Claims

1. A long-acting growth hormone (GH) for use in the treatment of an inflammation-induced disease.

2. The long-acting GH for use of claim 1, wherein the inflammation-induced disease is NAFLD.

3. The long-acting GH for use of claim 1 or 2, wherein the inflammation-induced disease is NASH.

4. The long-acting GH for use of any one of claims 1 to 3, wherein the long-acting GH comprises a growth hormone moiety covalently conjugated to one or more chemical moiety.

5. The long-acting GH for use of claim 4, wherein the chemical moiety is a polymeric moiety.

6. The long-acting GH for use of claim 4 or 5, wherein the chemical moiety is a PEG-based moiety.

7. The long-acting GH for use of any one of claims 4 to 6, wherein the bond between the growth hormone moiety and the chemical moiety is a stable covalent bond.

8. The long-acting GH for use of any one of claims 4 to 6, wherein the bond between the growth hormone moiety and the chemical moiety is a reversible covalent bond.

9. The long-acting GH for use of any one of claims 1 to 3, wherein the long-acting GH comprises growth hormone is non-covalently embedded or encapsulated in a polymer or lipid-comprising matrix.

10. The long-acting GH for use of any one of claims 1 to 3, wherein the long-acting growth hormone comprises a growth hormone moiety fused to at least one natural or unnatural amino acid sequence.

11. The long-acting GH for use of any one of claims 1 to 10, wherein administration of the long-acting GH triggers the re-balancing of macrophage phenotypes between M1 and M2.

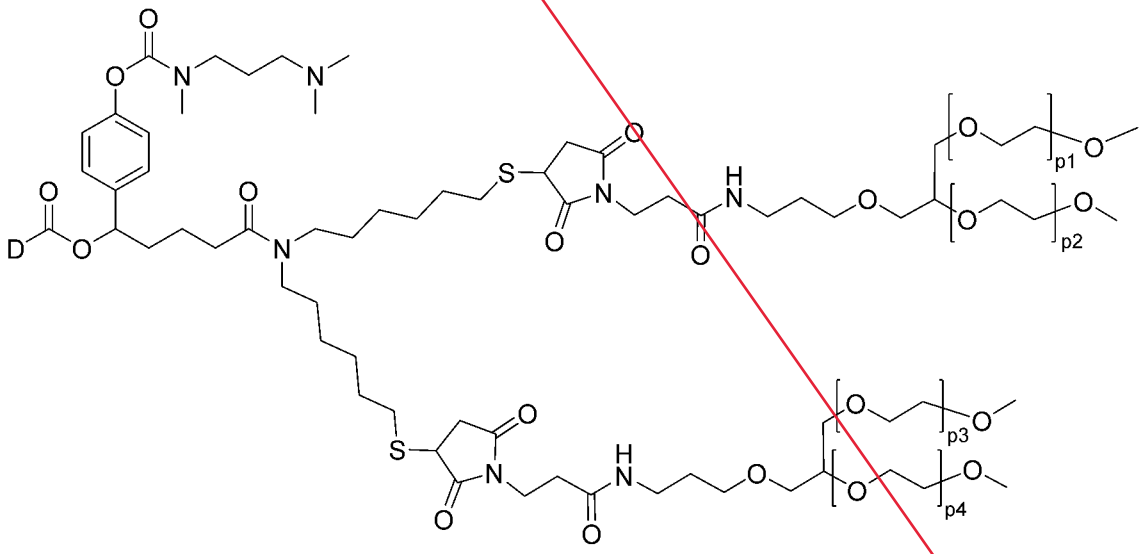
12. The long-acting GH for use of any one of claims 1 to 11, wherein administration of the long-acting growth hormone leads to a change in one or more markers of hepatic inflammation selected from the group consisting of cytokines, chemokines and other transcriptional and histological markers.

13. The long-acting GH for use of any one of claims 1 to 12, wherein the long-acting GH inhibits recruitment of inflammatory monocytes to the site of inflammation.

14. The long-acting GH for use of any one of claims 1 to 13, wherein administration of the long-acting growth hormone leads to a reduction in steatosis.

15. The long-acting GH for use of any one of claims 1 to 14, wherein the long-acting GH is administered to the patient once a week.

16. The long-acting GH for use of any one of claims 1 to 6, 8 or 11 to 15, wherein the long-acting GH is of formula (C-ii)



(C-ii),

wherein

-D is a hGH moiety connected to the rest of the molecule through the nitrogen of an amine functional group of -D; and

p1, p2, p3 and p4 are independently an integer ranging from 200 to 250.

