae GldM, F. psychrophilum GldM, C. canimorsus GldM, C. ochracea GldM, C. algicola GldM, C. lytica GldM, Maribacter sp. GldM, R. biformata GldM, C. atlanticus GldM, G. forsetii GldM, Z. profunda GldM, W. virosa GldM, R. anatipestifer GldM, C. hutchinsonii GldM, L. byssophila GldM, S. linguale GldM, D. fermentans GldM, M. tractuosa GldM, P. heparinus GldM, P. saltans GldM, C. pinensis GldM, P. propionigenes GldM, P. gingivalis PorM, P. distasonis GldM, P. ruminicola GldM, P. melaninogenica GldM. The alignment shows conserved regions with gaps indicated by dashes.

Sequence alignment for amino acids 430-480. Species listed on the left are the same as in the first block. The alignment continues with amino acids 430-480, showing further conservation and some insertions/deletions.

Sequence alignment for amino acids 490-540. Species listed on the left are the same as in the previous blocks. The alignment covers amino acids 490-540, with a high degree of sequence conservation across the species.

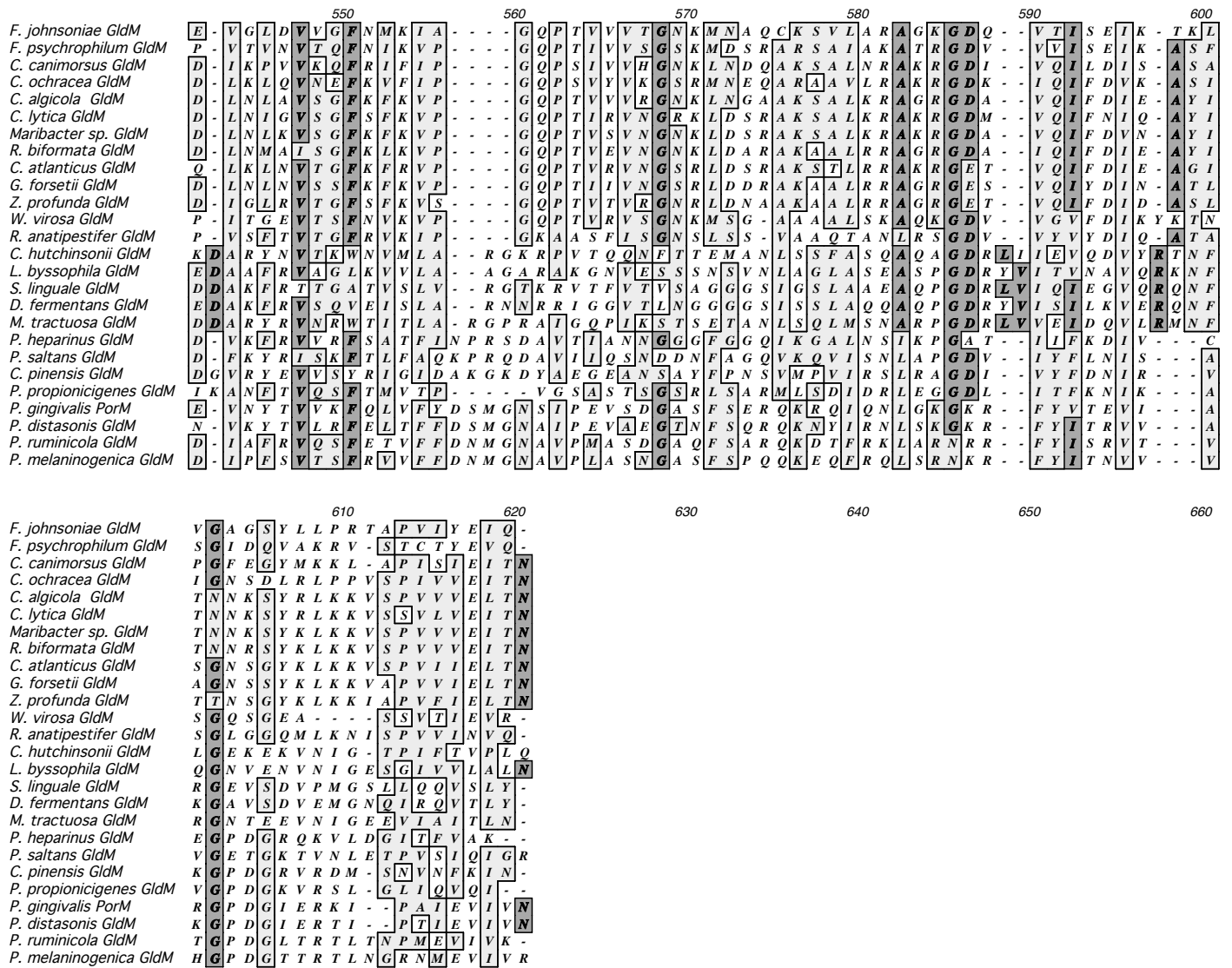


Figure S5. Alignment of GldM sequences using MUSCLE. Dark shading indicates identical amino acids and light shading indicates similar amino acids. Transmembrane region is indicated.

GldN

F. johnsoniae GldN
F. psychrophilum GldN
C. canimorsus GldN
C. ochracea GldN
C. algicola GldN
C. lytica GldN
Maribacter sp. GldN
R. biformata GldN
R. atlanticus GldN
G. forsetii GldN
Z. profunda GldN
W. virosa GldN
R. anatipestifer GldN
C. hutchinsonii GldN
L. byssophila GldN
S. linguale GldN
D. fermentans GldN
M. tractuosa GldN
P. heparinus GldN
P. saltans GldN
C. pinensis GldN
P. propionigenes GldN
P. gingivalis PorN
P. distasonis GldN
P. ruminicola GldN
P. melaninogenica GldN

F. johnsoniae GldN
F. psychrophilum GldN
C. canimorsus GldN
C. ochracea GldN
C. algicola GldN
C. lytica GldN
Maribacter sp. GldN
R. biformata GldN
R. atlanticus GldN
G. forsetii GldN
Z. profunda GldN
W. virosa GldN
R. anatipestifer GldN
C. hutchinsonii GldN
L. byssophila GldN
S. linguale GldN
D. fermentans GldN
M. tractuosa GldN
P. heparinus GldN
P. saltans GldN
C. pinensis GldN
P. propionigenes GldN
P. gingivalis PorN
P. distasonis GldN
P. ruminicola GldN
P. melaninogenica GldN

F. johnsoniae GldN
F. psychrophilum GldN
C. canimorsus GldN
C. ochracea GldN
C. algicola GldN
C. lytica GldN
Maribacter sp. GldN
R. biformata GldN
R. atlanticus GldN
G. forsetii GldN
Z. profunda GldN
W. virosa GldN
R. anatipestifer GldN
C. hutchinsonii GldN
L. byssophila GldN
S. linguale GldN
D. fermentans GldN
M. tractuosa GldN
P. heparinus GldN
P. saltans GldN
C. pinensis GldN
P. propionigenes GldN
P. gingivalis PorN
P. distasonis GldN
P. ruminicola GldN
P. melaninogenica GldN

