

CLAIMS

1. An inhibitor of gremlin-1 activity for use in the treatment of a bone fracture or bone defect.
- 5 2. An inhibitor of gremlin-1 activity according to claim 1, wherein the inhibitor is an anti-gremlin-1 antibody or functionally active fragment, variant or derivative thereof.
- 10 3. An inhibitor of gremlin-1 activity according to claim 2, wherein the functionally active antibody fragment is a Fab, Fab', F(ab')₂, Fv or scFv.
4. An inhibitor of gremlin-1 activity according to any of claims 2-3, wherein the antibody comprises at least one HCDR sequence selected from SEQ ID NOs: 3, 4,
15 5 and 6 and/or at least one LCDR sequence selected from SEQ ID NOs: 7, 8 and 9.
5. An inhibitor of gremlin-1 activity according to any of claims 2-4, wherein the antibody comprises a heavy chain variable region (HCVR) of SEQ ID NO: 10
20 and/or a light chain variable region (LCVR) of SEQ ID NO: 11.
6. An inhibitor of gremlin-1 activity according to any of claims 2-4, wherein the antibody comprises the sequence of SEQ ID NO: 3 or 4 for HCDR1, the sequence of SEQ ID NO: 5 for HCDR2, the sequence of SEQ ID NO: 6 for HCDR3, the
25 sequence of SEQ ID NO: 7 for LCDR1, the sequence of SEQ ID NO: 8 for LCDR2 and the sequence of SEQ ID NO: 9 for LCDR3; and wherein the heavy chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 10 and the light chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 11.
- 30 7. An inhibitor of gremlin-1 activity according to any of claims 2-6, wherein the antibody binds to an epitope on gremlin-1 comprising at least one residue selected from Ile131, Lys147, Lys148, Phe149, Thr150, Thr151, Arg169, Lys174 and Gln175, wherein the residue numbering is according to SEQ ID NO: 1.
- 35 8. An inhibitor of gremlin-1 activity according to any preceding claim, wherein the bone fracture or bone defect is a delayed-union or non-union fracture.

9. An inhibitor of gremlin-1 activity according to any preceding claim, wherein the bone fracture or bone defect is associated with a disease that affects bone integrity.
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10. An inhibitor of gremlin-1 activity according to claim 9, wherein the disease that affects bone integrity is osteoporosis, osteogenesis imperfecta, diabetes, Paget's disease of bone, rheumatoid arthritis, ankylosing spondylitis, multiple myeloma, primary bone cancer, cancer that metastasises to the bone, diffuse idiopathic skeletal hyperostosis, osteomyelitis, renal disease, Duchenne muscular dystrophy or thalassemia major.
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11. Use of an inhibitor of gremlin-1 activity for the manufacture of a medicament for the treatment of a bone fracture or bone defect.
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12. Use according to claim 11, wherein the inhibitor is an anti-gremlin-1 antibody or functionally active fragment, variant or derivative thereof.
13. Use according to claim 12, wherein wherein the functionally active antibody fragment is a Fab, Fab', F(ab')₂, Fv or scFv.
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14. Use according to any of claims 12-13, wherein the wherein the antibody comprises at least one HCDR sequence selected from SEQ ID NOs: 3, 4, 5 and 6 and/or at least one LCDR sequence selected from SEQ ID NOs: 7, 8 and 9.
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15. Use according to any of claims 12-14, wherein the antibody antibody comprises a heavy chain variable region (HCVR) of SEQ ID NO: 10 and/or a light chain variable region (LCVR) of SEQ ID NO: 11.
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16. Use according to any of claims 12-14, wherein the antibody comprises the sequence of SEQ ID NO: 3 or 4 for HCDR1, the sequence of SEQ ID NO: 5 for HCDR2, the sequence of SEQ ID NO: 6 for HCDR3, the sequence of SEQ ID NO: 7 for LCDR1, the sequence of SEQ ID NO: 8 for LCDR2 and the sequence of SEQ ID NO: 9 for LCDR3; and wherein the heavy chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 10 and the light chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 11.
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17. Use according to any one of claims 12-16, wherein the antibody binds to an epitope on gremlin-1 comprising at least one residue selected from Ile131, Lys147, Lys148, Phe149, Thr150, Thr151, Arg169, Lys174 and Gln175, wherein the residue numbering is according to SEQ ID NO: 1.
18. Use according to any preceding claim, wherein the bone fracture or bone defect is a delayed-union or non-union fracture.
19. Use according to any preceding claim, wherein the bone fracture or bone defect is associated with a disease that affects bone integrity.
20. Use according to claim 19, wherein the disease that affects bone integrity is osteoporosis, osteogenesis imperfecta, diabetes, Paget's disease of bone, rheumatoid arthritis, ankylosing spondylitis, multiple myeloma, primary bone cancer, cancer that metastasises to the bone, diffuse idiopathic skeletal hyperostosis, osteomyelitis, renal disease, Duchenne muscular dystrophy or thalassemia major.
21. A method for the treatment of a bone fracture or bone defect comprising administering a therapeutically effective amount of an inhibitor of gremlin-1 activity.
22. The method according to claim 21, wherein the inhibitor is an anti-gremlin-1 antibody or functionally active fragment, variant or derivative thereof.
23. The method according to claim 22, wherein the functionally active antibody fragment is a Fab, Fab', F(ab')₂, Fv or scFv.
24. The method according to any of claims 22-23, wherein the antibody comprises at least one HCDR sequence selected from SEQ ID NOs: 3, 4, 5 and 6 and/or at least one LCDR sequence selected from SEQ ID NOs: 7, 8 and 9.
25. The method according to any of claims 22-24, wherein the antibody comprises a heavy chain variable region (HCVR) of SEQ ID NO: 10 and/or a light chain variable region (LCVR) of SEQ ID NO: 11.

26. The method according to any of claims 22-24, wherein the antibody comprises the sequence of SEQ ID NO: 3 or 4 for HCDR1, the sequence of SEQ ID NO: 5 for HCDR2, the sequence of SEQ ID NO: 6 for HCDR3, the sequence of SEQ ID NO: 7 for LCDR1, the sequence of SEQ ID NO: 8 for LCDR2 and the sequence of SEQ ID NO: 9 for LCDR3; and wherein the heavy chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 10 and the light chain variable region comprises a sequence having at least 95% identity to the sequence of SEQ ID NO: 11.
27. The method according to any of claims 22-26, wherein the antibody binds to an epitope on gremlin-1 comprising at least one residue selected from Ile131, Lys147, Lys148, Phe149, Thr150, Thr151, Arg169, Lys174 and Gln175, wherein the residue numbering is according to SEQ ID NO: 1.
28. The method according to any preceding claim, wherein the bone fracture or bone defect is a delayed-union or non-union fracture.
29. The method according to any preceding claim, wherein the bone fracture or bone defect is associated with a disease that affects bone integrity.
30. The method according to claim 29, wherein the disease that affects bone integrity is osteoporosis, osteogenesis imperfecta, diabetes, Paget's disease of bone, rheumatoid arthritis, ankylosing spondylitis, multiple myeloma, primary bone cancer, cancer that metastasises to the bone, diffuse idiopathic skeletal hyperostosis, osteomyelitis, renal disease, Duchenne muscular dystrophy or thalassemia major.