

WHAT IS CLAIMED IS:

1. A method for producing a hydrogel that is capable of adhesion of cells and which comprises enzymatically cross-linked conjugates of a hydrogel forming agent and a flavonoid, the method comprising:

combining the conjugates of the hydrogel forming agent and the flavonoid, a peroxide and a peroxidase to form a mixture that comprises:

- (i) from about 0.1 mg/ml to about 500 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
- (ii) from about 0.001 mM to about 50 mM of the peroxide; and
- (iii) from about 0.001 units/ml to about 10 units/ml of the peroxidase;

and allowing the mixture to cross-link, thereby producing the hydrogel.

2. The method of claim 1, wherein the mixture comprises:

- (i) from about 1mg/ml to about 100 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
- (ii) from about 0.01 mM to about 5 mM of the peroxide; and
- (iii) from about 0.01 units/ml to about 10 units/ml of the peroxidase.

3. The method of claim 1 or 2, wherein the peroxidase is horseradish peroxidase.

4. The method of any one of claims 1 to 3, wherein the peroxide is hydrogen peroxide.

5. The method of any one of claims 1 to 4, wherein the flavonoid is a catechin-based flavonoid.

6. The method of any one of claims 1 to 5, wherein the flavonoid is epigallocatechin gallate.

7. The method of any one of claims 1 to 6, wherein the hydrogel forming agent is a polymer.
8. The method of any one of claims 1 to 7, wherein the hydrogel forming agent is hyaluronic acid.
9. The method of any one of claims 1 to 8, further comprising combining a bioactive agent with said conjugates, peroxide and peroxidase.
10. The method of claim 9, wherein the bioactive agent is an anti-cancer agent.
11. The method of claim 10, wherein the anti-cancer agent is herceptin.
12. A hydrogel capable of adhesion of cells and which comprises enzymatically cross-linked conjugates of a hydrogel forming agent and a flavonoid, the hydrogel produced by a method comprising combining the conjugates of the hydrogel forming agent and the flavonoid, a peroxide and a peroxidase to form a mixture that comprises:
 - (i) from about 0.1 mg/ml to about 500 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
 - (ii) from about 0.001 mM to about 50mM of the peroxide; and
 - (iii) from about 0.001 units/ml to about 10 units/ml of the peroxidase.
13. The hydrogel of claim 12 wherein the mixture comprises:
 - (i) from about 1mg/ml to about 100 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
 - (ii) from about 0.01 mM to about 5mM of the peroxide; and
 - (iii) from about 0.01 units/ml to about 10 units/ml of the peroxidase.
14. The hydrogel of claim 12 or claim 13, wherein the peroxidase is horseradish peroxidase.

15. The hydrogel of any one of claims 12 to 14, wherein the peroxide is hydrogen peroxide.
16. The hydrogel of any one of claims 12 to 15, wherein the flavonoid is a catechin-based flavonoid.
17. The hydrogel of any one of claims 12 to 16, wherein the flavonoid is epigallocatechin gallate.
18. The hydrogel of any one of claims 12 to 17, wherein the hydrogel forming agent is a polymer.
19. The hydrogel of any one of claims 12 to 18, wherein the hydrogel forming agent is hyaluronic acid.
20. The hydrogel of any one of claims 12 to 19 comprising a bioactive agent.
21. The hydrogel of claim 20, wherein the bioactive agent is an anti-cancer agent
22. The hydrogel of claim 21, wherein the anti-cancer agent is herceptin.
23. A method for adhering an *in vitro* cell to a hydrogel, the method comprising contacting the cell with a hydrogel according to any one of claims 12 to 22.
24. The method of claim 23, wherein the cell is a cancer cell, and wherein proliferation of the cancer cell is inhibited.
25. The method of claim 23, wherein the cell is a non-cancer cell, and wherein the non-cancer cell is proliferated.

