therefore a widely recognized need for peptide hydrogels that are easily formed, non-toxic and have a sufficiently high rigidity for standard applications.

SUMMARY

It is therefore desirable to provide a biocompatible compound that is capable of forming a hydrogel that meets at least some of the above requirements to a higher extent than currently available hydrogels and that is not restricted by the above mentioned limitations.

The objects of the present disclosure are solved by an amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:

a hydrophobic sequence stretch of n aliphatic amino acids, wherein *n* is an integer from 2 to 15, and

a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 5.

In one embodiment the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus wherein the N-terminus is protected by a protecting group, wherein said protecting group preferably is an acetyl group.

In one embodiment , the amphiphilic peptide and/or peptoid has a C-terminus, which, if a basic polar amino acid is located at the C-terminus, is preferably amidated.

In one embodiment , n is an integer from 2 to 6.

In one embodiment , m is an integer from 1 to 2.

In one embodiment, the amphiphilic peptide and/or peptoid consists of o amphiphilic sequences, as defined above, which amphiphilic sequences are linked to each other, o being an integer from 1 to 50.

In one embodiment , for a given amphiphilic peptide and/or peptoid, said aliphatic amino acids and said hydrophilic amino acids are either D-amino acids or L-amino acids.

In one embodiment , each of the hydrophilic amino acids has a polar group which is independently selected from a hydroxyl, an ether, a carboxyl, an imido, an amido, an ester, an amino, a guanidino, a thio, a thioether, a seleno, and a telluro group.

In one embodiment, said aliphatic amino acids arranged in order of identical amino acid size have a sequence with a length of 2 to 4 amino acids.

In one embodiment, said aliphatic amino acids arranged in an order of identical size have a sequence selected from LLLL, LLL, LL, IIII, III, II, VVVV, VVV, VV, AAAA, AAA, AA, GGGG, GGG, and GG.

In one embodiment, the amphiphilic sequence undergoes a conformational change during self-assembly, preferably a conformational change from a random coil conformation to a helical intermediate structure to a final beta conformation.
In one embodiment, the conformational change is concentration dependent.

In one embodiment, the amphiphilic linear sequence comprises a single hydrophilic and at least two aliphatic amino acids.

In one embodiment, the amphiphilic sequence is one of SEQ ID NO: 1 –42.

It should be noted that any of the amphiphilic sequences may carry a protecting group at the N-terminus or the C-terminus or both. For example, SEQ ID NO:1-42 may all carry an acetyl group as protecting group at the N-terminus. As a further example, SEQ ID NO: 19 (LIVAGK) may carry an amido-group as protecting group at the C-terminus, and additionally it may have an acetyl group at the N-terminus as protecting group.

In one embodiment, said amphiphilic peptide and/or peptoid is stable in aqueous solution at physiological conditions at ambient temperature for a period of time in the range from 1 day to at least 6 months, preferably to at least 8 months more preferably to at least 12 months.

In one embodiment, the amphiphilic peptide and/or peptoid is stable in aqueous solution at physiological conditions, at a temperature up to 90 °C, for at least 1 hour.

The objects of the present disclosure are solved by a hydrogel comprising the amphiphilic peptide and/or peptoid according to the present disclosure.

In one embodiment, the hydrogel is stable in aqueous solution at ambient temperature for a period of at least 7 days, preferably at least 2 to 4 weeks, more preferably at least 1 to 6 months.

In one embodiment, the hydrogel is characterized by a storage modulus G' to loss modulus G'' ratio that is greater than 2.

In one embodiment, the hydrogel is characterized by a storage modulus G' from 100 Pa to 80,000 Pa at a frequency in the range of from 0.02 Hz to 16 Hz.

In one embodiment, the hydrogel has a higher mechanical strength than collagen or its hydrolyzed form (gelatin).

In one embodiment, the hydrogel according to the present disclosure comprises fibers of the amphiphilic peptide and/or peptoid as defined above, said fibers defining a network that is capable of entrapping at least one of a microorganism, a virus particle, a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound.