	190	200	210	220	230	240
<i>F. johnsoniae</i> GldN	I T E V - Y -	A D S Y -	F N T K K S M K D	I Q G A L S R I D D T		
<i>F. psychrophilum</i> GldN	I T E V - Y -	G D S Y -	F R E K K K T L K D	I N A S L T K T D D T		
<i>C. canimorsus</i> GldN	I T E V - Y -	A D S Y -	F T K K K T Y D E	I K H S L M S V D D T		
<i>C. ochracea</i> GldN	I Q D I - Y -	V D S Y -	F T Q T K T A E S	I E A S L S K V D D T		
<i>C. algicola</i> GldN	I K D I - Y -	A D S Y -	F T E K R R E F S D	L E A T M Q K I D D T		
<i>C. lytica</i> GldN	L - E V - Y -	A D S Y -	F T E K R R K L E D	L K A S M Q K V D D T		
<i>Maribacter</i> sp. GldN	L E D V - Y -	V D S Y -	F T E K R R K F S E	L A A T L S K K D D T		
<i>R. biformata</i> GldN	L T D V - Y -	V D S Y -	F T E K R R N F S D	L Q A T L Q K V D D T		
<i>C. atlanticus</i> GldN	I E T I - Y -	T D S Y -	F T E K R R T L K D	I S A A L S K V D D T		
<i>G. forsetii</i> GldN	I E N V - Y -	A D S Y -	F K E K R R T L K D	I S A T L S K V D D T		
<i>Z. profunda</i> GldN	I E N I - Y -	A D S Y -	F T E K R R T L K D	I Q A T L S R V D D T		
<i>W. virosa</i> GldN	I T E V - Y -	D D E F -	F K Q K M T Y D Q	I M A R A E K V D D T		
<i>R. anatipestifer</i> GldN	I K E V - Y -	D D E M -	F T S T R L K P E E	I Q Q R M S R V D D T		
<i>C. hutchinsonii</i> GldN	L I T P - Y -	A N D S L E N G S	L L S I D E F N A L L I M P	S D Q P V Y T P E D T	L M M F Q N	
<i>S. byssophila</i> GldN	V L E P - F -	S N D S -	L A T K I T L E E	F N K R I H R D F E G G	L S Q D E I D A G F	G K A T E
<i>S. linguale</i> GldN	L I D A - Y -	A N D S -	C T K I S I E K F	H E N M L I P N T G G	L S A E E K A A G F	T E D G K T A G A N D
<i>D. fermentans</i> GldN	L I D A - Y -	V N D S -	C A T K I T G E E	L H K R I L I P N T Q	A G L S A E E I A A G F	G E P A K A D G W D A
<i>M. tractuosa</i> GldN	I I P I - Y -	K D D S -	L Q N R K T K E E	F L E D L E N P Q L	Q D L N A G G D D	A W G S S D D
<i>P. heparinus</i> GldN	L T - V - Y -	S P K D -	T S G K I L E D	N D S F K I A L T	A Q A L Q G A R G	
<i>P. saltans</i> GldN		M D G Y -	N S D Q F T M E V		D S A T I D G A L T	
<i>C. pinensis</i> GldN	V Q A F - S P I D D R		F T V I P F S E		V Q N K L S G E E K	
<i>P. propionigenes</i> GldN		T V - Y -	R R N A R D L	L K P Q F H E E D	K L	
<i>P. gingivalis</i> PorN	L D V Y E Y -	L D G F E A	F T D Q Y K I K		F Q E F L D R F G I	
<i>P. distasonis</i> GldN	I K A Y E Y -	L D G Y E E	F T D E A H L I N		F K D L D R	
<i>P. ruminicola</i> GldN	I P V Y E Y P T D G S D V	F S D A T K A D			M K A L L D N	
<i>P. melaninogenica</i> GldN	N R G G I A A Y N Y R M D G N E I F T D S A R V K P				L Q F L D N	

	250	260	270	280	290	300
<i>F. johnsoniae</i> GldN		T D A G R E L I N Q Y P D D Y K S R V V K K V -			V T G S G K K K V V T Y V D E T V	
<i>F. psychrophilum</i> GldN		T D A G R E Q M N E D P Q A F R T R V T E V P I Y E M			V K V G K K T K K Q V G T E K K T I	
<i>C. canimorsus</i> GldN		L D A G Y E L L N -				
<i>C. ochracea</i> GldN		L D V G Y E Q L N -				
<i>C. algicola</i> GldN		T D Y G Y E Q Y N -				
<i>C. lytica</i> GldN		T D Y G Y D Q Y N -				
<i>Maribacter</i> sp. GldN		T D M G Y E Q I N -				
<i>R. biformata</i> GldN		T D L G Y E Q V N -				
<i>C. atlanticus</i> GldN		T D Y G I E Q Y N -				
<i>G. forsetii</i> GldN		T D L G I E Q Y N -				
<i>Z. profunda</i> GldN		T N Y G I E Q Y N -				
<i>W. virosa</i> GldN		T D F Y R Q Q V E -				
<i>R. anatipestifer</i> GldN		S D W L I D K I N -				
<i>C. hutchinsonii</i> GldN		E D Y S Y R T T -				
<i>S. byssophila</i> GldN		E D L G W G S E T T S T E T K K A S S				
<i>S. linguale</i> GldN	G W D A P A K D K K K P A	A D D G W G T P K K A A E P A V A D D G W G T P K K K T A			V A K N A K G K K G K A K V A A P V V	
<i>D. fermentans</i> GldN	K A K T D P S K Q A A N	A D D G W G N T A K K D T K K E E V V E D D G W G P P K K K S S K K G A			K T E V A K E E P K V E	
<i>M. tractuosa</i> GldN		S G W G N D D G W D D T				
<i>P. heparinus</i> GldN		V T E G V A D S V -				
<i>P. saltans</i> GldN		T V R S L D P V -				
<i>C. pinensis</i> GldN		Y D N D N D N N L				
<i>P. propionigenes</i> GldN		Y Y Q P S T N				
<i>P. gingivalis</i> PorN		F Y I L Y E E I P G R				
<i>P. distasonis</i> GldN		Y H I F Y E E K D				
<i>P. ruminicola</i> GldN		Y H I F Y E R T D				
<i>P. melaninogenica</i> GldN						

