WHAT IS CLAIMED IS:

1. A method of modifying a porous substrate having diffusive pores and surface reactive unsaturated functionalities, said method comprising:

a) providing a porous substrate selected from the group consisting of porous polymeric beads, porous agarose beads and porous ceramic beads, having diffusive pores having a pore size >about 100 Å and <about 1 µm and surface reactive unsaturated functionalities attached to the surface of the substrate;

b) providing a solution comprising a grafting monomer or a mixture of grafting monomers, and a soluble radical polymerization initiator;

c) contacting the substrate with the solution; ~~and~~

d) initiating free radical polymerization between the surface reactive unsaturated allylic groups ~~functionalities~~ on the surface of the substrate and the grafting monomers or mixture of grafting monomers by the introducing the free radical polymerization initiator in the solution to form polymeric chains coupled to the substrate, wherein 20 µmol/ml to 400 µmol/ml of the surface reactive unsaturated allylic groups have the formula R-O-CH_2-$CH=CH_2$, wherein R is the porous substrate surface or a linker between the surface and the allylic groups, and the linkers are selected from the group consisting of methacrylate, amides, acrylamides, epoxides, amines, butanediol diglycidyl ether, epichlorohydyin, polyethylenediol diglycidyl ether, ethylenediol diglycidyl ether, allyl chloroacetate, allyl chloride, allyl(chloro) dimethylsilane, allyl glycidyl ether, allyl bromide, allyl methacrylate, and combinations thereof; and

e) washing the substrate to remove any excess unreacted grafting monomers, mixture of grafting monomers, or unattached polymer chains, resulting in a porous substrate having a protein binding capacity greater than 100 g/L.

~~2. The method of claim 1, wherein the substrate is selected from the group consisting of porous polymeric beads, porous agarose beads and porous ceramic beads.~~

~~3. The method of claim 1, further comprising after step (d):~~

~~e) washing the substrate to remove any excess unreacted grafting monomers, mixture of grafting monomers, or unattached polymer chains, resulting in a porous substrate having a protein binding capacity greater than 100 g/L.~~

~~4~~ 2. The method of claim ~~3~~ 1, further comprising after step (e):
step (f) coupling ligands to the polymer chains attached to the porous substrate surface.

~~5~~ 3. The method of claim 1, wherein the radical polymerization initiator is selected from the group consisting of ammonium persulfate, potassium persulfate, azobis(4-cyanovaleric acid, Irgacure® 2959, 2,2'-azobis(2-amidino-propane)hydrochloride and combinations thereof.

~~6. The method of claim 1, wherein the unsaturated functionalities are comprised of allylic groups.~~

~~7. The method of claim 6, wherein the allylic groups are comprised of the formula R-O-CH2-CH=CH2, where R is the porous substrate surface or a linker between the surface and the allylic groups.~~

~~8. The method of claim 1, wherein about 20 to about 400 pmol/mL of surface reactive groups have the formula R-O-CH2-CH=CH2, where R is the porous substrate surface or a linker between the surface and the allylic groups.~~

~~9~~ 4. The method of claim 1, wherein the grafting monomers or mixture of grafting monomers are selected from the group consisting of methacrylates, acrylates, acrylamides, acrylic acid, 2-acrylamido-2-methyl-1-propanesulfonic acid, [3-(methacryloylamino) propyl] trimethylammonium chloride, 2-acrylamido-glycolic acid, itaconic acid or ethyl vinyl ketone, glycidyl methacrylate, N,N-Dimethylacrylamide, acrylamide, hydroxypropyl methacrylate, N-phenylacrylamide, hydroxylpropyl acrylamide, and combinations thereof.