In one embodiment, the hydrogel comprises at least one of a microorganism, a virus particle, a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound entrapped by the network of fibers of the amphiphilic polymer.

In one embodiment, the fibers of the amphiphilic polymer are coupled to the at least one of a microorganism, a virus particle, a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound entrapped by the network of fibers of the amphiphilic polymer.

In one embodiment, the hydrogel is comprised in at least one of a fuel cell, a solar cell, an electronic cell, a biosensing device, a medical device, an implant, a pharmaceutical composition and a cosmetic composition.

In one embodiment, the hydrogel according to the present disclosure is for use in at least one of the following: release of a pharmaceutically active compound, medical tool kit, a fuel cell, a solar cell, an electronic cell, tissue regeneration, stem cell therapy and gene therapy.

In one embodiment, the hydrogel according to the present disclosure is injectable.

The objects of the present disclosure are solved by a method of preparing a hydrogel, the method comprising dissolving an amphiphilic peptide and/or peptoid according to the present disclosure in an aqueous solution.

In one embodiment, the dissolved amphiphilic peptide and/or peptoid in aqueous solution is further exposed to temperature, wherein the temperature is in the range from 20 °C to 90 °C, preferably from 20 °C to 70 °C.

In one embodiment, the amphiphilic peptide and/or peptoid is dissolved at a concentration from 0.01 µg/ml to 100 mg/ml, preferably at a concentration from 1 mg/ml to 50 mg/ml, more preferably at a concentration from about 1 mg/ml to about 20 mg/ml.

The objects of the present disclosure are also solved by a surgical implant, or stent, the surgical implant or stent comprising a peptide and/or peptoid scaffold, wherein the peptide and/or peptoid scaffold is formedby a hydrogel according to the present disclosure.

The objects of the present disclosure are also solved by a pharmaceutical and/or cosmetic composition and/or a biomedical device and/or electronic device comprising the amphiphilic peptide and/or peptoid according to the present disclosure.

In one embodiment, the pharmaceutical and/or cosmetic composition and/or the biomedical device, and/or the electronic devices as defined above, further comprises a pharmaceutically active compound.

In one embodiment, the pharmaceutical and/or cosmetic composition as defined above, further comprises a pharmaceutically acceptable carrier.

The objects of the present disclosure are also solved by a kit of parts, the kit comprising a first container with an amphiphilic peptide and/or peptoid according to the present disclosure and a second container with an aqueous solution.

In one embodiment, the aqueous solution of the second container further comprises a pharmaceutically active compound.

In one embodiment, the first container with an amphiphilic peptide and/or peptoid further comprises a pharmaceutically active compound.

The objects of the present disclosure are solved by a method of tissue regeneration comprising the steps:

providing a hydrogel as defined above,
exposing said hydrogel to cells which are to form regenerated tissue,
allowing said cells to grow on said hydrogel.

In one embodiment, the method as defined above is performed in-vitro or in-vivo.

In one embodiment, the method as defined above is performed in vivo, wherein, in step a), said hydrogel is provided at a place in a body where tissue regeneration is intended.
In one embodiment, said step a) is performed by injecting said hydrogel at a place in the body where tissue regeneration is intended.