	310	320	330	340	350	360
<i>F. johnsoniae</i> GldN	G P T R T V P A - - - E Y -	I L K Q D L T S A D V T Q Y K I K G Y W Y F D K R Q S E L K Y R R L L G L C P				V T P D
<i>F. psychrophilum</i> GldN	P A T R T I S E - - - E F -	I N K F D L A S E I D V S D Y K I V G L W Y F D K R Q S D L L Y R R I L G I C P				V T P D
<i>C. canimorsus</i> GldN	A G E Q I T E - - - E Y -	I T K R E I S P E D I L Q Y R I R G L W Y F D K R Q G E L K Y R R L L G I A P				V A T D
<i>C. ochracea</i> GldN	A G E A L S P - - - E Y -	V T H R N L E S A D I A Q Y H I R G I W Y F D K R Q G E L K Y R R L L A L A P				V A P D
<i>C. algicola</i> GldN	A G E Q V S P - - - E Y -	V N R R D L A A A D L E E Y L I K G I W Y F D K R Q G E L K Y R R L L G I A P				R A P D
<i>C. lytica</i> GldN	A G E E V S E - - - E Y -	I N K R D L V A A D L E E Y L I K G M W Y F D K R Q G E L K Y R R L L G I A P				V A P D
<i>Maribacter</i> sp. GldN	A G E E L S A - - - E F -	I N E R D L T A A D I E E Y R I K G M W Y F D K R Q G E L K Y R R L L G I A P				V A P D
<i>R. biformata</i> GldN	A G E Q V S A - - - E Y -	I N R R N I T A A D I E E Y R I K G M W Y F D K R Q G E L K Y R R L L G I A P				V A P D
<i>C. atlanticus</i> GldN	A G E E I D A - - - Q Y -	I T R R D I N A G D I S E Y H V K G L W Y F D K R Q G E L K Y R R L L G I A P				C A P D
<i>G. forsetii</i> GldN	A G E E V D A - - - Q F -	V D R R D L G A A D I A E Y H I R G M W Y F D K R L A E L K Y R R L L G I A P				V A P D
<i>Z. profunda</i> GldN	A G E E V D E - - - Q F -	I D R R D L S A A D I Q E Y K I R G I W Y F D K R Q A E L K Y R R L L G I A P				R A P D
<i>W. virosa</i> GldN	A G E T P D E - - - G G -	J F R F N I D T Q D I K M I K V K G M W Y I D K R L G E M R Y R L L G L S I				M G P D
<i>R. anatipestifer</i> GldN	S G E K V S D E D K K A G -	T D V Y E T K S E H V K L K I K G M W Y I D R R D G Q M K Y R R L L G I A A				M G P D
<i>C. hutchinsonii</i> GldN		S L G G D S F F P T D I Y Q M E I K E E W L F D K Q R S R Q Y F D I D A I T F				Y V P A
<i>S. byssophila</i> GldN	S Q D G W G D D Q V T Q L -	A T G Y D L L P S E L Y L I E L K E D W I F D S Q R S R R A Y Y D V L V T I				K I P A
<i>S. linguale</i> GldN	E P K K D S V V V A A A P T -	L S G D E Y F P K E L N I L E V R E D W V F D R K R S R R A Y Y D V Q T V T L				L L P A
<i>D. fermentans</i> GldN	E P K P D S T S F E T Q Q F A	A A T E E E Y F P E Q L S I L E V E D W V F D K K R S R L Y N D I Q T L T I				V L P A
<i>M. tractuosa</i> GldN	G G E E E E E D T A A E -	E V D T K F S N R Q V S M L E I V E D M I F D R Q R S V L V W D I Q A I K L				V I P A
<i>P. heparinus</i> GldN	T G K I A E P - - - - -	K L R K L R S D E F L K F R I K E D W I L D T K R S I F E P R I V G L A P				M - -
<i>P. saltans</i> GldN	L G I V S D E - - - E F -	S D Y E K N V R F G L R I V E D W Y F D K N R S E F K P F I V G I A V				I V P N
<i>C. pinensis</i> GldN	T G E E K M V - - - - -	T T R D E F D P R T V Y Q Y K I K E I W Y F D K E A S A L K V R I L G I A P				M V S R
<i>P. propionigenes</i> GldN	I Q Q D S V S K E L K V N -	T D Q Y N Y V K N Q F K F L V O E I V F F D K H T S R M Y S Q I M A I A P L Y A L H P D				
<i>P. gingivalis</i> PorN	K N A E L F K - - - - -	V A D S D I P S A E V V K A Y Y V K E A W Y F T P T N S D V D I K I Q A I C P				I M T G
<i>P. distasonis</i> GldN	A G E E P T F - - - - -	I N E S D I P A A D V R S Y Y V K E A W Y F D Q N N S A F D V V K I L A I C P				I L T S
<i>P. ruminicola</i> GldN	G K I R - - - - -	V D N S D I P S A M V K K Y Y L K E S A Y Y D Q A N S S F H I K V Q A L C P				I M M D
<i>P. melaninogenica</i> GldN	H G I R L D N - - - - -	S D I P S G E V K G Y Y L K E S A Y Y D Q G T A T F H R K V V A L C P				I M Y R

370 380 390 400 410 420
F. johnsoniae GldN V Y T M N S - - - - - D E K - - - - - D Y I E L F W V I F F P N A R R E V I L H E A K A - - - - - F N D N - N
F. psychrophilum GldN V Y T M D D K - - - - - P E K - - - - - E Y I D L F W V V F Y P G A R R E I I L H E A K A - - - - - F N D K - N
C. canimorsus GldN V S M L G D L D M A Q G E E V S N - - - - - A Q V V D L F W V W Y P S V R R D I L H E A K T - - - - - F N R K - N
C. ochracea GldN V N F I D S - - - - - D D S T M S - - - - - A L V V P L F W V F Y P Q V R D I L H E A K T - - - - - F N R K - N
C. algicola GldN V N F I D D - - - - - E S M D Q E E - - - - - N K K I P L F W V W Y P S A R R Q I L H E A K V - - - - - F N Q R - N
C. lytica GldN V N F I D D - - - - - E S V D I D G - - - - - N K I P L F W V W Y P D A R R E I L H E A K V - - - - - F N Q R - N
Maribacter sp. GldN V N F I D D - - - - - E S M D P A D - - - - - A K V E L F W V W Y P G A R R Q I L H D A K V - - - - - F N Q R - N
R. biformata GldN V N F I D D - - - - - D S M A P E D - - - - - A L V V P L F W V W Y P S A R R Q I L H E A K V - - - - - F N Q G - N
C. atlanticus GldN V N F I D E - - - - - E D T - - - - - Q V V E L F W V W F P G V R R E V L H N A K A - - - - - F N R Q - N
G. forsetii GldN V N F I D S - - - - - G Q T - - - - - D L V E L F W V W Y P D A R R K V L H D A K V - - - - - F T G G - N
Z. profunda GldN V N F I D D - - - - - S E L N - - - - - D L V D L F W V W Y P D A R R E V L Y K A K A - - - - - Y I G N - N
W. virosa GldN A Q T L G T - - - - - E F N D G - - - - - E F V D L F W V I Y Y P G A R R D V L A N Y K V - - - - - F N P N - N
R. anatipestifer GldN P Q T M G Q - - - - - Q F A D K E - - - - - E L I D L F W V F Y P D A R R E I T A N A R V - - - - - F N S K - N
C. hutchinsonii GldN D H P S N I - - - - - K G - - - - - I Q Y A I A S F S Y K E L C E K L F K D N P K A I W F N P Q - - - - - F N P Q - N
L. byssophila GldN E Y S P E G - - - - - - - - - - - I E R D L A S F K Y K E L E S Y F R L N P N - C L W F N E E - - - - - F N P Q - N
S. linguale GldN D K N Q A G - - - - - - - - - - - Y E K P I A T F K Y K D L D K L F R S D P P K K F I W F N P Q - - - - - F N P Q - N
D. fermentans GldN E Q T A T G - - - - - - - - - - - L E L P V A S F R W K D V R W K D L F R S N D P K K Y I W Y N T H - - - - - F N P Q - N
M. tractuosa GldN E N F T S G - - - - - - - - - - - L E K V I G V F K Y K D L V E D L F R S N P E Q M I W F N P Q - - - - - F N P Q - N
P. heparinus GldN - K M V E G - - - - - - - - - - - N W Q P V F W I Y Y D D A R E L L S K K R L - - - - - V N P L - N
P. saltans GldN S I N L N T G P A L P G G N G G P G G G E N L G D L L L N M Q P V V W I N Y P S I R D R L C K Y N I - - - - - A H A - N
C. pinensis GldN M N E D G S - - - - - F R - - - - - A A I P L F W V Y Y P D L R P V L A K F D V - - - - - Y N Q N - N
P. propionigenes GldN N T K S K K - - - - - S I K Y F Q - - - - - E S V L C W F L F D E L R P Y L A K Q Y V - - - - - I P N G - N
P. gingivalis PorN Q D E F G E - - - - - V R - - - - - N Q - P L F W I P Y E N I R P Y I A R E R V - - - - - M L S S L N
P. distasonis GldN T G D M G E - - - - - - - - - - - T Q M P M F W I P Y E N I R P Y I S N S Y I - - - - - M T S M N
P. ruminicola GldN E F G G E A - - - - - - - - - - - T Q Y P L F W V K Y S D L E P Y L N R Q T V - - - - - M A S S M N
P. melaninogenica GldN E D D F G D - - - - - G E - - - - - V K Y P L F W V R Y D D L A P F L A K Q T I - - - - - M T S N L N