17. The long-acting GH for use of claim 16, wherein p1, p2, p3 and p4 of formula (C-ii) are independently an integer ranging from 210 to 240.

18. The long-acting GH for use of claim 16 or 17, wherein p1, p2, p3 and p4 of formula (C-ii) are independently an integer ranging from 220 to 240.

19. The long-acting GH for use of any one of claims 16 to 18, wherein -D is a hGH moiety of SEQ ID NO:1.

20. The long-acting GH for use of any one of claims 16 to 19, wherein -D is connected to the rest of the molecule through a nitrogen of an amine functional group provided by a lysine side chain of -D.

21. The long-acting GH for use of any one of claims 1 to 4, 7 or 11 to 15, wherein the long-acting GH is somapacitan.

22. The long-acting GH for use of any one of claims 1 to 21, wherein the treatment comprises the steps of

(a) administering at least a first dose of the long-acting GH to a patient having an inflammation-induced disease;

(b) measuring Insulin-like Growth Factor-1 (IGF-1) levels; and

(c) reducing the dose of the long-acting GH by at least 5% if IGF-1 levels are above a standard deviation score of +3 and increasing the dose of the long-acting GH by at least 5% if IGF-1 levels are below a standard deviation score of 0.

23. The long-acting GH for use of any one of claims 1 to 21, wherein the treatment comprises the steps of

(a) administering at least a first dose of the long-acting GH to a patient having an inflammation-induced disease;

(b) measuring biomarkers indicative for M1 and M2 macrophages;

(c) adjusting the dose of the long-acting GH based on the macrophage phenotype change by M1 reduction or M2 induction indicated by said biomarkers.

24. The long-acting GH for use of claim 23, wherein the biomarkers indicative of M2 macrophages are selected from the group consisting of IL-2, IL-4, IL-10, IL-13, CCL17, CCL18, CCL22, CCL24, CCL13, CCL16, CXCR1, CXCR2, CD14, CD23, CD36, CD163, mannose receptor (CD206), scavenger receptor A, Chi3l3/Ym1, Retnla/Fizz-1 and arginase-1.

25. The long-acting GH for use of claim 23 or 24, wherein dose adjustments in step (c) are accompanied by measuring IGF-1 levels and adjustments of the dose of the long-acting GH are such that IGF-1 levels are in a range from 0 to +3 standard deviation scores.

26. The long-acting GH for use of any one of claims 23 to 25, wherein steps (b) and (c) are repeated until macrophage rebalancing is achieved.

Claims

1. Use of a long-acting growth hormone (GH) in the manufacture of a medicament for the treatment of an inflammation-induced disease.

2. The use of claim 1, wherein the inflammation-induced disease is non-alcoholic fatty liver disease (NAFLD).

3. The use of claim 1 or 2, wherein the inflammation-induced disease is non-alcoholic steatohepatitis (NASH).

4. The use of any one of claims 1 to 3, wherein the long-acting GH comprises a growth hormone moiety covalently conjugated to one or more chemical moiety.

5. The use of claim 4, wherein the chemical moiety is a polymeric moiety.

6. The use of claim 4 or 5, wherein the chemical moiety is a PEG-based moiety.

7. The use of any one of claims 4 to 6, wherein the bond between the growth hormone moiety and the chemical moiety is a stable covalent bond.

8. The use of any one of claims 4 to 6, wherein the bond between the growth hormone moiety and the chemical moiety is a reversible covalent bond.

9. The use of any one of claims 1 to 3, wherein the long-acting GH comprises growth hormone non-covalently embedded or encapsulated in a polymer or lipid-comprising matrix.

10. The use of any one of claims 1 to 3, wherein the long-acting growth hormone comprises a growth hormone moiety fused to at least one natural or unnatural amino acid sequence.

11. The use of any one of claims 1 to 10, wherein administration of the long-acting GH triggers the re-balancing of macrophage phenotypes between M1 and M2.

