Claims

1. A synergistic combination comprising a quorum-sensing inhibitor and/or a postbiotic metabolite, an antibiotic and a probiotic, wherein the quorum-sensing inhibitor and/or a postbiotic metabolite is a peptide.

2. The synergistic combination of claim 1, wherein the peptide comprises or consists of one or more of the following amino acid sequences: XX[L or I]PPK, wherein X designates a hydrophobic amino acid; X_1X_2[L or I]PPK, wherein X_1 is selected from N, C, Q, M, S, and T and wherein X_2 is selected from A, I, L, and V; MALPPK; CVLPPK; HLLPLP; LKPTPEGD; YPVEPF; YPPGGP; YPPG; NQPY; LPVPK; ALPK; EVLNCLALPK; LPLP; HLLPLPL; YVPEPF; KYVPEPF; EMPFKPYPVEPF; and variants thereof altered by deletion, substitution or insertion wherein the activity of the molecules is not substantially reduced, including peptides and/or variants thereof with post-translational modifications including glycosylation.

3. The synergistic combination of claim 1 or 2, wherein the peptide comprises or consists of 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20 amino acid residues, such as from 2, 3, 4, 5, 6, 7, 8, or 9 to 3, 4, 5, 6, 7, 8, 9, or 10 amino acid residues.

4. The synergistic combination of any one of claims 1 to 3, wherein the quorum-sensing inhibitor and/or postbiotic metabolite is less than about 4000, 3900, 3800, 3700, 3600, 3500, 3400, 3300, 3200, 3100, 3000, 2900, 2800, 2700, 2600, 2500, 2400, 2300, 2200, 2100, 2000, 1900, 1800, 1700, 1600, 1500, 1400, 1300, 1200, 1100, 1000, 900, 800, 700, 600, or 500 Da in size, such as less than about 3000, 2000, or 1000 Da in size.

5. The synergistic combination of any one of claims 1 to 4, wherein the quorum-sensing inhibitor and/or postbiotic metabolite is in a probiotic bacterial culture fraction, such as a supernatant.

6. The synergistic combination of claim 5, wherein the probiotic bacterial culture fraction is a cell-free spent medium (CSFM), which is optionally concentrated in liquid or dry form (e.g. by lyophilization and/or spray-drying).

7. The synergistic combination of claim 6, wherein the CSFM has a molecular weight cut-off of about 4000, 3900, 3800, 3700, 3600, 3500, 3400, 3300, 3200, 3100, 3000, 2900, 2800, 2700, 2600, 2500, 2400, 2300, 2200, 2100, 2000, 1900, 1800, 1700, 1600, 1500, 1400, 1300, 1200, 1100, 1000, 900, 800, 700, 600, or 500 Da in size, such as about 3000, 2000, or 1000 Da.

8. The synergistic combination of any one of claims 1 to 7, wherein the antibiotic is an aminoglycoside, a bacitracin, a beta-lactam antibiotic, a cephalosporin, a chloramphenicol, a glycopeptide, a macrolides, a lincosamide, a penicillin, a quinolone, a rifampin, a glycopeptide, a tetracycline, a trimethoprim, a sulfonamides, or a combination thereof.

9. The synergistic combination of claim 8, wherein the antibiotic is a β-lactam antibiotic, such as cefoxitin.

10. The synergistic combination of any one of claims 1 to 9, wherein the quorum-sensing inhibitor and/or postbiotic metabolite is derived from the culture medium or supernatant of probiotic bacteria of the

genera *Aerococcus*, *Bacillus*, *Bacteroides*, *Bifidobacterium*, *Clostridium*, *Enterococcus*, *Fusobacterium*, *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Melissococcus*, *Micrococcus*, *Pediococcus*, *Peptostrepococcus*, *Propionibacterium*, *Staphylococcus*, *Streptococcus, Weissella,* or combinations thereof.

11. The synergistic combination of claim 10, wherein the quorum-sensing inhibitor and/or postbiotic metabolite is derived from *Lactobacillus*, such as *Lactobacillus acidophilus*, such as *Lactobacillus acidophilus* (DSM13241) and/or wherein the quorum-sensing inhibitor and/or postbiotic metabolite is derived from *Enterococcus*, such as *Enterococcus faecium*.

