

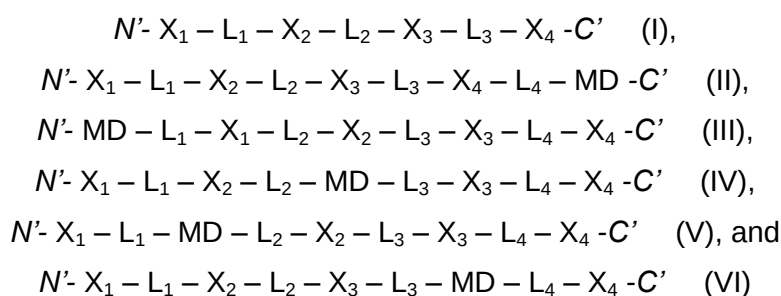
CLAIMS

1. A fusion molecule having binding specificity for pyoverdine type I, II and III and
5 pyochelin, comprising
- (a) a first polypeptide comprising a human neutrophil gelatinase-associated lipocalin (hNGAL) mutein that binds pyoverdine type I, wherein the hNGAL mutein comprises ten or more amino acid substitutions at positions 28, 36, 39-41, 46, 49, 52, 54, 55, 59, 65, 68, 70, 72-75, 77, 79-81, 87, 96, 100, 103, 106, 125, 127, 132, 134 and 136 of SEQ ID NO: 1;
- 10 (b) a second polypeptide comprising an hNGAL mutein that binds pyoverdine type II, wherein the hNGAL mutein comprises ten or more amino acid substitutions at positions 28, 36, 40, 41, 49, 52, 54, 65, 68, 70, 72-75, 77, 79, 81, 87, 96, 100, 103, 106, 125, 127, 132 and 134 of SEQ ID NO: 1;
- (c) a third polypeptide comprising an hNGAL mutein that binds pyoverdine type III,
15 wherein the hNGAL mutein comprises ten or more amino acid substitutions at positions 28, 36, 40-42, 45-47, 49, 52, 65, 68, 70, 72, 73, 77, 79, 81, 87, 96, 100, 103, 105, 106, 125, 127, 132, 134 and 145 of SEQ ID NO: 1; and
- (d) a fourth polypeptide comprising an hNGAL mutein that binds pyochelin, wherein the hNGAL mutein comprises ten or more amino acid substitutions at positions 28, 34, 36, 40,
20 41, 44-46, 49, 52, 54, 65, 68, 70, 72-74, 77, 79-81, 87, 96, 100, 103, 106, 108, 123, 125, 127, 132, 134 and 141 of SEQ ID NO: 1;
- wherein the first, second, third and fourth polypeptides are covalently linked.
2. The fusion molecule of claim 1, wherein the hNGAL mutein that binds pyoverdine
25 type I comprises the amino acid sequence of SEQ ID NO: 16, wherein the hNGAL mutein that binds pyoverdine type II comprises the amino acid sequence of SEQ ID NO: 36, wherein the hNGAL mutein that binds pyoverdine type III comprises the amino acid sequence of SEQ ID NO: 53, and/or wherein the hNGAL mutein that binds pyochelin comprises the amino acid sequence of SEQ ID NO: 62.
- 30 3. The fusion molecule of claim 1 or 2, wherein the hNGAL mutein binds pyoverdine type I, pyoverdine type II, pyoverdine type III and pyochelin, respectively, with a dissociation constant K_D of 200 nM or lower.
- 35 4. The fusion molecule of any one of claims 1 to 3, wherein the first, second, third and fourth polypeptides are covalently linked via linker molecules, in particular peptide linkers.

5. The fusion molecule of any one of claims 1 to 4, further comprising a multimerization domain allowing the multimerization of the fusion molecule, in particular a dimerization domain allowing the dimerization of the fusion molecule.

6. The fusion molecule of claim 5, wherein the dimerization domain is selected from the group consisting of an Fc domain, an IgE heavy-chain domain 2 (EHD2), an IgM heavy-chain domain 2 (MHD2), an IgG heavy-chain domain 3 (GHD3), an IgA heavy-chain domain 3 (AHD2), an IgD heavy-chain domain 3 (DHD3), an IgE heavy-chain domain 4 (EHD4), an IgM heavy-chain domain 4 (MHD4), an uteroglobin dimerization domain and variants or fragments of any one of the foregoing, wherein, in particular, the Fc domain is a human IgG4-Fc domain.

7. The fusion molecule of any one of claims 1 to 6, having a general formula selected from the group consisting of



wherein

X_1 , X_2 , X_3 and X_4 are, at each occurrence, selected from the group consisting of the first, second, third and fourth polypeptides, with the proviso that the fusion molecule comprises each of the first, second, third and fourth polypeptides;

MD comprises a multimerization domain; and

L_1 , L_2 , L_3 and L_4 are, at each occurrence, independently selected from a covalent bond and a linker molecule.

8. The fusion molecule of any one of claims 1 to 7, being present as a multimeric (e.g., dimeric) complex.

9. The fusion molecule of any one of claims 1 to 8, wherein the fusion molecule has one or more of the following properties:

(i) it further comprises at least one label or tag allowing the detection and/or isolation of the fusion molecule;

(ii) it further comprises one or more modifications increasing the stability of the fusion molecule and/or extending the serum half-life of the fusion molecule;

- (iii) it inhibits or reduces iron-uptake by *P. aeruginosa* through pyochelin and/or pyoverdine;
 - (iv) it inhibits or reduces virulence factor expression by *P. aeruginosa*;
 - (v) it inhibits or reduces pyochelin- and/or pyoverdine-mediated signalling;
 - (vi) it inhibits or reduces *P. aeruginosa* bacterial growth; and
- 5 (vii) it is associated with or conjugated/fused to a pharmaceutically active agent, wherein, in particular, the pharmaceutically active agent is selected from the group consisting of an antibiotic, a cytostatic agent, a toxin, a metal or metal compound/complex, a chelating agent, a hapten and an antibody.
- 10 10. A nucleic acid molecule comprising a nucleotide sequence encoding the fusion molecule of any one of claims 1 to 9.
11. A host cell containing a nucleic acid molecule of claim 10.
- 15 12. A pharmaceutical composition comprising a fusion molecule of any one of claims 1 to 9, a nucleic acid molecule of claim 10, or a cell of claim 11.
13. A kit comprising a fusion molecule of any one of claims 1 to 9, a nucleic acid molecule of claims 10, a cell of claim 11, or a pharmaceutical composition of claim 12.
- 20 14. A fusion molecule of any one of claims 1 to 9, a nucleic acid molecule of claim 10, a cell of claim 11, or a pharmaceutical composition of claim 12 for use as a medicament.
15. A fusion molecule of any one of claims 1 to 9, a nucleic acid molecule of claim 10, a cell of claim 11, or a pharmaceutical composition of claim 12 for use in the prevention or treatment of *P. aeruginosa* biofilm infection in a subject.
- 25 16. A fusion molecule of any one of claims 1 to 9, a nucleic acid molecule of claim 10, a cell of claim 11, or a pharmaceutical composition of claim 12 for use in the prevention or treatment of a disease or disorder associated with or caused by *P. aeruginosa* biofilm infection in a subject.
- 30 17. The fusion molecule, nucleic acid molecule, cell or pharmaceutical composition for use of claim 15 or 16, wherein the *P. aeruginosa* biofilm infection is acute or chronic
- 35 infection.