26. A hydrogel according to any one of claims 12 to 22 for use in the treatment of cancer in a subject.

27. The hydrogel for use of claim 26, wherein the cancer may be selected from the group consisting of breast cancer, colorectal cancer, brain cancer, prostate cancer, cervical cancer, ovarian cancer, bone cancer, skin cancer, lung cancer, pancreatic cancer, bladder cancer, gallbladder cancer, kidney cancer, esophageal cancer, Hodgkin lymphoma, non-Hodgkin lymphoma, laryngeal cancer, leukemia, multiple myeloma, oral cancer, pleural mesothelioma, small intestine cancer, testicular cancer, uterine cancer, thyroid cancer and stomach cancer.

28. Use of a hydrogel according to any one of claims 12 to 22 in the manufacture of a medicament for the treatment of cancer in a subject.

29. The use of claim 28, wherein the cancer may be selected from the group consisting of breast cancer, colorectal cancer, brain cancer, prostate cancer, cervical cancer, ovarian cancer, bone cancer, skin cancer, lung cancer, pancreatic cancer, bladder cancer, gallbladder cancer, kidney cancer, esophageal cancer, Hodgkin lymphoma, non-Hodgkin lymphoma, laryngeal cancer, leukemia, multiple myeloma, oral cancer, pleural mesothelioma, small intestine cancer, testicular cancer, uterine cancer, thyroid cancer and stomach cancer.

WHAT IS CLAIMED IS:

1. A method for producing a hydrogel that is capable of adhesion of cells and which comprises enzymatically cross-linked conjugates of a hydrogel forming agent and a flavonoid, the method comprising ~~combining~~:

combining the conjugates of the hydrogel forming agent and the flavonoid, a peroxide and a peroxidase to form a mixture that comprises:

- (i) from about 0.1 mg/ml to about 500 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
- (ii) from about 0.001 mM to about 50 mM of the peroxide; and
- (iii) from about 0.001 units/ml to about 10 units/ml of the peroxidase;

and allowing the mixture to cross-link, thereby producing the hydrogel.

2. The method of claim 1, ~~comprising combining~~ wherein the mixture comprises:

- (i) from about 1mg/ml to about 100 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
- (ii) from about 0.01 mM to about 5 mM of the peroxide; and
- (iii) from about 0.01 units/ml to about 10 units/ml of the peroxidase.

3. The method of claim 1 or 2, wherein the peroxidase is horseradish peroxidase.

4. The method of any one of claims 1 to 3, wherein the peroxide is hydrogen peroxide.

5. The method of any one of claims 1 to 4, wherein the flavonoid is a catechin-based flavonoid.

6. The method of any one of claims 1 to 5, wherein the flavonoid is epigallocatechin gallate.

7. The method of any one of claims 1 to 6, wherein the hydrogel forming agent is a polymer.
8. The method of any one of claims 1 to 7, wherein the hydrogel forming agent is hyaluronic acid.
9. The method of any one of claims 1 to 8, further comprising combining a bioactive agent with said conjugates, peroxide and peroxidase.
10. The method of claim 9, wherein the bioactive agent is an anti-cancer agent.
11. The method of claim 10, wherein the anti-cancer agent is herceptin.
12. A hydrogel capable of adhesion of cells and which comprises enzymatically cross-linked conjugates of a hydrogel forming agent and a flavonoid, the hydrogel produced by a method comprising combining the conjugates of the hydrogel forming agent and the flavonoid, a peroxide and a peroxidase to form a mixture that comprises:
- (i) from about 0.1 mg/ml to about 500 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
 - (ii) from about 0.001 mM to about 50mM of the peroxide; and
 - (iii) from about 0.001 units/ml to about 10 units/ml of the peroxidase.
13. The hydrogel of claim 12 ~~produced by combining~~ wherein the mixture comprises:
- (i) from about 1mg/ml to about 100 mg/ml of the conjugates of the hydrogel forming agent and the flavonoid;
 - (ii) from about 0.01 mM to about 5mM of the peroxide; and
 - (iii) from about 0.01 units/ml to about 10 units/ml of the peroxidase.
14. The hydrogel of claim 12 or claim 13, wherein the peroxidase is horseradish peroxidase.

