

## Claims

1. A method of determining a level of activity of bacteria in the lung of a patient, the method comprising:
  - 5 making a first measurement at a first time of a level of at least one marker of a bacterial iron scavenging process and of at least one secreted bacterial protein in a sample of sputum from the lung;
  - making a second measurement at a second time of the levels of said marker and said toxin in a sample of sputum from the lung; and
  - 10 determining said level of bacterial activity from changes in said measured levels of said marker of a bacterial iron scavenging process and said secreted bacterial toxin over time.
2. A method as claimed in claim 1 comprising measuring the level of a plurality  
15 of said markers of bacterial iron scavenging processes and determining said level of bacterial activity from said plurality of measured levels.
3. A method as claimed in claim 1 or 2 wherein said marker(s) comprise siderophore(s), in particular including one or more of: pyochelin, pyoverdin,  
20 pyocyanin.
4. A method as claimed in claim 1, 2 or 3 further comprising measuring the level of at least one iron (III) sequestration intermediate for determining said level of bacterial activity.  
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5. A method as claimed in any one of claims 1 to 4 wherein said protein is a toxin, preferably exotoxin A.
6. A method as claimed in any one of claims 1 to 5 wherein said marker of a  
30 bacterial iron scavenging process is a siderophore.
7. A method as claimed in any one of claims 1 to 6 wherein said marker is pyoverdin and said protein is exotoxin A.
- 35 8. A method of predicting an exacerbation of a level of bacterial activity in the lung of a patient, the method comprising making a time series of measurements of

bacterial activity on said patient using a method as claimed in any one of claims 1 to 7; and using said time series of measurements to predict said exacerbation.

5 9. A method of determining the effectiveness of an antibiotic treatment of a bacterial lung infection, the method comprising making a time series of measurements of bacterial activity on a patient undergoing said treatment of a lung infection using the method of any one of claims 1 to 7 and determining said effectiveness from a time profile of said level of bacterial activity.

10 10. A method as claimed in claim 9 comprising determining that said antibiotic treatment is ineffective if said level of bacterial activity does not fall with time.

15 11. A method as recited in any preceding claim wherein said bacteria comprises *P. aeruginosa*, and wherein said marker has a concentration dependent on a level of quorum signalling between said *P. aeruginosa* bacteria.

12. A method as recited in any preceding claim further comprising the step of detecting a host marker of an iron scavenging process.

20 13. A method as recited in any preceding claim further comprising measuring the level of an inflammatory response of said patient.

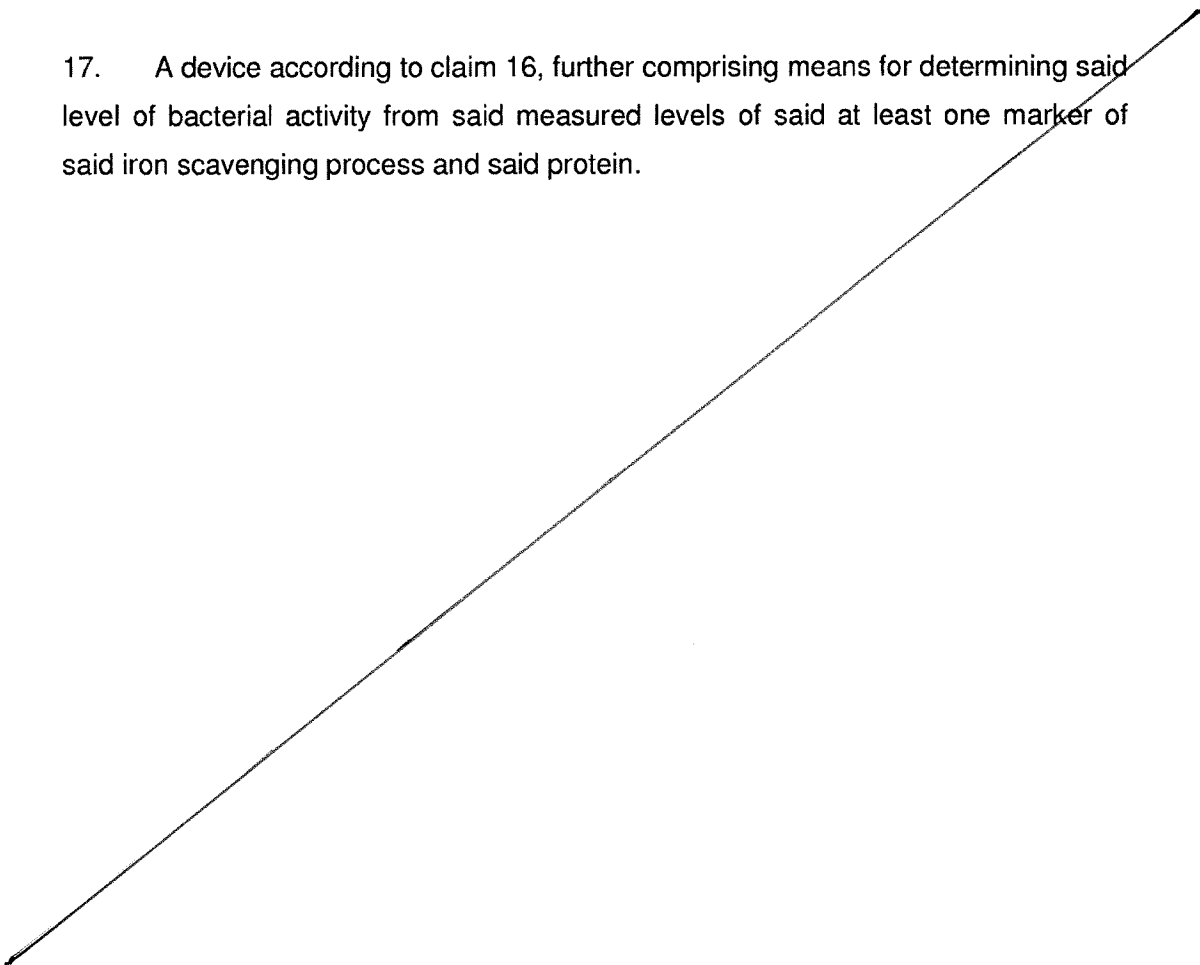
25 14. A method as recited in any preceding claim wherein the combination of a bacterial toxin, a bacterial marker of iron scavenging process, and a host marker of an iron scavenging process are detected.