The present disclosure provides an amphiphilic peptide and/or peptoid capable of forming a hydrogel. The amphiphilic peptide and/or peptoid includes a hydrophobic and a hydrophilic sequence. This hydrophobic sequence has a length of *n* L- or D- amino acids. *n* is an integer, which may typically range from 2 to about 15. The hydrophilic sequence has a polar and/or charged moiety comprising *m* L- or D- amino acids. *m* is an integer from 1 to 5. Each of the *m* aliphatic amino acids carries an independently selected polar group. The amphiphilic linear sequence has a net charge at physiological pH and a N-terminus carrying a protecting group. The protecting group can be an acetyl group. The amphiphilic peptide and/or peptoid may comprise *o* linked amphiphilic peptide and/or peptoid sequences of *n* hydrophobic and m hydrophilic L- and D- amino acids, wherein *o* is an integer from 1 to about 50. The amphiphilic peptide and/or peptoid may consist of *o* linked amphiphilic peptide and/or peptoid sequences of *n* hydrophobic and m hydrophilic L- and D- amino acids. The value of *n* may be an integer from 2 to about 15. The value of *m* may be 1 to 5. The charged and/or polar group of each of the *m* hydrophilic L- and D- amino acids may be independently selected from a hydroxyl, an ether, a carboxyl, an amido, an ester, an amino, a guanidino, a thio, a thioether, a seleno, and a telluro group. The charged or polar moiety of the hydrophilic sequence may comprise *m* L-or D-amino acids selected from the group consisting of aspartic

the C-terminus of the amphiphilic peptide and/or peptoid. The remaining non-polar amino acid of the non-polar moiety of *n-m* amino acids may be one of alanine, valine and glycine. The amphiphilic linear sequence may undergo a conformational change from a random coil conformation to a helical conformation during self-assembly. The conformational change may be concentration dependent. The non-polar moiety of the amphiphilic linear sequence may comprise at least one L-or D-amino acid selected from the group consisting of glycine, homoallylglycine, homopropargylglycine, alanine, valine, leucine, norleucine and isoleucine. The amphiphilic linear sequence may comprise a single polar and/or charge and a single non-polar moiety.` The amphiphilic linear sequence may have a positive or a negative net charge. The net charge may be from about -1 to about -4 or from about +5 to about +1. The net charge may be from about -1 to about -2. The net charge may be -2. The net charge may be +1 or +2or +5. The amphiphilic peptide and/or peptoid may be stable in aqueous solution at physiological conditions at ambient temperature for a period of time in the range from 1 day to at least 6 months, preferably at least 8 months, more preferably at least 12 months. The amphiphilic peptide and/or peptoid may be stable in aqueous solution at physiological conditions at a temperature to 90 °C for at least 1 hour.

In an aspect, there is provided an amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:

a hydrophobic sequence stretch of *n* aliphatic amino acids, wherein *n* is an integer from 2 to 6, wherein all or a portion of the aliphatic amino acids of the hydrophobic sequence stretch are arranged in an order of decreasing amino acid size in the direction from N- to C-terminus of the amphiphilic peptide and/or peptoid, wherein the size of the aliphatic amino acids is defined as I = L > V > A > G, and

a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2, wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,

wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,

and wherein the N-terminus is protected by an acetyl group.

In another aspect, there is provided an amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:
a hydrophobic sequence stretch of *n* aliphatic amino acids, wherein *n* is an integer from 2 to 6, and
a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2,
wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,
wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,
wherein the N-terminus is protected by an acetyl group,
wherein all or a portion of the aliphatic amino acids of the hydrophobic sequence stretch are arranged in an order of identical amino acid size in the amphiphilic peptide and/or peptoid,
and said aliphatic amino acids arranged in order of identical amino acid size have a sequence with a length of 2 to 4 amino acids,
wherein said aliphatic amino acids arranged in an order of identical size have a sequence selected from LLLL, LLL, LL, IIII, III, II, VVVV, VVV, VV, AAAA, AAA, AA, GGGG, and GG.

In another aspect, there is provided an amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:
a hydrophobic sequence stretch with the amino acid sequence AIVAG, and
a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2,
wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,
wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,
and wherein the N-terminus is protected by an acetyl group.