430 440 450 460 470 480
F. johnsoniae GldN S A L P I S F D Q I L N S R R F N A V I Y K E E N L Y G D R A I T S D Y M K D - - - - - N A Q N Q L L E S E R V K E K I R N F
F. psychrophilum GldN S A M P I T F D D L L N S R R F N A V I Y K E E N N V Y G D R R P I K D Y I V D Y M K D - - - - - N S L M Q L L E S E R V K D K V I R N F
C. canimorsus GldN S A R P L S F D H L L N S R R F S S V I Y K E E N V V Q G D R R P I K D Y I H D - - - - - N S L F Q L L E S D R I R E K I R D R
C. ochracea GldN D A R P V S F D H V L N A R M F S S V I F K E E A N V V Y G D R R K I K E F L P D - - - - - N A L F Q L L E A D K I K E K I R D R
C. algicola GldN S A Q P I S F D M L L N A R R F N A T I Y K E E N V V F G D R R A I K D Y I S D - - - - - N S L F Q L L E S N R I K E T I R D K
C. lytica GldN S A S P I S F D M L L N S R R F H A T I Y K E E N V V H G D R R K I K D Y I S D - - - - - N A L F Q L L E A K R I K E V I R D R
Maribacter sp. GldN S A Q P I S F D M L L N A R R F N G V I Y K E E N V V H G D R R K V I A D - - - - - N A L F Q L L E A K R I K E V I R D R
R. biformata GldN S A Q P L S F D M L L N A R R F N G M I Y K E E N V V H G D R R E I R D Y I A D - - - - - N A L F Q L L E S Q R I K E Q I R N R
C. atlanticus GldN S S Q P I T F D H L L N S R R F N G V I Y K E E N E Y G D R T V E D Y I N N - - - - - N A L M Q L L E S D R I K E Q I R N F
G. forsetii GldN T S Q V I S F D H L L N S R R F D G I I Y K E E N V V Q G D R R E I D E Y I A D - - - - - N A F M Q L L E S Q R I K E Q I R N F
Z. profunda GldN T T - - - - - S Y D Q L L N S R R F N S V I Y K E E N V V Q G D R R Q I N D Y I V D - - - - - N S F M Q L L E S E R I K E Q I R N F
W. virosa GldN S S S S I S Y D D M L N A R R F S S S V I Y K A Q T A Y G N R P I E D Y I P K - - - - - D A K G Q L E E N D R I R E S I L Q S
R. anatipestifer GldN L S S D I S F D D I L N A R R F S S S I Y K S E N G L G N G V I K D Y I P N - - - - - D A E A Q L E E S E R I K N Q I L E M
C. hutchinsonii GldN E R E H K N L A D A F D L R L F S S Y I T K V S N P K - D S Y I L T D I Y G G - - - - - D Q L K G L M A S Q W A A F E L L E Y
L. byssophila GldN T A K H M N Y A D A I E L R L F S G R I V R T S D P P R - N R Y L D G Y I K - - - - - N P R E A L L K S Q E W E Y K I M E T
S. linguale GldN Q A Q H K N L A D A F D L R L F Y G R I T K V A N P - G D T D L V G M Y G D - - - - - R E G L L K S Y Q T E Y E L M E T
D. fermentans GldN T A Q N K N L A D A F D L R L F Y G R I T K F S N A N D K A F L D J Y N G E - - - - - K E A L I K S L N Y E Q E L M E L
M. tractuosa GldN S A E H K N L A D A F A L R L F S A R I V K V A N P S - D N N I I D I Y D E - - - - - S P R E G I M A S Q W I E Y E L M E K
P. heparinus GldN D A S Q L T F D D F F V R R L F S S Y V V K E T N P A - N K N I V D I L G Q T D P K D T R K L Y E S E R I K S I S D Y
P. saltans GldN D K I G Y S F D D A M Q L R F F T S I I S K E S N P E D I R I K D R K D L A - - - - - N G V D K L L E G A D R I K N N L M Q Y
C. pinensis GldN D E A T M S W E D L F E M R F F E S S F I Y K E E N T Y - - - - - R R E I K E Y I K D - - - - - G T M R L L E G Q A I K D K I F N K
P. propionigenes GldN E T Q R L T Y D E F F A Q K L Y S S Y L L G D S N M F - N R M L L D Y Y V D - - - - - P V K I K K E Q D R L E T E L M N F
P. gingivalis PorN N T R N S T I D D F F R L N L Y K G D I V K T E N L H - - - - - A L A E Y C P T - - - - - P D S M K M E S K R I D K E L Q G F
P. distasonis GldN N A M T F T M D D Y F R R R E M F E G D I I K T Q N L M - N L P L Q A Y C P T - - - - - P D S L K N E Q A R I E D Q L T G F
P. ruminicola GldN N A A T V S M D D F F T L N M Y R G K I Y K T N N A Q G - K T L L Q L C G G - - - - - D E A K M T A E Q K R I E A E L E G F
P. melaninogenica GldN N A A T M S V D D Y F T M N L Y K G K I Y K T T N M L G - K T L A Q Y C P N - - - - - D S A M A - A E Q K I E R E L V A F

490 500 510 520 530 540
F. johnsoniae GldN E Q D M W N Y
F. psychrophilum GldN E Q D M W N Y
C. canimorsus GldN E Q D M W A N
C. ochracea GldN E Q D M W T N
C. algicola GldN E Q D M W S Y
C. lytica GldN E Q D M W S Y
Maribacter sp. GldN E Q D M W A Y
R. biformata GldN E Q D M W A Y
C. atlanticus GldN E Q D M W N Y
G. forsetii GldN E Q D M W S Y
Z. profunda GldN E Q D M W N Y
W. virosa GldN E A D M W H Y
R. anatipestifer GldN E N D M W N Y
C. hutchinsonii GldN E H N L W E F
L. byssophila GldN E S N L W E N
S. linguale GldN E H S L W E Y
D. fermentans GldN E H G L W E Y
M. tractuosa GldN E H E L W S Y
P. heparinus GldN E Q S L W E Y
P. saltans GldN D Q D L W E Y
C. pinensis GldN E Q D M W Q Y
P. propionigenes GldN E Q D L W E Y
P. gingivalis PorN R D G L F V T Q D T T W M K Q V E T K K S K G K K L E K A R G K N I T S R T R G Q G E G A A E T E A V E P K K Q K A S K
P. distasonis GldN E K S L W Y P D T T - - - - - Q V A V D S K A A K K A A K R S A R - - - - - K D K G S T K E A A P E K A A K V K A P K A E K
P. ruminicola GldN K K T I F G D P A K R D S L D S I A A L K D T - - - - - K A D K K V K A A K N K P A A T K G V K V A K Q K S A K T E K S S G S S
P. melaninogenica GldN E K T I Y G D P A R R D S L D S I S A A K E A E K A P R K L G R S R R T S P S T S G V - - - - - S R S R R S S S S S G S A G

