

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A composition comprising a polymer and a natural or synthetic peptide or protein (NSPP), wherein the polymer comprises:
 - 5 a first monomer for binding water;
 - a second monomer for imparting mechanical properties to said hydrogel;
 - a third monomer for binding to a natural or synthetic peptide or protein (NSPP); and
 - 10 a fourth monomer for imparting phase-transition behaviour;and wherein the natural or synthetic peptide or protein (NSPP) is Thymosin beta-4 or a functional homolog thereof.
2. The composition according to claim 1, wherein the first monomer is selected from: polyethers, polyvinyl alcohol (PVA); poly(vinyl pyrrolidone) (PVP);
15 poly(amino acids) and dextran.
3. The composition according to claim 2, wherein the polyethers are selected from: polyethylene glycol (PEG), oligo(ethylene glycol) (OEG), polyethylene
20 oxide (PEO), polyethylene oxide-co-propylene oxide (PPO), co-polyethylene oxide block or random copolymers thereof.
4. The composition according to claim 2, wherein the first monomer is oligo (ethylene) glycol monomethyl ether methacrylate (OEGMA).
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5. The composition according to any one of the preceding claims, wherein the second monomer is a methacrylate, or a random co-polymer comprising a methacrylate.
- 30 6. The composition according to any one of the preceding claims, wherein the second monomer is selected from: hydroxyethyl methacrylate (HEMA), a hydroxyethyl methacrylate poly(lactic acid) copolymer (HEMA-PLA), poly(lactic acid), poly(caprolactone), poly(glycolide), poly(glycolide-co-lactide) or poly(glycolide-co-caprolactone).

7. The composition according any one of the preceding claims, wherein the second monomer is hydroxyethyl methacrylate poly(lactic acid) (HEMA-PLA).
- 5 8. The composition according to any one of the preceding claims, wherein the third monomer has electrophilic functional groups for binding to said NSPP.
9. The composition according to any one of the preceding claims, wherein the third monomer is selected from: N-hydroxysulfosuccinimide (SNHS), N-
10 hydroxyethoxylated succinimide (ENHS), and N-acryloxysuccinimide (NAS).
10. The composition according to any one of the preceding claims, wherein the third monomer is N-acryloxysuccinimide (NAS).
- 15 11. The composition according to any one of the preceding claims, wherein the fourth monomer is selected from: poly(ethylene oxide)/poly(propylene oxide) and poly(N-isopropylacrylamide) (PNIPAAm) homopolymers and copolymers.
12. The composition according to any one of the preceding claims, wherein the
20 fourth monomer is (N-isopropylacrylamide).
13. The composition according to any one of the preceding claims wherein the polymer comprises the first monomer in an amount of from about 3 to about 8 mol%, preferably about 5 mol%.
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14. The composition according to any one of the preceding claims, wherein the polymer comprises the second monomer in an amount of from about 5 to about 9 mol%, preferably about 7 mol%.
- 30 15. The composition according to any one of the preceding claims, wherein the polymer comprises the third monomer in an amount of at least about 7 mol%.
16. The composition according to any one of the preceding claims, wherein the polymer comprises:

the first monomer in an amount of from about 3 to about 8 mol%,
the second monomer in an amount of from about 5 to about 9 mol%,
the third monomer in an amount of at least about 7 mol%, and
the fourth monomer in an amount which makes up the remainder to
5 100% of the polymer composition.

17. The composition according to any one of the preceding claims, wherein the
polymer comprises the fourth monomer in an amount from about 60 to about
85 mol%.

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18. The composition according to claim 1, wherein:

the first monomer is OEGMA,
the second monomer is HEMA-PLA,
the third monomer is NAS, and
15 the fourth monomer is NIPAAm,

and wherein the polymer comprises:

OEGMA in an amount of from about 3 to about 8 mol%,
HEMA-PLA in an amount of from about 5 to about 9 mol%,
NAS in an amount of greater than about 7 mol% and
20 NIPAAm in an amount of up to about 85 mol%.

19. The composition according to claim 18, wherein the polymer comprises:
OEGMA in an amount of about 5 mol%,
HEMA-PLA in an amount of from about 7 mol%,
25 NAS in an amount of greater than about 7 mol% and
NIPAAm in an amount of up to about 81 mol%.

20. The composition according to any one of the preceding claims, wherein the
natural or synthetic peptide or protein (NSPP) is Thymosin beta-4.

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21. The composition according to any one of the preceding claims, comprising
equimolar amounts of the polymer and Thymosin beta-4.

22. The composition according to any one of the preceding claims, wherein the

concentration of the polymer is from about 100 mg/mL to about 300 mg/mL of the composition.

