CLAIMS

What is claimed:

1. A growth-independent method for detecting a microorganism of interest in a sample, comprising:
   - contacting the sample with a plurality of non-replicative transduction particles (NRTPs) such that the plurality of NRTPs transduces one or more microorganisms of interest in the sample, wherein the plurality of NRTPs comprises a reporter nucleic acid sequence, and wherein the growth rate of the one or more microorganisms of interest is less than logarithmic phase;
   - providing conditions for activation of the reporter nucleic acid sequence; and
   - detecting a signal produced by the reporter nucleic acid sequence, wherein the presence of the signal indicates the presence of the one or more microorganisms of interest, and wherein the absence of the signal indicates the absence of the one or more microorganisms of interest.
2. The method of claim 1, wherein the growth rate of the one or more microorganisms of interest is less than 0.1 divisions per hour, and wherein the one or more microorganisms of interest is Methicillin Resistant *Staphylococcus aureus* (MRSA).
3. The method of ~~any preceding method~~ any one claims 1 or 2, further comprising providing an antimicrobial agent to the sample and detecting for the signal produced by the reporter nucleic acid sequence to determine whether the one or more microorganisms of interest is susceptible or non-susceptible to the antimicrobial agent.
4. The method of any ~~preceding method claim~~ one of claims 1 to 3, wherein the one or more microorganisms of interest is in stationary phase; or wherein the one or more microorganisms of interest is undergoing no growth.

~~5. The method of any preceding method claim except claim 2, wherein the growth rate of the one or more microorganisms of interest is less than or equal to 0.1-5, 0.1-3, 0.1-1, 0.5-1, 0.1, 0.2, 0.3, 0.4, 0.5, 1, 2, or 3 divisions per hour.~~

~~6. The method of any preceding method claim, wherein the growth rate of the one or more microorganisms of interest is less than or equal to 0-10, 1-9, 2-8, 3-7, 4-6, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 cell division per 4 hour period.~~

~~7.~~5. The method of any ~~preceding method claim~~one of claims 1 to 4, wherein the growth rate of the one or more microorganisms of interest is negative or homeostatic.

~~8.~~6. The method of any ~~preceding method claim~~ one of claims 1 to 5, wherein the one or more microorganisms of interest comprises a Methicillin Resistant *Staphylococcus aureus* (MRSA) cell,

Staphylococcus aureus, *Staphylococcus spp.*, Enterobacteriaceae, *Enterococcus spp.* *Streptococcus spp.*, *Acinetobacter spp.*, *Pseudomonas spp.*, *Stenotrophomonas spp.*, or *Mycobacterium spp.*.

~~9.~~7. The method of any ~~preceding method claim~~ one of claims 1 to 6, wherein the sample is a clinical sample.

~~10. The method of any preceding method claim, wherein the sample is a nasal swab sample, a rectal swab sample, a blood sample, a positive blood culture sample, a skin/soft tissue sample, a bronchoalveolar lavage sample, a sputum sample, a stool sample, a urine sample, and/or a sample of an isolated microorganism.~~

~~11. The method of any preceding method claim, wherein the signal is a luminescence signal; or wherein the detecting step comprises measuring the relative light units (RLU) emitted by the signal.~~

~~12.~~8. The method of any ~~preceding method claim~~ one of claims 1 to 7, wherein the providing step comprises contacting the sample with a fatty aldehyde bacterial luciferase substrate reagent, optionally wherein the reagent is tridecanal.

~~13. The method of any preceding method claim, wherein the signal is greater than a background threshold calculated from an average background signal plus 0-3x, 0x, 1x, 2x, or 3x the standard deviation of the average background signal.~~

~~14.~~9. The method of claim 3, wherein the antimicrobial agent is cefoxitin, a β-lactam, an extended-spectrum β-lactam, an Aminoglycoside, an Ansamycin, a Carbacephem, Carbapenems, any generation of Cephalosporin, a Glycopeptide, a Lincosamide, a Lipopeptide, a Macrolide, a Monobactam, a Nitrofuran, an Oxazolidonone, a Penicillin, a Polypeptide, a Quinolone, a Fluoroquinolone, a Streptogramin, a Sulfonamide, a Tetracycline, a Rifampicin, a mycobacterial antibiotic, Chloramphenicol, and/or Mupirocin.