The disclosure provides a hydrogel. The hydrogel includes an amphiphilic peptide and/or peptoid as defined above. The hydrogel may be stable in aqueous solution at ambient temperature for a period of at least 7 days. The hydrogel may be stable in aqueous solution at ambient temperature for a period of at least 2 to 4 weeks. The hydrogel may be stable in aqueous solution at ambient temperature for a period of at least 1 to 6 months. The hydrogel mechanical property may be characterized by a loss modulus G'' to storage modulus G' ratio that is less than1. The hydrogel may be characterized by magnitude of storage modulus G' greater than loss modulus G" by minimum factor of 1.5. The hydrogel may be characterized by a storage modulus G' of from 100 Pa to 80,000 Pa at a frequency in the range of from 0.02 Hz to 16 Hz. The hydrogel may be characterized by higher storage modulus G' with increase in the concentration of peptide. The hydrogel may have a higher mechanical strength than collagen or hydrolyzed form (gelatin). The hydrogel may comprise fibers of an amphiphilic peptide and/or peptoid described herein. The fibers may define a network that is capable of entrapping at least one of a microorganism, a virus particle, a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound. The hydrogel may comprise at least one of a microorganism, a virus particle,

a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound entrapped by the network of fibers of the amphiphilic polymer. The fibers of the amphiphilic polymer may be coupled to the at least one of a microorganism, a virus particle, a peptide, a peptoid, a protein, a nucleic acid, an oligosaccharide, a polysaccharide, a vitamin, an inorganic molecule, a synthetic polymer, a small organic molecule or a pharmaceutically active compound entrapped by the network of fibers of the amphiphilic polymer. The hydrogel may be comprised in at least one of a fuel cell, a solar cell, a electronic cell, a biosensing device, a medical device, an implant, a pharmaceutical composition, drug delivery system, tissue culture medium, biosensor devices and a cosmetic composition. The hydrogel may be for at least one of release of a pharmaceutically active compound, medical tool kit, a fuel cell, a solar cell, an electronic cell, tissue regeneration, stem cell therapy and gene therapy.

In another aspect, there is provided a hydrogel comprising the amphiphilic peptide and/or peptoid as defined herein,
wherein, preferably, the hydrogel is stable in aqueous solution at ambient temperature for a period of at least 7 days, the hydrogel is characterized by a storage modulus G' to loss modulus G'' ratio that is greater than 2, wherein, preferably, the hydrogel has a higher mechanical strength than collagen or its hydrolyzed form (gelatin).

In some embodiments the hydrogel may be used for tissue regeneration, drug release or gene therapy.

The disclosure provides a method of preparing a hydrogel. The method includes providing an amphiphilic peptide and/or peptoid as defined above. The method further includes dissolving and/or dispersing the amphiphilic peptide and/or peptoid in an aqueous solution. The dissolved/dispersed amphiphilic peptide and/or peptoid in aqueous solution may be further exposed to a temperature. The temperature may be selected in the range from about 20 °C to about 90, preferably from 20°C to 70°C. The amphiphilic peptide and/or peptoid may be dissolved at a concentration from about 0.01 μg/ml to about 100 mg/ml. The amphiphilic peptide and/or peptoid may be dissolved at a concentration from about 1 mg/ml to about 50 mg/ml. The amphiphilic peptide and/or peptoid may be dissolved and/or dispersed at a concentration from about 1 mg/ml to about 30 mg/ml.

In another aspect, there is provided a method of preparing a hydrogel, the method comprising dissolving an amphiphilic peptide and/or peptoid as defined herein in an aqueous solution, wherein the dissolved amphiphilic peptide and/or peptoid in aqueous solution is further exposed to temperature, wherein the temperature is in the range from 20 °C to 90 °C, wherein, preferably, the amphiphilic peptide and/or peptoid is dissolved at a concentration from 0.01 µg/ml to 100 mg/ml.

The disclosure provides a surgical implant or stent. The surgical implant or stent includes a peptide and/or peptoid scaffold. The peptide and/or peptoid scaffold is defined by a hydrogel as defined above.

In another aspect, there is provided a surgical implant, or stent, the surgical implant or stent comprising a peptide and/or peptoid scaffold, wherein the peptide and/or peptoid scaffold is formed by a hydrogel as defined herein.