~~26. The method of claim 27, comprising administering to a subject the hydrogel comprising an effective amount of the conjugates for the treatment of cancer.~~

~~27. A method for producing a hydrogel comprising conjugates of a hydrogel forming agent and a flavonoid, the method comprising combining the conjugates in a solution in the absence of an exogenously added peroxide and in the absence of a peroxidase.~~

~~28. The method of claim 29 comprising controlling the gelation rate of the hydrogel by modifying the pH of the solution.~~

~~29. The method of claim 29 or 30, wherein the pH is modified between 3 and 10.~~

~~30. The method of any one of claims 29 to 31, wherein the pH is modified between 6 and 8.~~

~~31. The method of any one of claims 29 to 32 comprising adding catalase to the solution.~~

~~32. A method for producing a hydrogel comprising conjugates of a hydrogel forming agent and a flavonoid, the method comprising:~~

- ~~(i) combining the conjugates and a peroxidase in a solution in the absence of an exogenously added peroxide; and~~
- ~~(ii) controlling the gelation rate of the hydrogel by modifying the pH of the solution.~~

~~33. The method of any one of claims 29 to 34, wherein the flavonoid is a catechin-based flavonoid.~~

~~34. The method of any one of claims 29 to 35, wherein the flavonoid is epigallocatechin gallate.~~

- ~~35. The method of any one of claims 29 to 36, wherein the hydrogel forming agent is a polymer.~~
- ~~36. The method of any one of claims 29 to 37, wherein the hydrogel forming agent is hyaluronic acid.~~
- ~~37. The method of any one of claims 29 to 38 wherein the concentration of the conjugates in the solution is from about 0.1 mg/ml to about 500 mg/ml.~~
- ~~38. The method of any one of claims 29 to 39 wherein the concentration of the conjugates in the solution is from about 1mg/ml to about 100 mg/ml.~~
- ~~39. The method of any one of claims 29 to 40, further comprising combining a bioactive agent with the conjugates in the solution.~~
- ~~40. The method of claim 41, wherein the bioactive agent is an anti-cancer agent.~~
- ~~41. The method of claim 42, wherein the anti-cancer agent is hereceptin.~~
- ~~42. A hydrogel comprising conjugates of a hydrogel forming agent and a flavonoid, the hydrogel produced by the method of any one of claims 29 to 43.~~
- ~~43. A method for delivering a flavonoid to an *in vitro* cell, the method comprising contacting the hydrogel of claim 44 with the cell.~~

26. A hydrogel according to any one of claims 12 to 22 for use in the treatment of cancer in a subject.

27. The hydrogel for use of claim 26, wherein the cancer may be selected from the group consisting of breast cancer, colorectal cancer, brain cancer, prostate cancer, cervical cancer, ovarian cancer, bone cancer, skin cancer, lung cancer, pancreatic cancer, bladder cancer, gallbladder cancer, kidney cancer, esophageal cancer, Hodgkin lymphoma, non-Hodgkin lymphoma, laryngeal cancer, leukemia, multiple myeloma, oral cancer, pleural mesothelioma, small intestine cancer, testicular cancer, uterine cancer, thyroid cancer and stomach cancer.

28. Use of a hydrogel according to any one of claims 12 to 22 in the manufacture of a medicament for the treatment of cancer in a subject.

29. The use of claim 28, wherein the cancer may be selected from the group consisting of breast cancer, colorectal cancer, brain cancer, prostate cancer, cervical cancer, ovarian cancer, bone cancer, skin cancer, lung cancer, pancreatic cancer, bladder cancer, gallbladder cancer, kidney cancer, esophageal cancer, Hodgkin lymphoma, non-Hodgkin lymphoma, laryngeal cancer, leukemia, multiple myeloma, oral cancer, pleural mesothelioma, small intestine cancer, testicular cancer, uterine cancer, thyroid cancer and stomach cancer.