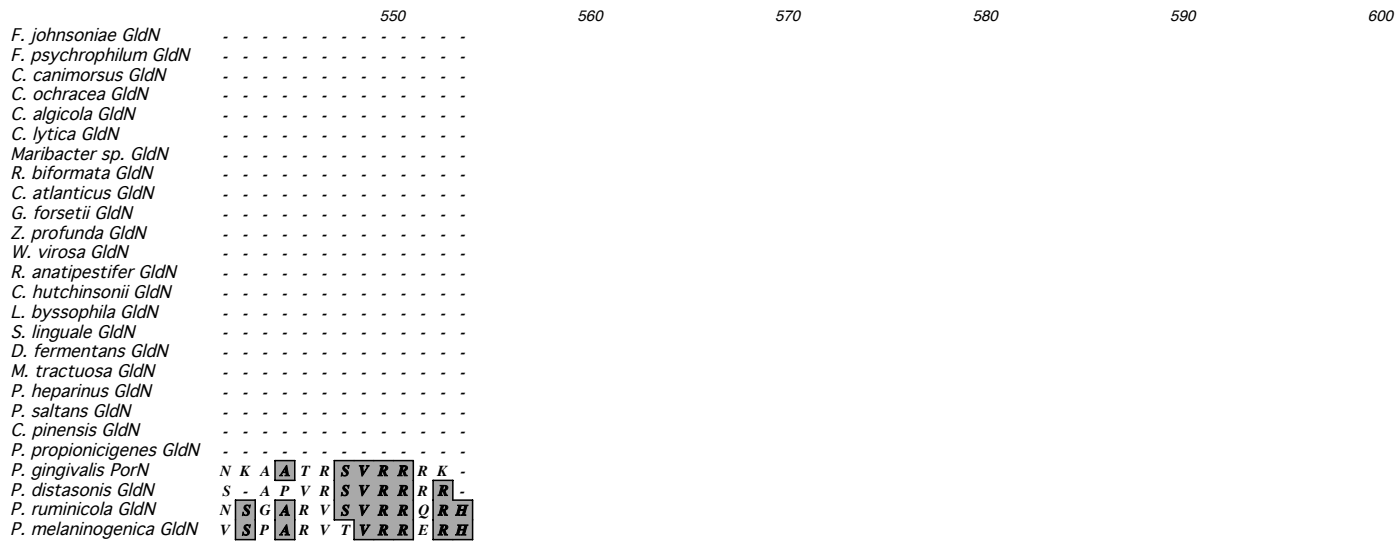


Figure S6. Alignment of GldN sequences using MUSCLE. Dark shading indicates identical amino acids and light shading indicates similar amino acids.

16S rRNA

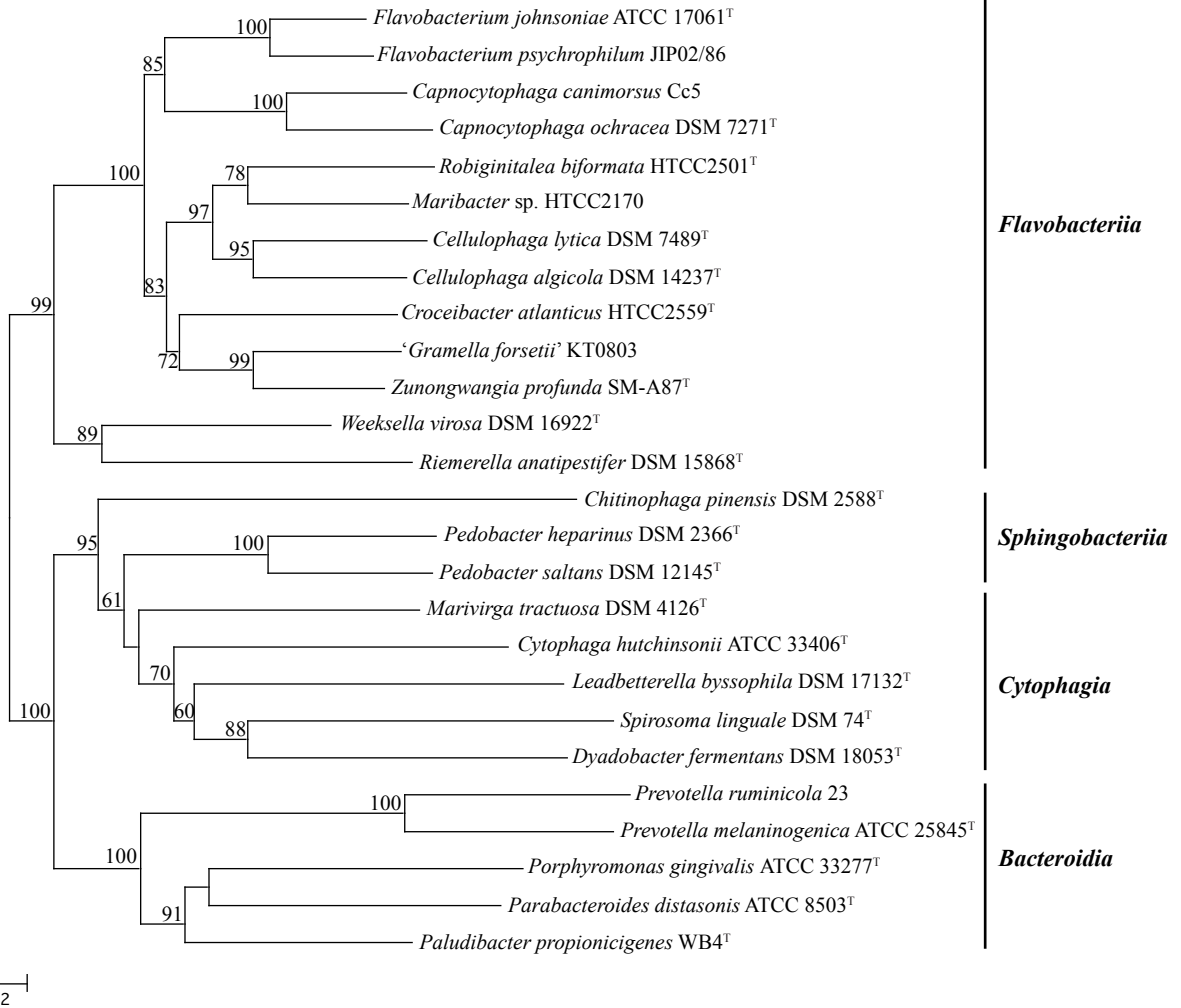


Figure S7. Phylogenetic tree of members of the phylum *Bacteroidetes* based on 16S rRNA sequences. Sequences were aligned by CLUSTALW and the phylogenetic tree was generated using the Neighbor Joining method. Midpoint rooting was used in order to allow easy comparison with the Gld protein phylogenetic trees. Bootstrap values are indicated as percentages at branch points. Branches with bootstrap values less than 50% are unlabeled.