~~15.~~10. The method of any ~~preceding method claim~~one of claims 1 to 9, wherein the reporter nucleic acid sequence is a luciferase gene, optionally wherein the luciferase gene is *luxAB*, *luc*, *ruc*, or *nluc*.

~~16.~~11. The method of any ~~preceding method claim~~one of claims 1 to 10, wherein the reporter nucleic acid sequence is operatively linked to a constitutive promoter, optionally wherein the constitutive promoter is a *S. aureus clpB* promoter.

~~17. The method of any preceding method claim, wherein said method produces at least 80-100, 80-90, 80-95, 90-95, 80, 85, 90, 95, 96, 97, 98, 99% specificity of detection with reference to a standard cell culture-based assay.~~

~~18. The method of any preceding method claim, wherein said method achieves at least 80-100, 80-90, 80-95, 90-95, 80, 85, 90, 95, 96, 97, 98, 99% sensitivity of detection with reference to a standard cell culture-based assay.~~

~~19. The method of any preceding method claim, wherein said method achieves at least 95% specificity of detection and at least 90% sensitivity of detection with reference to a standard cell culture-based assay.~~

~~20. The method of any one of claims 17-19, wherein the cells of the standard cell culture-based assay are in logarithmic phase.~~

~~21. The method of any preceding method claim, wherein the one or more microorganisms of interest is a Methicillin Resistant *Staphylococcus aureus* (MRSA) cell.~~

~~22. The method of any preceding method claim except claim 2, wherein the one or more microorganisms of interest is a Methicillin Sensitive *Staphylococcus aureus* (MSSA) cell.~~

~~23. The method of any preceding method claim, wherein the reporter nucleic acid sequence encodes a detectable or selectable marker.~~

~~24.~~12. The method of any ~~preceding method claim~~ one of claims 1 to 11, wherein the reporter nucleic acid sequence is selected from the group consisting of genes encoding enzymes mediating luminescence reactions (luxA, luxB, luxAB, luc, ruc, nluc), genes encoding enzymes mediating colorimetric reactions (lacZ, HRP), genes encoding fluorescent proteins (GFP, eGFP, YFP, RFP, CFP, BFP, mCherry, near-infrared fluorescent proteins), nucleic acid molecules encoding affinity peptides (His-tag, 3X-FLAG), and genes encoding selectable markers (ampC, tet(M), CAT, erm).

~~25.~~13. The method of any ~~preceding method claim~~ one of claims 1 to 12, wherein the reporter nucleic acid sequence is operatively linked to a constitutive promoter.

~~26. The method of any preceding method claim, wherein the signal can be detected at a limit of detection (LoD) of less than 1-1000, 10-100, 100-1000, 10, 100, 1,000 colony forming units (CFU).~~

~~27. The method of claim 26, wherein the signal can be detected at a LoD of less than or equal to one to five, two to four, three to five or five CFU, or wherein the signal can be detected at a LoD of less than or equal to three CFU, or wherein the signal can be detected at a LoD of less than or equal to two CFU, or wherein the signal can be detected at a LoD of less than or equal to one CFU.~~

~~28.~~14. The method of any ~~preceding method claim~~ one of claims 1 to 13, further comprising providing an antibiotic to the sample at a pre-determined concentration and detecting a presence or absence of the

signal to determine whether the one or more microorganisms of interest is resistant or sensitive to the antibiotic.

~~29.~~15. The method of any ~~preceding method claim~~ one of claims 1 to 15, further comprising providing varying pre-determined concentrations of antibiotic to the sample and detecting the amount of the signal to determine the minimum inhibitory concentration of the one or more microorganisms of interest to the antibiotic.

~~30.~~16. A sample or cell culture comprising a plurality of non-replicative transduction particles (NRTPs) and one or more microorganisms of interest, optionally wherein the plurality of NRTPs comprises a reporter nucleic acid sequence, and wherein the growth rate of the one or more microorganisms of interest is less than logarithmic phase.

~~31. The sample or cell culture of any preceding sample or cell culture claim, wherein the growth rate of the one or more microorganisms of interest is less than or equal to 0.1 divisions per hour, and wherein the one or more microorganisms of interest is Methicillin Resistant *Staphylococcus aureus* (MRSA).~~

~~32.~~17. The sample or cell culture of ~~any preceding sample or cell culture~~ claim 16, further comprising an antimicrobial agent.