The disclosure provides a pharmaceutical and/or cosmetic composition. The pharmaceutical and/or cosmetic composition includes the amphiphilic peptide and/or peptoid as defined above. The pharmaceutical and/or cosmetic composition may comprise

a pharmaceutically active compound. The pharmaceutical and/or cosmetic composition may comprise a pharmaceutically acceptable carrier.

In another aspect, there is provided a pharmaceutical and/or cosmetic composition and/or a biomedical device and/or electronic device comprising the amphiphilic peptide and/or peptoid as defined herein, preferably, further comprising a pharmaceutically active compound and/or further comprising a pharmaceutically acceptable carrier.

The disclosure provides a kit of parts. The kit includes a first container and a second container. The first container includes a peptide and/or peptoid as defined above. The second container includes an aqueous solution. The aqueous solution of the second container may further comprise a pharmaceutically active compound. The fist container with an amphiphilic peptide and/or peptoid may further comprise a pharmaceutically active compound.

In another aspect, there is provided a method of tissue regeneration comprising the steps:

a) providing a hydrogel as defined herein,

b) exposing said hydrogel to cells which are to form regenerated tissue,

c) allowing said cells to grow on said hydrogel,

which method is performed *in-vitro*.

Other objects and features of the present disclosure will become apparent to those skilled in the art upon review of the following description of specific embodiments of the disclosure in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1A 1J represent a sorted list of some exemplary peptides of the invention capable of forming hydrogels. These peptides are embodiments in which the entire peptide consists of a single linear amphiphilic sequence. Peptides which are forming hydrogels are named with a short code, but their individual sequence is disclosed. The peptides of these examples consist

of a sequence of natural amino acids containing 3 to 7 amino acids. The N-terminus is acetylated which removes the charge that would otherwise restrain the amphiphilic character of the peptides.

Figure 2 depicts gelation pictures for peptide based hydrogels at lowest concentrations.

Figure 3 depicts gelation pictures for Ac-AS-6 (L) at concentrations of 5 mg/ml, 10 mg/ml, 15 mg/ml.

Figure 4 depicts a hypothesis of self-assembly from peptide monomers to supramolecular network of condensed fibers. (A) Assembly is believed to initiate with antiparallel pairing of

Claims

1. An amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:

   a hydrophobic sequence stretch of *n* aliphatic amino acids, wherein *n* is an integer from 2 to 6, wherein all or a portion of the aliphatic amino acids of the hydrophobic sequence stretch are arranged in an order of decreasing amino acid size in the direction from N- to C-terminus of the amphiphilic peptide and/or peptoid, wherein the size of the aliphatic amino acids is defined as I = L > V > A > G,
   and
   a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2, wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,
   wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,
   and wherein the N-terminus is protected by an acetyl group.

2. An amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:

   a hydrophobic sequence stretch of *n* aliphatic amino acids, wherein *n* is an integer from 2 to 6, and
   a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2,
   wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,
   wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,
   wherein the N-terminus is protected by an acetyl group,
   wherein all or a portion of the aliphatic amino acids of the hydrophobic sequence stretch

are arranged in an order of identical amino acid size in the amphiphilic peptide and/or peptoid,
and said aliphatic amino acids arranged in order of identical amino acid size have a sequence with a length of 2 to 4 amino acids,
wherein said aliphatic amino acids arranged in an order of identical size have a sequence selected from LLLL, LLL, LL, IIII, III, II, VVVV, VVV, VV, AAAA, AAA, AA, GGGG, and GG.

3. An amphiphilic peptide and/or peptoid capable of forming a hydrogel, the amphiphilic peptide and/or peptoid comprising an amphiphilic sequence consisting of:

a hydrophobic sequence stretch with the amino acid sequence AIVAG, and
a hydrophilic sequence stretch linked to said hydrophobic sequence stretch and having a polar moiety which is acidic, neutral or basic, said polar moiety comprising *m* adjacent hydrophilic amino acids, wherein *m* is an integer from 1 to 2,
wherein the amphiphilic peptide and/or peptoid has a C-terminus and an N-terminus,
wherein said hydrophobic sequence stretch comprises and/or forms the N-terminus of the amphiphilic peptide and/or peptoid and said polar moiety consists of at least one amino acid positioned at the C-terminus of the amphiphilic peptide and/or peptoid,
and wherein the N-terminus is protected by an acetyl group.