GldK/PorK

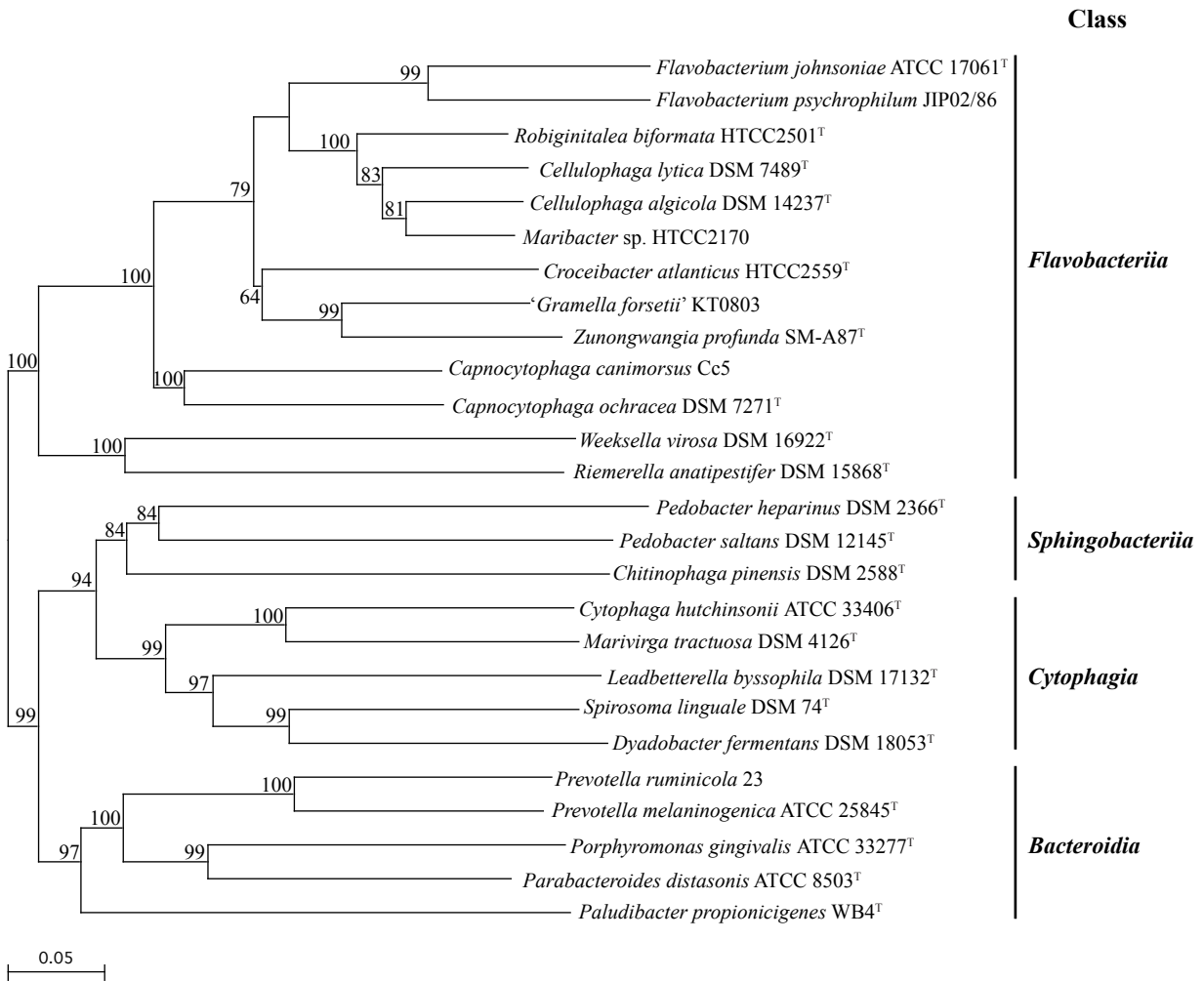


Figure S8. Phylogenetic tree based on GldK protein sequences. Sequences were aligned using MUSCLE and the phylogenetic tree was generated using the Neighbor Joining method. Orthologs of GldK are not found outside of the phylum *Bacteroidetes* so there was no obvious outgroup and midpoint rooting was used. Bootstrap values are indicated as percentages at branch points. Branches with bootstrap values less than 50% are unlabeled.

GldL/PorL

Class

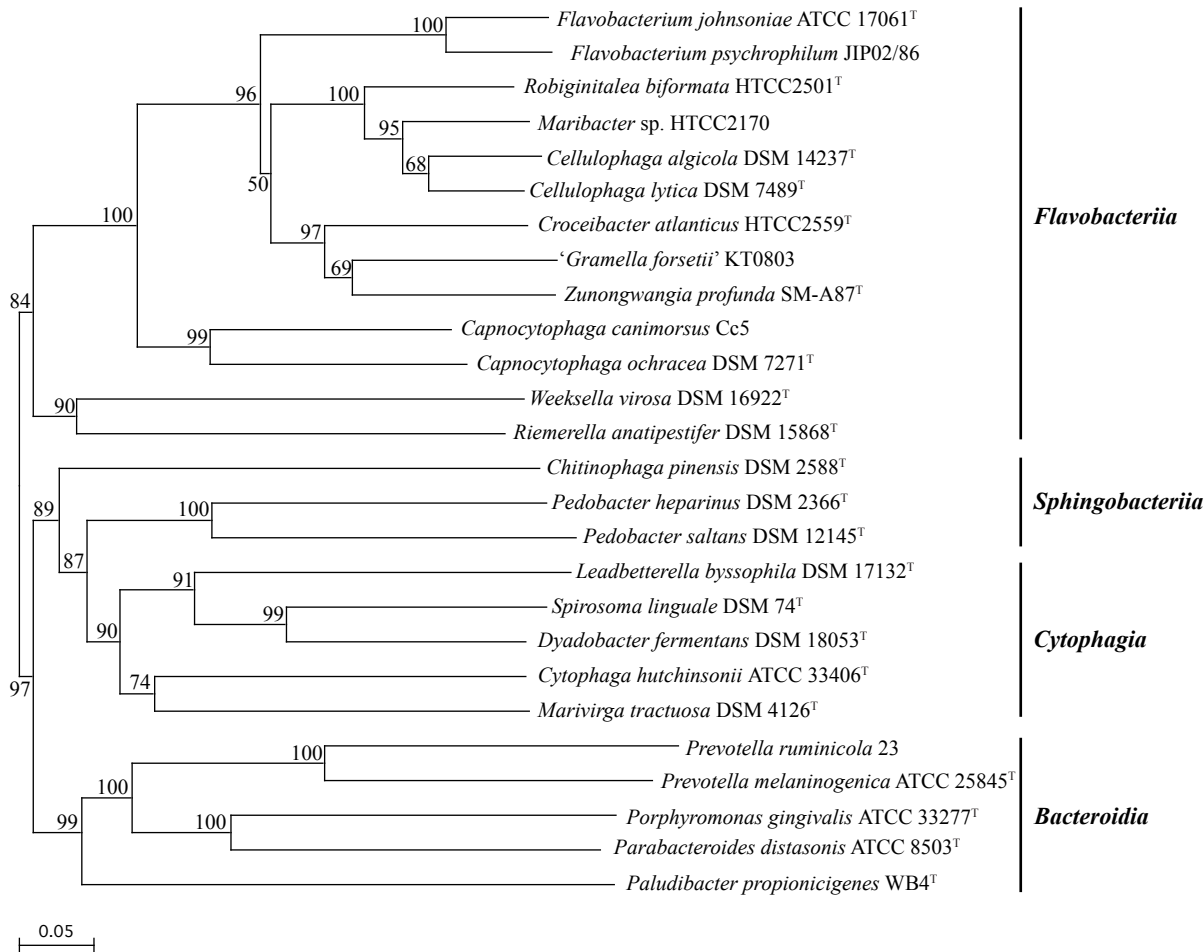


Figure S9. Phylogenetic tree based on GldL protein sequences. Sequences were aligned using MUSCLE and the phylogenetic tree was generated using the Neighbor Joining method. Orthologs of GldL are not found outside of the phylum *Bacteroidetes* so there was no obvious outgroup and midpoint rooting was used. Bootstrap values are indicated as percentages at branch points.