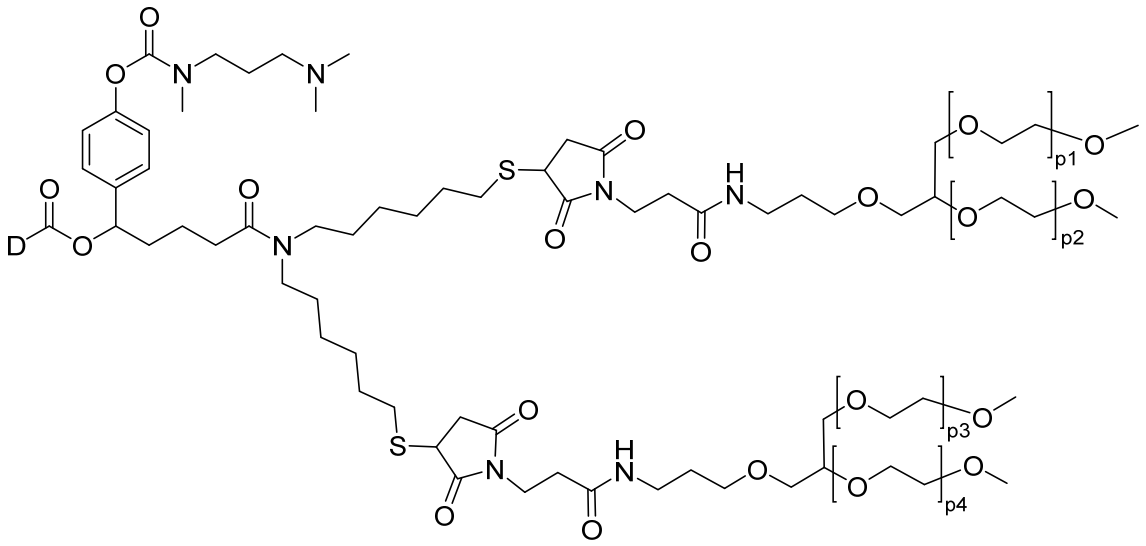
12. The use of any one of claims 1 to 11, wherein administration of the long-acting growth hormone leads to a change in one or more markers of hepatic inflammation selected from the group consisting of cytokines, chemokines and other transcriptional and histological markers.

13. The use of any one of claims 1 to 12, wherein the long-acting GH inhibits recruitment of inflammatory monocytes to the site of inflammation.

14. The use of any one of claims 1 to 13, wherein administration of the long-acting growth hormone leads to a reduction in steatosis.

15. The use of any one of claims 1 to 14, wherein the long-acting GH is to be administered to the patient once a week.

16. The use of any one of claims 1 to 6, 8 or 11 to 15, wherein the long-acting GH is of formula (C-ii)



(C-ii),

wherein

-D is a hGH moiety connected to the rest of the molecule through the nitrogen of an amine functional group of -D; and

p1, p2, p3 and p4 are independently an integer ranging from 200 to 250.

17. The use of claim 16, wherein p1, p2, p3 and p4 of formula (C-ii) are independently an integer ranging from 210 to 240.

18. The use of claim 16 or 17, wherein p1, p2, p3 and p4 of formula (C-ii) are independently an integer ranging from 220 to 240.

19. The use of any one of claims 16 to 18, wherein -D is a hGH moiety of SEQ ID NO:1.

20. The use of any one of claims 16 to 19, wherein -D is connected to the rest of the molecule through a nitrogen of an amine functional group provided by a lysine side chain of -D.

21. The use of any one of claims 1 to 4, 7 or 11 to 15, wherein the long-acting GH is somapacitan.

22. The use of any one of claims 1 to 21, wherein at least a first dose of the long-acting GH is to be administered to a patient having an inflammation-induced disease, wherein the treatment comprises the steps of

(a) measuring Insulin-like Growth Factor-1 (IGF-1) levels; and
(b) reducing the dose of the long-acting GH by at least 5% if IGF-1 levels are above a standard deviation score of +3 and increasing the dose of the long-acting GH by at least 5% if IGF-1 levels are below a standard deviation score of 0.

23. The use of any one of claims 1 to 21, wherein at least a first dose of the long-acting GH is to be administered to a patient having an inflammation-induced disease, wherein the treatment comprises the steps of

(a) measuring biomarkers indicative for M1 and M2 macrophages;
(b) adjusting the dose of the long-acting GH based on the macrophage phenotype change by M1 reduction or M2 induction indicated by said biomarkers.

24. The use of claim 23, wherein the biomarkers indicative of M2 macrophages are selected from the group consisting of IL-2, IL-4, IL-10, IL-13, CCL17, CCL18, CCL22, CCL24, CCL13, CCL16, CXCR1, CXCR2, CD14, CD23, CD36, CD163, mannose receptor (CD206), scavenger receptor A, Chi3l3/Ym1, Retnla/Fizz-1 and arginase-1.

25. The use of claim 23 or 24, wherein dose adjustments in step (b) are accompanied by measuring IGF-1 levels and adjustments of the dose of the long-acting GH are such that IGF-1 levels are in a range from 0 to +3 standard deviation scores.

26. The use of any one of claims 23 to 25, wherein steps (a) and (b) are repeated until macrophage rebalancing is achieved.