15. The method of claim 14 wherein exotoxin A, a siderophore, and haem or a haem breakdown product are detected.

30 16. A device for use in the method of any preceding claim, the device comprising:  
means for collecting said sample of sputum;  
means for making a measurement of levels of at least one marker of a bacterial iron scavenging process and of at least one secreted bacterial protein in said sample.

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17. A device according to claim 16, further comprising means for determining said level of bacterial activity from said measured levels of said at least one marker of said iron scavenging process and said protein.



## Claims

1. A method of determining a level of activity of *Pseudomonas aeruginosa* bacteria in the lung of a patient, the method comprising:
  - 5 making a first measurement at a first time of a level of at least one marker of a bacterial iron scavenging process and of at least one secreted bacterial protein in a sample of sputum from the lung;
  - making a second measurement at a second time of the levels of said marker and said secreted protein in a sample of sputum from the lung; and
  - 10 determining said level of bacterial activity from changes in said measured levels of said marker of a bacterial iron scavenging process and said secreted bacterial protein over time.
2. A method as claimed in claim 1 comprising measuring the level of a plurality  
15 of said markers of bacterial iron scavenging processes and determining said level of bacterial activity from said plurality of measured levels.
3. A method as claimed in claim 1 or 2 wherein said marker(s) comprise siderophore(s), in particular including one or more of: pyochelin, pyoverdin,  
20 pyocyanin.
4. A method as claimed in claim 1, 2 or 3 further comprising measuring the level of at least one iron (III) sequestration intermediate for determining said level of  
25 bacterial activity.
5. A method as claimed in any one of claims 1 to 4 wherein said protein is a toxin, preferably exotoxin A.
6. A method as claimed in any one of claims 1 to 5 wherein said marker of a  
30 bacterial iron scavenging process is a siderophore.
7. A method as claimed in any one of claims 1 to 6 wherein said marker is pyoverdin and said protein is exotoxin A.
- 35 8. A method of predicting an exacerbation of a level of *Pseudomonas aeruginosa* bacterial activity in the lung of a patient, the method comprising making a time series of measurements of bacterial activity on said patient using a method as

claimed in any one of claims 1 to 7; and using said time series of measurements to predict said exacerbation.

9. A method of determining the effectiveness of an antibiotic treatment of a  
5 *Pseudomonas aeruginosa* bacterial lung infection, the method comprising making a  
time series of measurements of bacterial activity on a patient undergoing said  
treatment of a lung infection using the method of any one of claims 1 to 7 and  
determining said effectiveness from a time profile of said level of bacterial activity.
- 10 10. A method as claimed in claim 9 comprising determining that said antibiotic  
treatment is ineffective if said level of bacterial activity does not fall with time.
11. A method as recited in any preceding claim wherein said marker has a  
concentration dependent on a level of quorum signalling between said *P. aeruginosa*  
15 bacteria.
12. A method as recited in any preceding claim further comprising the step of  
detecting a host marker of an iron scavenging process.
- 20 13. A method as recited in any preceding claim further comprising measuring the  
level of an inflammatory response of said patient.
14. A method as recited in any preceding claim wherein the combination of a  
bacterial toxin, a bacterial marker of iron scavenging process, and a host marker of  
25 an iron scavenging process are detected.
15. The method of claim 14 wherein exotoxin A, a siderophore, and haem or a haem  
breakdown product are detected.