4. The amphiphilic peptide and/or peptoid according to any of claims 1 to 3, wherein the amphiphilic peptide and/or peptoid has a C-terminus, which, if a basic polar amino acid is located at the C-terminus, is preferably amidated.

5. The amphiphilic peptide and/or peptoid according to any of claims 1 to 4, wherein the amphiphilic peptide and/or peptoid consists of *o* amphiphilic sequences, as defined in claim 1, which amphiphilic sequences are linked to each other, *o* being an integer from 1 to 50.

6. The amphiphilic peptide and/or peptoid of any one of claims 1, 2, 4 or 5, wherein said aliphatic amino acids arranged in an order of decreasing amino acid size have a sequence which is a repetitive or non-repetitive sequence,
wherein, preferably, said aliphatic amino acids arranged in order of decreasing amino acid size have a sequence with a length of 2 to 6.

7. The amphiphilic peptide and/or peptoid of any one of claims 1 to 6, wherein said aliphatic amino acids arranged in an order of decreasing amino acid size have a sequence selected from LIVAG, ILVAG, LIVAA, IVAG, LIVA, LIVG, IVA and IV, wherein, optionally, there is an A preceding such sequence at the N-terminus.

8. The amphiphilic peptide and/or peptoid of any one of claims 1 to 7, wherein the amphiphilic sequence undergoes a conformational change during self-assembly, from a random coil conformation to a helical intermediate structure to a final beta conformation,
wherein, preferably, the conformational change is concentration dependent.

9. The amphiphilic peptide and/or peptoid according to any of claims 1 and 3 to 8, wherein the amphiphilic sequence is one of SEQ ID NO: 1 to 3, 6 to 7, 9 to 24, 31, 33, 35 to 36, and 38 to 42.

10. The amphiphilic peptide and/or peptoid according to claim 3 or 7, wherein the amphiphilic sequence is one of SEQ ID NO: 4-5, 34 or 37.

11. The amphiphilic peptide and/or peptoid according to any of claims 2 to 8, wherein the amphiphilic sequence is one of SEQ ID NO: 25 to 30.

12. A hydrogel comprising the amphiphilic peptide and/or peptoid of any one of claims 1 to 11, wherein, preferably, the hydrogel is stable in aqueous solution at ambient temperature for a period of at least 7 days,
the hydrogel is characterized by a storage modulus G' to loss modulus G'' ratio that is greater than 2,
wherein, preferably, the hydrogel has a higher mechanical strength than collagen or its hydrolyzed form (gelatin).

13. A method of preparing a hydrogel, the method comprising dissolving an amphiphilic peptide and/or peptoid according to any one of claims 1 to 11 in an aqueous solution,
wherein the dissolved amphiphilic peptide and/or peptoid in aqueous solution is further exposed to temperature, wherein the temperature is in the range from 20 °C to 90 °C,
wherein, preferably, the amphiphilic peptide and/or peptoid is dissolved at a concentration from 0.01 µg/ml to 100 mg/ml.

14. A surgical implant, or stent, the surgical implant or stent comprising a peptide and/or peptoid scaffold, wherein the peptide and/or peptoid scaffold is formed by a hydrogel according to claim 12.

15. A pharmaceutical and/or cosmetic composition and/or a biomedical device and/or electronic device comprising the amphiphilic peptide and/or peptoid of any one of claims 1 to 11,
preferably, further comprising a pharmaceutically active compound
and/or further comprising a pharmaceutically acceptable carrier.

16. A method of tissue regeneration comprising the steps:
    a) providing a hydrogel as defined in claim 12,
    b) exposing said hydrogel to cells which are to form regenerated tissue,
    c) allowing said cells to grow on said hydrogel,
    which method is performed *in-vitro*.