Claims

1. A composite comprising:

    a polymer; and
    a gelatin or collagen;

    wherein

    (i) at least one of said polymer and said gelatin or collagen is conjugated with a phenol-containing moiety, said polymer is less cell-adhesive than said gelatin or collagen, said at least one of said polymer and said gelatin or collagen is crosslinked to form a matrix, and said composite comprises discrete regions that are rich in one of said polymer and said gelatin or collagen; or
    (ii) said polymer and a first phenol-containing moiety form a first conjugate, said gelatin or collagen and a second phenol-containing moiety form a second conjugate, said polymer is selected so that said first conjugate is less cell-adhesive than said second conjugate, at least one of said first and second conjugates is crosslinked to form a matrix, and said composite comprises discrete regions that are rich in one of said first and second conjugates.

2. The composite of claim 1, wherein in (ii) said composite is a composite hydrogel.

3. The composite of claim 1 or claim 2, wherein in (ii) said polymer comprises a hyaluronic acid, a poly(ethylene glycol), or a dextran.

4. The composite of any one of claims 1 to 3, wherein in (ii) at least one of said first phenol-containing moiety and said second phenol-containing moiety comprises tyramine or a hydroxyphenylpropionic acid.

5. The composite of any one of claims 1 to 4, wherein in (ii) said second conjugate comprises said gelatin, and optionally comprises a conjugate of said gelatin and tyramine, and a conjugate of said gelatin and hydroxyphenylpropionic acid.

6. The composite of any one of claims 1 to 5, wherein in (ii) said first conjugate comprises a conjugate of said polymer and tyramine, and a conjugate of said polymer and hydroxyphenylpropionic acid.

7. The composite of any one of claims 1 to 6, wherein in (ii) said discrete regions are rich in said second conjugate.

8. The composite of any one of claims 1 to 7, wherein in (ii) said discrete regions have an average size of about 10 nm to about 500 μm, and an average distance between adjacent discrete regions is from about 5 nm to about 500 μm.

9. The composite of any one of claims 1 to 8, wherein in (ii) said first conjugate is nonadhesive to cells.

10. A method of forming the composite as defined in (ii) of claim 1 or any one of claims 2 to 9, comprising:

    mixing precursors for the first and second conjugates in a solution for forming said composite; and
    dispersing a catalyst in said solution to catalyze crosslinking of at least one of said first and second conjugates to form the matrix,

    wherein said catalyst is dispersed in said solution in an amount selected to control a rate of said crosslinking to allow one of said first and second conjugates to concentrate in discrete regions having sizes in a pre-selected range.

11. The method of claim 10, wherein said catalyst comprises one of horseradish peroxidase and H_2O_2, or wherein said catalyst comprises both horseradish peroxidase and H_2O_2 and the concentration of horseradish peroxidase in said solution is optionally selected to control said rate of crosslinking and the concentration of H_2O_2 in said solution is optionally selected to control stiffness of said composite.

12. A method of forming the composite of claim 1, comprising:

    mixing said polymer and said gelatin or collagen in a solution for forming said composite, wherein the at least one of said polymer and said gelatin or collagen is conjugated with said phenol-containing moiety; and
    dispersing a catalyst in said solution to catalyze crosslinking of at least one of said polymer and said gelatin or collagen to form the matrix,

wherein said catalyst is dispersed in said solution in an amount selected to control a rate of said crosslinking to allow one of said first and second conjugates to concentrate in discrete regions having sizes in a pre-selected range.