GldM/PorM

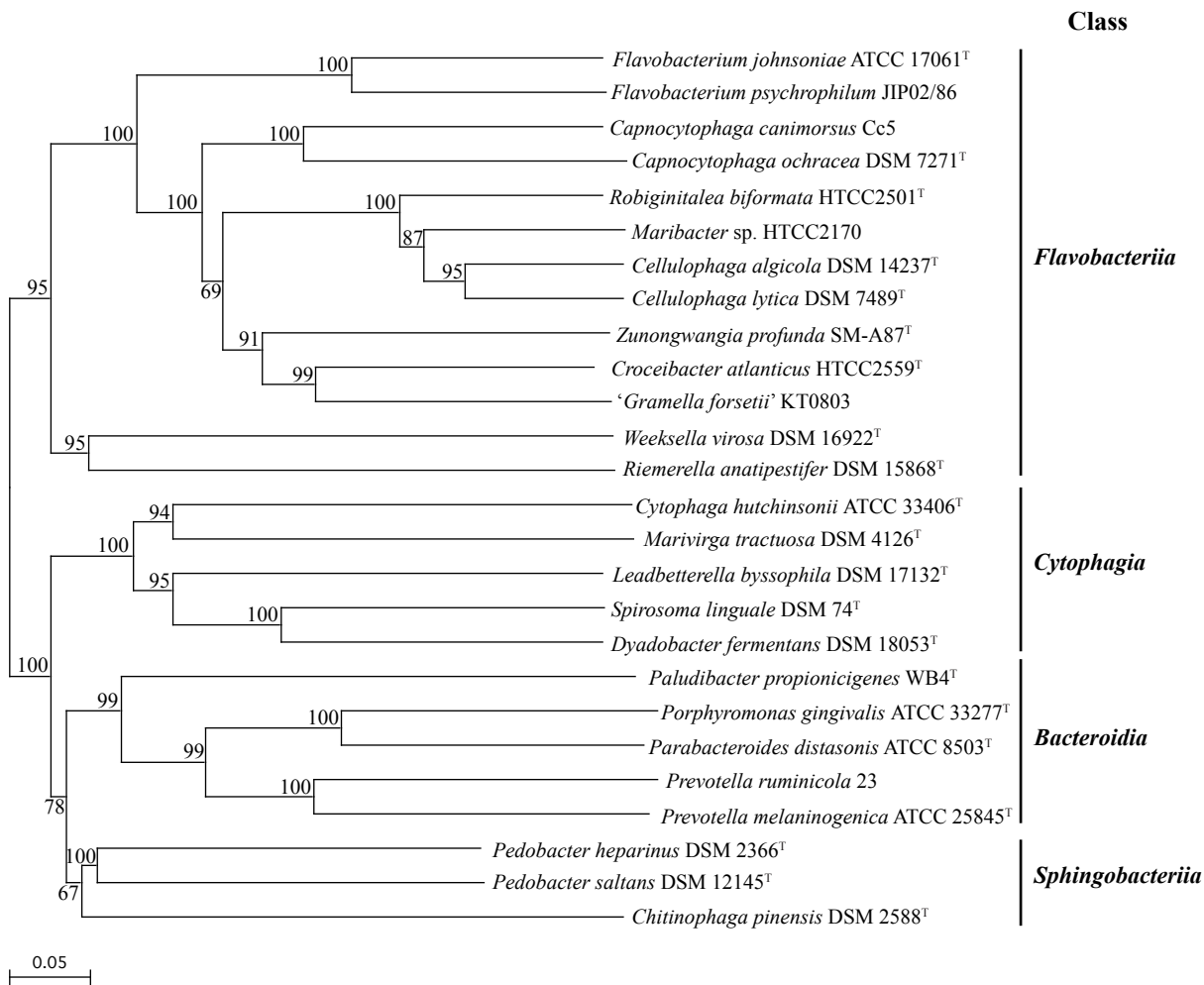


Figure S10. Phylogenetic tree based on GldM protein sequences. Sequences were aligned using MUSCLE and the phylogenetic tree was generated using the Neighbor Joining method. Orthologs of GldM are not found outside of the phylum *Bacteroidetes* so there was no obvious outgroup and midpoint rooting was used. Bootstrap values are indicated as percentages at branch points.

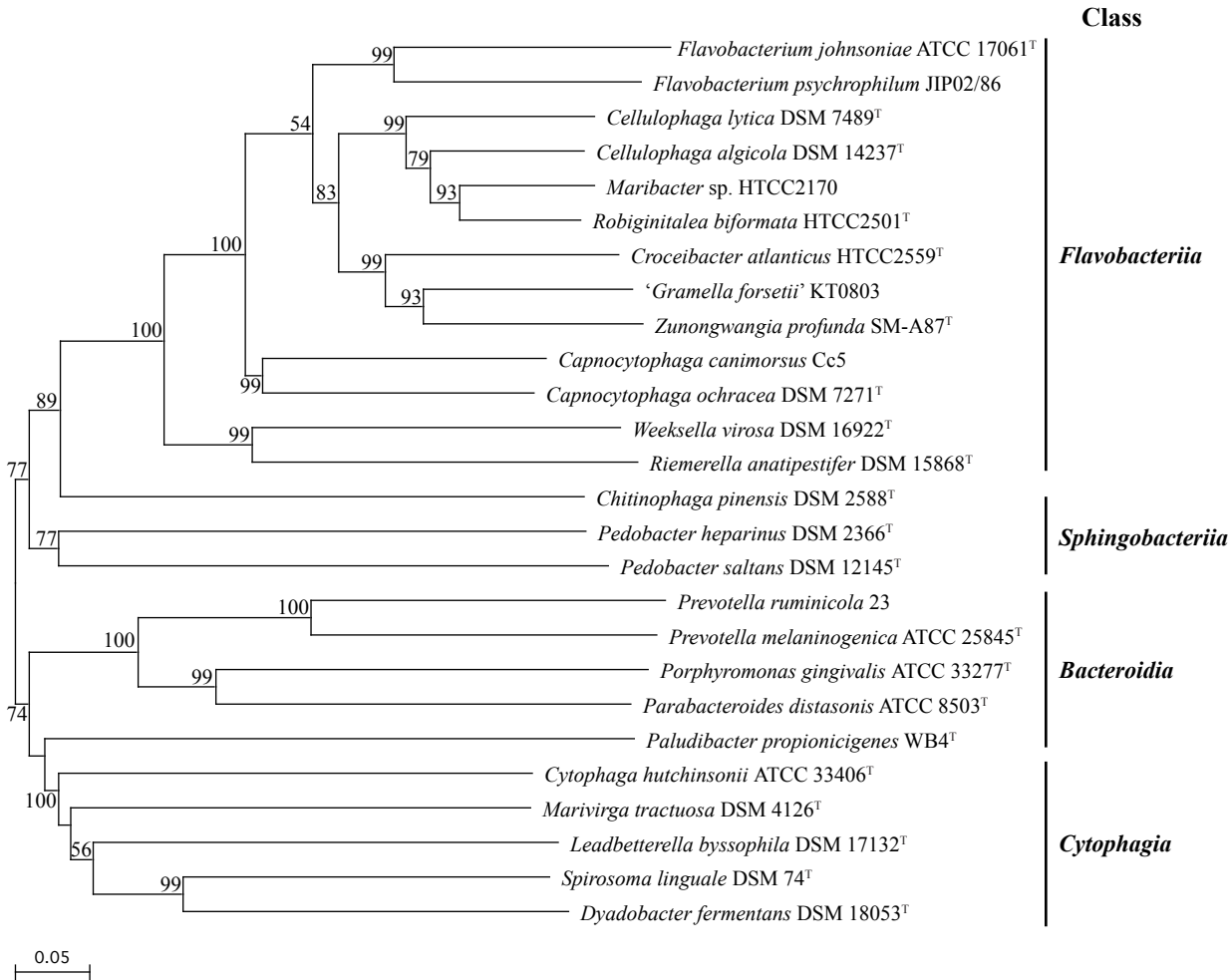
GldN/PorN

Figure S11. Phylogenetic tree based on GldN protein sequences. Sequences were aligned using MUSCLE and the phylogenetic tree was generated using the Neighbor Joining method. Orthologs of GldN are not found outside of the phylum *Bacteroidetes* so there was no obvious outgroup and midpoint rooting was used. Bootstrap values are indicated as percentages at branch points. Branches with bootstrap values less than 50% are unlabeled.

Table S1. Primers used in this study.

