

CLAIMS

1. A polypeptide having binding specificity for pyoverdine type I, II, III or pyochelin, wherein the polypeptide comprises an hNGAL mutein that binds
5 pyoverdine type I, II, III or pyochelin with a K_D of 200 nM or lower, wherein:
 - (i) the hNGAL mutein binding to pyoverdine type I 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 (ii) the hNGAL mutein binding to pyoverdine type II 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;
 - (iii) the hNGAL mutein binding to pyoverdine type III comprises ten or more
15 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
 - (iv) the hNGAL mutein binding to pyochelin comprises ten or more amino acid
20 substitutions at positions 28, 34, 36, 40, 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.
2. The polypeptide according to claim 1, wherein the hNGAL mutein binding to pyoverdine type I comprises ten or more of the following amino acid substitutions in
25 SEQ ID NO: 1: L36W, A40T, I41A, Q49P, Y52P, T54V, N65D, S68D, L70Q, R72P, K73E, K75E, D77I, W79S, I80T, R81I, C87S, N96G, Y100S, L103Q, Y106H, K125Y, S127T, Y132G, K134N and T136A.
3. The polypeptide according to claim 1 or 2, wherein the hNGAL mutein binding
30 to pyoverdine type I comprises the amino acid sequence of SEQ ID NO: 16.
4. The polypeptide according to claim 1, wherein the hNGAL mutein binding to pyoverdine type II comprises ten or more of the following amino acid substitutions in

SEQ ID NO: 1 L36V, A40T, Q49G, Y52N, T54A, N65D, S68D, L70R, R72I, K73R, D77H, W79Y, R81D, C87S, L103T, Y106Q, K125I, S127R, Y132I and K134W.

5. The polypeptide according to claim 1 or 4, wherein the hNGAL mutein binding to pyoverdine type II comprises the amino acid sequence of SEQ ID NO: 36.

6. The polypeptide according to claim 1, wherein the hNGAL mutein binding to pyoverdine type III comprises ten or more of the following amino acid substitutions in SEQ ID NO: 1: L36E, A40L, I41A, L42R, Q49M, Y52M, N65D, S68E, L70R, K73H, D77K, W79D, R81V, C87S, N96L, Y100D, L103Q, S105P, Y106E, S127V and K134W.

7. The polypeptide according to claim 1 or 6, wherein the hNGAL mutein binding to pyoverdine type III comprises the amino acid sequence of SEQ ID NO: 53.

8. The polypeptide according to claim 1, wherein the hNGAL mutein binding to pyochelin comprises ten or more of the following amino acid substitutions in SEQ ID NO: 1: L36H, A40Q, I41W, D45G, K46R, Q49R, Y52W, N65D, S68D, L70D, R72A, K73I, D77L, W79R, R81T, C87S, Y100H, L103G, Y106G, K125F, S127I, Y132A and K134F.

9. The polypeptide according to claim 1 or 8, wherein the hNGAL mutein binding to pyochelin comprises the amino acid sequence of SEQ ID NO: 62.

10. A nucleic acid molecule comprising a nucleotide sequence encoding the polypeptide according to any one of claims 1 to 9.

11. A host cell containing a nucleic acid molecule according to claim 10.

12. A method of producing the polypeptide according to any one of claims 1 to 9, wherein the polypeptide is produced starting from the nucleic acid coding for the polypeptide by means of genetic engineering methods.

13. A composition comprising one or more polypeptides selected from the group consisting of (i) a polypeptide according to any one of claims 1 to 3 specific for pyoverdine type I, (ii) a polypeptide according to any one of claims 1, 4 and 5 specific for pyoverdine type II, (iii) a polypeptide according to any one of claims 1, 6 and 7 specific for pyoverdine type III and (iv) a polypeptide according to any one of claims 1, 8 and 9 specific for pyochelin.

14. A kit comprising in one or more containers, separately or in admixture, a polypeptide according to any one of claims 1 to 3 specific for pyoverdine type I or composition thereof, a polypeptide according to any one of claims 1, 4 and 5 specific for pyoverdine type II or composition thereof, a polypeptide according to any one of claims 1, 6 and 7 specific for pyoverdine type III or composition thereof, and/or a polypeptide according to any one of claims 1, 8 and 9 specific for pyochelin or composition thereof.

15. One or more polypeptides selected from the group consisting of (i) a polypeptide according to any one of claims 1 to 3 binding to pyoverdine type I, (ii) a polypeptide according to any one of claims 1, 4 and 5 binding to pyoverdine type II, (iii) a polypeptide according to any one of claims 1, 6 and 7 binding to pyoverdine type III and (iv) a polypeptide according to any one of claims 1, 8 and 9 binding to pyochelin, for use in the treatment or alleviation of *P. aeruginosa* biofilm infection in a subject.

16. A combination of two or more polypeptides according to any one of claims 1 to 9.