- 5 23. A hydrogel comprising the composition according to any one of claims 1 to 22 and water, wherein the binding of the NSPP to the third monomer crosslinks the polymer, thereby forming a hydrogel, with the water contained therein.
- 10 24. A method of making a hydrogel, the method comprising adding water to the composition of any one of claims 1 to 22.
25. A method of making a hydrogel, the method comprising mixing an aqueous solution of the composition of any one of claims 1 to 22 with an aqueous solution of the natural or synthetic peptide or protein (NSPP).
- 15 26. A method according to claim 25, wherein the hydrogel is formed at body temperature.
- 20 27. A method according to claim 25 or claim 26, wherein the hydrogel is formed following administration of the composition and the NSPP to a mammal by injection.
- 25 28. Use of a composition according to any one of claims 1 to 22 in the manufacture of a hydrogel for: repair and/or restoration of hard or soft body tissue; wound healing; temporary wrinkle reduction; temporarily lifting the base of a scar and promoting healing; supporting dermal connective tissue formation in scar tissue after a surgical intervention and promoting healing; supporting dermal connective tissue formation in scar management of post burn injuries; supporting vascular ingrowth in an acute dermal defect with bleeding and promoting healing; filling a surgically generated dermal cavity; supporting a skin grafting operation; physically delivering bone graft substitutes; filling a prosthetic; use as a filler with no tissue-inductive properties; supporting and repairing periodontal tissue after tooth extraction; or temporarily lifting a periodontal ligament tissue and/or supporting periodontal ligament tissue grafting.
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29. Use of a hydrogel according to claim 23 in the manufacture of a medicament for repair and/or restoration of tissue.
- 5 30. A method for: repair and/or restoration of hard or soft body tissue; wound healing; temporary wrinkle reduction; temporarily lifting the base of a scar and promoting healing; supporting dermal connective tissue formation in scar tissue after a surgical intervention and promoting healing; supporting dermal connective tissue formation in scar management of post burn injuries; 10 supporting vascular ingrowth in an acute dermal defect with bleeding and promoting healing; filling a surgically generated dermal cavity; supporting a skin grafting operation; physically delivering bone graft substitutes; filling a prosthetic; use as a filler with no tissue-inductive properties; supporting and repairing periodontal tissue after tooth extraction; or temporarily lifting a 15 periodontal ligament tissue and/or supporting periodontal ligament tissue grafting, the method comprising administering to a mammal a composition according to any one of claims 1 to 22.
- 20 31. A method of repair and/or restoration of tissue, the method comprising administering to a mammal a hydrogel according to claim 23.
- 25 32. A method according to claim 30 or claim 31, wherein the administration step is made by injection or by administering an aerosol, thereby to form a hydrogel at the body temperature of the mammal.
- 30 33. A composition according to any one of claims 1 to 22 for use in: the repair and/or restoration of tissue; wound healing; temporary wrinkle reduction; temporarily lifting the base of a scar and promoting healing; supporting dermal connective tissue formation in scar tissue after a surgical intervention and promoting healing; supporting dermal connective tissue formation in scar management of post burn injuries; supporting vascular ingrowth in an acute dermal defect with bleeding and promoting healing; filling a surgically generated dermal cavity; supporting a skin grafting operation; physically delivering bone graft substitutes; filling a prosthetic; use as a filler with no

tissue-inductive properties; supporting and repairing periodontal tissue after tooth extraction; or temporarily lifting a periodontal ligament tissue and/or supporting periodontal ligament tissue grafting.

- 5 34. A composition for use according to claim 33, wherein the filler has no tissue-inductive properties.
35. A composition according to any one of claims 1 to 22 for use in supporting and repairing periodontal tissue after tooth extraction.
- 10 36. A composition according to any one of claims 1 to 22 for use in temporarily lifting a periodontal ligament tissue and/or supporting periodontal ligament tissue grafting.
37. A hydrogel according to claim 23 for use in repair and/or restoration of tissue.
38. A composition for use according to any one of claims 33 to 37, wherein the administration step is made by injection or by administering an aerosol, thereby to form a hydrogel at the body temperature of the mammal.
- 20 39. A hydrogel for use according to claim 37, wherein the administration step is made by injection or by administering an aerosol, thereby to form a hydrogel at the body temperature of the mammal.
40. A kit for forming a hydrogel, the kit comprising:
 a polymer and a natural or synthetic peptide or protein (NSPP),
 wherein the polymer comprises:
 a first monomer for binding water;
 a second monomer for imparting mechanical properties to said
30 hydrogel;
 a third monomer for binding to a natural or synthetic peptide or protein (NSPP); and
 a fourth monomer for imparting phase-transition behaviour;
 and wherein the natural or synthetic peptide or protein (NSPP) is

Thymosin beta-4 or a functional homolog thereof.

41. The kit according to claim 40, further comprising water in a separate container.
- 5 42. A kit for forming a hydrogel, comprising in separate containers:
a natural or synthetic peptide or protein (NSPP); and
a composition,
wherein the composition comprises:
a first monomer for binding water;
10 a second monomer for imparting mechanical properties to said
hydrogel;
a third monomer for binding to a natural or synthetic peptide or
protein (NSPP); and
a fourth monomer for imparting phase-transition behaviour;
15 wherein the natural or synthetic peptide or protein (NSPP) is
Thymosin beta-4 or a functional homolog thereof;
and wherein the NSPP and the second monomer are crosslinked,
thereby enabling formation of the hydrogel when the composition is contacted
with water.
- 20 43. The kit according to claim 42 wherein one or both of the NSPP and the
composition are in solid form.
44. The kit according to claim 42 or claim 43 further comprising water in a
25 separate container.
45. The kit according to any one of claims 42 to 44 further comprising instructions
for the sequential or simultaneous administration of the components of the kit.
- 30 46. The kit according to any one of claims 42 to 45, configured such that the
composition, the NSPP and water are mixed together when dispensed.