12. The synergistic combination of any one of claims 1 to 11, wherein the probiotic is of the genera *Aerococcus*, *Bacillus*, *Bacteroides*, *Bifidobacterium*, *Clostridium*, *Enterococcus*, *Fusobacterium*, *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Melissococcus*, *Micrococcus*, *Pediococcus*, *Peptostrepococcus*, *Propionibacterium*, *Staphylococcus*, *Streptococcus, Weissella,* or combinations thereof.

13. The synergistic combination of any one of claims 1 to 12, wherein the probiotic is *Lactobacillus*, such as *Lactobacillus acidophilus*, such as *Lactobacillus acidophilus* (DSM13241) and/or *Enterococcus*, such as *Enterococcus faecium*.

14. The synergistic combination of any one of claims 1 to 13, wherein the probiotic is live.

15. The synergistic combination of any one of claims 1 to 14, wherein the probiotic is present in an amount of 100 million to 500 million CFU per dose, such as about 200 million CFU per dose.

16. A composition comprising the synergistic combination of any one of claims 1 to 15.

17. Use of a synergistic combination of any one of claims 1 to 15 or a composition of claim 16 in the manufacturing of a medicament for:

(a) resensitizing an antibiotic-resistant infection to an antibiotic, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is to be administrated to a subject afflicted with the antibiotic-resistant infection;

(b) decreasing resistance of a bacterial infection to hydrogen peroxide cytotoxicity, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is to be administrated to a subject afflicted with the bacterial infection;

(c) treating and/or preventing diarrhea in a subject, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite and the antibiotic is to be administrated to the subject;

(d) treating MRSA or MRSP, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite and the antibiotic is to be administrated to a subject afflicted with MRSA or MRSP;

(e) reducing carotenoid synthesis in bacteria, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is to be administrated to the bacteria; and/or

(f) sensitizing bacteria to oxidant killing, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is to be administrated to the bacteria.

18. The use of claim 17, wherein the probiotic is to be administrated to the subject.

19. The use of claim 18, wherein the probiotic is of the genera *Aerococcus*, *Bacillus*, *Bacteroides*, *Bifidobacterium*, *Clostridium*, *Enterococcus*, *Fusobacterium*, *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Melissococcus*, *Micrococcus*, *Pediococcus*, *Peptostrepococcus*, *Propionibacterium*, *Staphylococcus*, *Streptococcus, Weissella,* or combinations thereof.

20. The use of claim 19, wherein the probiotic is *Lactobacillus*, such as *Lactobacillus acidophilus*, such as *Lactobacillus acidophilus* (DSM13241) and/or wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is derived from *Enterococcus*, such as *Enterococcus faecium*.

21. The use of any one of claims 18 to 20, wherein the probiotic is live.

22. The use of any one of claims 18 to 21, wherein the probiotic is present in an amount of 100 million to 500 million CFU per dose, such as about 200 million CFU per dose.

23. The use of any one of claims 17 to 22, wherein the subject is a pet, such as a dog.

24. The use of any one of claims 17 to 22, wherein the subject is a farm animal, such as swine or poultry.

25. The use of any one of claims 17 to 22, wherein the subject is a human.

26. The use of any one of claims 17 to 25, wherein the quorum-sensing inhibitor and/or the postbiotic metabolite and the antibiotic act synergistically.

27. A tablet or capsule comprising a synergistic combination of any one of claims 1 to 15 or a composition of claim 16.

28. A synergistic combination of any one of claims 1 to 15 or a composition of claim 16 for use as a medicament.

29. The synergistic combination of claim 28, wherein the probiotic is of the genera *Aerococcus*, *Bacillus*, *Bacteroides*, *Bifidobacterium*, *Clostridium*, *Enterococcus*, *Fusobacterium*, *Lactobacillus*, *Lactococcus*, *Leuconostoc*, *Melissococcus*, *Micrococcus*, *Pediococcus*, *Peptostrepococcus*, *Propionibacterium*, *Staphylococcus*, *Streptococcus, Weissella,* or combinations thereof.

30. The synergistic combination of claim 29, wherein the probiotic is *Lactobacillus*, such as *Lactobacillus acidophilus*, such as *Lactobacillus acidophilus* (DSM13241) and/or wherein the quorum-sensing inhibitor and/or the postbiotic metabolite is derived from *Enterococcus*, such as *Enterococcus faecium*.

31. The synergistic combination of any one of claims 28 to 30, wherein the probiotic is live.

32. The synergistic combination of any one of claims 28 to 31, wherein the probiotic is present in an amount of 100 million to 500 million CFU per dose, such as about 200 million CFU per dose.