~~33.~~18. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 or 17, wherein the one or more microorganisms of interest is in stationary phase; or wherein the one or more microorganisms of interest is undergoing no growth.

~~34. The sample or cell culture of any preceding sample or cell culture claim, wherein the growth rate of the one or more microorganisms of interest is less than or equal to 0.1-5, 0.1-3, 0.1-1, 0.5-1, 0.1, 0.2, 0.3, 0.4, 0.5, 1, 2, or 3 divisions per hour.~~

~~35. The sample or cell culture of any preceding sample or cell culture claim, wherein the growth rate of the one or more microorganisms of interest is less than or equal to 0-10, 1-9, 2-8, 3-7, 4-6, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 cell division per 4 hour period.~~

~~36. The sample or cell culture of any preceding sample or cell culture claim, wherein the growth rate of the one or more microorganisms of interest is negative or homeostatic.~~

~~37.~~19. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 18, wherein the one or more microorganisms of interest comprises a Methicillin Resistant *Staphylococcus aureus* (MRSA) cell, *Staphylococcus aureus*, *Staphylococcus spp.*, Enterobacteriaceae, *Enterococcus spp. Streptococcus spp.*, *Acinetobacter spp.*, *Pseudomonas spp.*, *Stenotrophomonas spp.*, or *Mycobacterium spp.*.

~~38. The sample or cell culture of any preceding sample or cell culture claim, wherein the sample is a clinical sample.~~

~~39. The sample or cell culture of any preceding sample or cell culture claim, wherein the sample is a nasal swab sample, a rectal swab sample, a blood sample, a positive blood culture sample, a skin/soft tissue sample, a bronchoalveolar lavage sample, a sputum sample, a stool sample, a urine sample, and/or a sample of an isolated microorganism.~~

~~40.~~20. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 19, further comprising a fatty aldehyde bacterial luciferase substrate reagent, optionally wherein the reagent is tridecanal.

~~41.~~21. The sample or cell culture of claim ~~32~~18, wherein the antimicrobial agent is cefoxitin, a β-lactam, an extended-spectrum β-lactam, an Aminoglycoside, an Ansamycin, a Carbacephem, Carbapenems, any generation of Cephalosporin, a Glycopeptide, a Lincosamide, a Lipopeptide, a Macrolide, a Monobactam, a Nitrofuran, an Oxazolidonone, a Penicillin, a Polypeptide, a Quinolone, a Fluoroquinolone, a Streptogramin, a Sulfonamide, a Tetracycline, a Rifampicin, a mycobacterial antibiotic, Chloramphenicol, and/or Mupirocin.

~~42.~~22. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 21, wherein the reporter nucleic acid sequence is a luciferase gene, optionally wherein the luciferase gene is *luxAB*, *luc*, *ruc*, or *nluc*.

~~43.~~23. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 22, wherein the reporter nucleic acid sequence is operatively linked to a constitutive promoter, optionally wherein the constitutive promoter is a *S. aureus clpB* promoter.

~~44. The sample or cell culture of any preceding sample or cell culture claim, wherein the one or more microorganisms of interest is a Methicillin Resistant *Staphylococcus aureus* (MRSA) cell.~~

~~45. The sample or cell culture of any preceding sample or cell culture claim, wherein the one or more microorganisms of interest is a Methicillin Sensitive *Staphylococcus aureus* (MSSA) cell.~~

~~46. The sample or cell culture of any preceding sample or cell culture claim, wherein the reporter nucleic acid sequence encodes a detectable or selectable marker.~~

~~47.~~24. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 23, wherein the reporter nucleic acid sequence is selected from the group consisting of genes encoding enzymes mediating luminescence reactions (luxA, luxB, luxAB, luc, ruc, nluc), genes encoding enzymes mediating colorimetric reactions (lacZ, HRP), genes encoding fluorescent proteins (GFP, eGFP, YFP, RFP, CFP, BFP, mCherry, near-infrared

fluorescent proteins), nucleic acid molecules encoding affinity peptides (His-tag, 3X-FLAG), and genes encoding selectable markers (ampC, tet(M), CAT, erm).

~~48.~~25. The sample or cell culture of any ~~preceding sample or cell culture claim~~ one of claims 16 to 24, wherein the reporter nucleic acid sequence is operatively linked to a constitutive promoter.