Primers	Sequence and Description
685	5' TCCGCTGGAAGAAGAGGAAC 3'; used for RT PCR. Binds upstream of <i>gldK</i> . Also used to check <i>gldK</i> deletion.
690	5' GATGAGTATTATGCTGAAGTAATGG 3'; used for RT PCR. Binds in <i>gldK</i> region. Also used to check <i>gldL</i> deletion.
616	5' CAGTTGAGGATGAATTAGATTGG 3'; used for RT PCR. Binds in <i>gldL</i> region. Also used to check <i>gldM</i> deletion.
692	5' AAGGATTCCTGCGATCGC 3'; used for RT PCR. Binds in <i>gldM</i> region.
695	5' TTAAGATATACTCAGCAGGAACCG 3'; used for RT PCR. Binds in <i>gldN</i> region.
704	5' TTGGTGAATTCGGAGGGAAATGGCATCCTG 3'; used in construction of pJVB4. EcoRI site underlined.
705	5' TATACACGTCGACATTATTATTTCTTCCGCC 3'; used in construction of pJVB4. Also used for RT PCR. Sall site underlined.
706	5' AGGGACAGAATTCCTTTCTATCGGTCTTTTGACTGAGG 3'; used in construction of pJVB2. EcoRI site underlined.
707	5' CTTCTGTGTCGACGTTAATTTTCCTCCTGCC 3'; used in construction of pJVB2. Also used to check <i>gldK</i> and <i>gldL</i> deletions. Sall site underlined.
708	5' CAGCTCACAAAGTTCAGGCTGC 3'; used in construction of pJVB6.
709	5' AGTTTTAGTCGACTTATTATTGTATTTTCGTAAATTACC 3'; used in construction of pJVB6. Sall site underlined.
733	TAGAAGGTCGACCTCCAGCGATAGAAACAATAGC; used to check <i>gldM</i> deletion. Binds downstream of <i>gldM</i> .
1197	5' GCTAGGGATCCGGCTGAGCCTGTATTTTCGAG 3'; used in construction of pAB19 for <i>gldL</i> deletion. BamHI site underlined.
1198	5' GCTAGTCTAGACATAACTTTTTTACTTAATAATGCCAT 3'; used to construct pAB19 for <i>gldL</i> deletion. XbaI site underlined.

1199	5' GCTAGTCTAGAGGTATGCTTTCTGCAATGAGTAAC 3'; used in construction of pAB19 for <i>gldL</i> deletion. XbaI site underlined.
1200	5' GCTAGGTCGACAGTACTTCACGTGCATTTGGG 3'; used in construction of pAB19 for <i>gldL</i> deletion. SalI site underlined.
1333	5' GCTAGGGATCCCACGACGATCAGCACGGA3'; used in construction of pAB30 for <i>sprA</i> deletion. BamHI site underlined. Also used to check <i>sprA</i> deletion.
1334	5' GCTAGTCTAGATGACCGCAAACGTTACCACA 3'; used in construction of pAB30 for <i>sprA</i> deletion. XbaI site underlined.
1335	5' GCTAGTCTAGAGTTATTTTCGACGTCATTCCCG 3'; used in construction of pAB30 for <i>sprA</i> deletion. XbaI site underlined.
1336	5' GCTAGGTCGACCTCCCTGAATCTGCACCATGT 3'; used in construction of pAB30 for <i>sprA</i> deletion. SalI site underlined. Also used to check <i>sprA</i> deletion.
1209	5' GCTAGGGATCCGCCAATTGCTGTTTACAAAGGAG 3'; used in construction of pJJ01 for <i>gldK</i> deletion. BamHI site underlined.
1210	5' GCTAGGTCGACACCTGACTTACCACAGCCGAT 3'; used in construction of pJJ01 for <i>gldK</i> deletion. SalI site underlined.
1211	5'GCTAGGTCGACATGGGAACTCAAGTAACAGGAGGC 3'; used in construction of pJJ01 for <i>gldK</i> deletion. SalI site underlined.
1212	5' GCTAGGCATGCTGTAGCCTCAGTACCTTGACCTGG 3'; used in construction of pJJ01 for <i>gldK</i> deletion. SphI site underlined.
1237	5' GCTAGGGATCCTCCGCTGGAAGAAGAGGAAC 3'; used in construction of pJJ02 for <i>gldM</i> deletion. BamHI site underlined.
1214	5'GCTAGGTCGACCTGTCTAGGGGTTAATTTTCCTCC 3'; used in construction of pJJ02 for <i>gldM</i> deletion. SalI site underlined.
1215	5' GCTAGGTCGACCCAAGAACTGCTCCGGTAATTTAC 3'; used in construction of pJJ02 for <i>gldM</i> deletion. SalI site underlined.
1238	5' GCTAGGCATGCACAAGCCTCCTGCAATTCTCGAAG 3'; used in construction of pJJ02 for <i>gldM</i> deletion. SphI site underlined.

Table S2. *F. johnsoniae* genes predicted to encode proteins secreted by the T9SS.

Locus tag	Gene name	TIGRFAM family ¹	Predicted function
Fjoh_0074		TIGR04183	endonuclease/exonuclease/phosphatase family (pfam03372)
Fjoh_0547		TIGR04183	
Fjoh_0549		TIGR04183	cell adhesion related domain (pfam07705)
Fjoh_0707		TIGR04183	
Fjoh_0798		TIGR04183	peptidase (pfam13574)
Fjoh_0808	<i>remA</i>	TIGR04183	gliding motility adhesin
Fjoh_0848		TIGR04183	tetratricopeptide repeat protein (pfam13371; pfam13414)
Fjoh_0886		TIGR04183	peptidase (pfam01447; pfam02868)
Fjoh_0979	<i>sprB</i>	TIGR04131	gliding motility adhesin
Fjoh_1022		TIGR04183	glycosyl hydrolase (pfam01270)
Fjoh_1123		TIGR04131	
Fjoh_1188		TIGR04183	
Fjoh_1189		TIGR04183	lectin/glucanase/pectate lyase (pfam13385; pfam13573)
Fjoh_1208		TIGR04183	α amylase (pfam00128)
Fjoh_1231		TIGR04183	pectate lyase (pfam00544)
Fjoh_1269		TIGR04183	pectate lyase (pfam13573)
Fjoh_1408		TIGR04183	α amylase (pfam00128)
Fjoh_1645		TIGR04131	Hyalin repeat, adhesion (pfam02494)
Fjoh_1720		TIGR04131	lectin (IPR016186; IPR016187; IPR001304)
Fjoh_1905		TIGR04183	glycosyl hydrolase/lectin (pfam02055; pfam14200)
Fjoh_1985		TIGR04131	Hyalin repeat, adhesion (pfam02494)
Fjoh_2150		TIGR04183	
Fjoh_2273		TIGR04131	
Fjoh_2336		TIGR04183	
Fjoh_2338		TIGR04183	
Fjoh_2339		TIGR04183	
Fjoh_2389		TIGR04183	peptidase (pfam00082)
Fjoh_2456		TIGR04183	
Fjoh_2666		TIGR04183	
Fjoh_3203		TIGR04183	bacterial Ig-like domain (pfam02368)
Fjoh_3246		TIGR04183	
Fjoh_3296		TIGR04183	
Fjoh_3324		TIGR04183	glucose/sorbosone dehydrogenase/ carbohydrate binding (pfam07995; pfam03422)
Fjoh_3421		TIGR04183	
Fjoh_3478		TIGR04131	
Fjoh_3731		TIGR04183	

Fjoh_3777		TIGR04183	
Fjoh_3855		TIGR04183	
Fjoh_3952		TIGR04131	
Fjoh_3971		TIGR04131	
Fjoh_4051		TIGR04183	pectate lyase (pfam13573)
Fjoh_4174		TIGR04183	lectin/carbohydrate binding (pfam14200; pfam03422)
Fjoh_4175		TIGR04183	glycosyl hydrolase/carbohydrate binding (pfam00704; pfam03422)
Fjoh_4176		TIGR04183	lectin/carbohydrate binding (pfam14200; pfam03422)
Fjoh_4177		TIGR04183	glycosyl hydrolase (pfam00722)
Fjoh_4242		TIGR04183	peptidase (pfam00082)
Fjoh_4436		TIGR04183	
Fjoh_4538		TIGR04131	
Fjoh_4721		TIGR04183	endonuclease (pfam04231)
Fjoh_4723		TIGR04183	endonuclease (pfam04231)
Fjoh_4750		TIGR04131	pectate lyase (pfam13573)
Fjoh_4934		TIGR04131	
Fjoh_4948		TIGR04183	

1- TIGR04131 is described as 'gliding motility-associated C-terminal domain', and TIGR04183 is described as 'Por secretion system C-terminal sorting domain' on the J. Craig Venter Institute TIGR website (<http://www.jcvi.org/cgi-bin/tigrfams/index.cgi>).