~~10. The method of claim 1, wherein the diffusive pores on the porous substrate have a pore size > about 100 A and < about 1 μ.~~

~~11~~ 5. A method of modifying a porous chromatography bead having diffusive pores with surface polymer chain extenders, said method comprising:
a) providing a porous chromatography bead having diffusive pores, a surface, and surface reactive unsaturated functionalities coupled to the surface;

b) providing a solution comprising grafting monomers or a mixture of grafting monomers, and a soluble radical polymerization initiator;
c) contacting the chromatography bead with the solution;
d) initiating free radical polymerization between the surface reactive unsaturated functionalities on the bead and the grafting monomers or mixture of grafting monomers by the introduction of the radical polymerization initiator in the solution to form polymer chain extenders coupled to the bead;
e) washing the bead to remove any excess unreacted grafting monomers, mixture of grafting monomers, or unattached polymer chains resulting in a porous chromatography bead having a protein binding capacity greater than 100 g/L; and
f) coupling ligands to the polymer chains attached to the chromatography bead surface.

~~12~~ 6. The method of claim ~~11~~ 5, wherein the porous chromatography bead is selected from the group consisting of polymeric beads, agarose beads and ceramic beads.

~~13~~ 7. The method of claim ~~11~~ 5, wherein the radical polymerization initiator is selected from group consisting of ammonium persulfate, potassium persulfate, azobis(4-cyanovaleric acid, Irgacure® 2959, 2,2'-azobis(2-amidino-propane)hydrochloride and combinations thereof.

~~14~~ 8. The method of claim ~~11~~ 5, wherein the unsaturated functionalities are comprised of allylic groups.

~~15~~ 9. The method of claim ~~14~~ 8, wherein the allylic groups are comprised of the formula R-O-CH2-CH=CH2, where R is the porous substrate surface or a linker between the surface and the allylic groups.

~~16~~ 10. The method of claim ~~11~~ 5, wherein 20 to 400 mol/mL of surface reactive groups have the formula R-O-CH2-CH=CH2, where R is the porous chromatography bead or a linker between the surface of the bead and the allylic groups.

~~17~~ 11. The method of claim ~~11~~ 8, wherein the grafting monomers or mixture of grafting monomers are selected from the group consisting of methacrylates, acrylates, acrylamides and combinations thereof.

~~18~~ 12. The method of claim ~~11~~ 8, wherein the diffusive pores on the porous chromatography bead have a pore size > about 100 A and < about 1 μ.

~~19~~ 13. The method of claim ~~11~~ 8, wherein the ligands are selected from the group consisting of strong cation exchange groups, sulphopropyl, sulfonic acid, anion exchange groups, trimethylammonium chloride, weak cation exchange groups, carboxylic acid, weak anion exchange groups, N, N diethylamino, DEAE, hydrophobic interaction groups, phenyl groups, butyl groups, and propyl groups, and affinity groups, Protein A, Protein G, and Protein L.

~~20~~ 14. The method according to any one of the above claims ~~7, 8, 15 and 16~~ wherein the linkers are selected from the group consisting of methacrylate, amides, acrylamides, epoxides, amines, butanediol digylcidyl ether, epichlorohydrin, polyethylenediol diglycidyl ether, ehtylenediol digylcidyl ether, allyl chloroacetate, allyl chloride, allyl(chloro)dimethylsilane, allyl glycidyl ether, allyl bromide, allyl methacrylate, and combinations thereof.

~~21~~ 15. The method of claim 4 2, wherein the ligands are selected from the group consisting of strong cation exchange groups, sulphopropyl, sulfonic acid, anion exchange groups, trimethylammonium chloride, weak cation exchange groups, carboxylic acid, weak anion exchange groups, N,N diethylamino, DEAE, hydrophobic interaction groups, phenyl groups, butyl groups, and propyl groups, and affinity groups, Protein A, Protein G, and Protein L.

~~22~~ 16. The method according to claim ~~15~~ 9, wherein the linkers are selected from the group consisting of methacrylate, amides, acrylamides, epoxides, amines, butanediol diglycidyl ether, epichlorohydrin, polyethylenediol diglyeidyl ether, ehtylenediol digylcidyl ether, allyl chloroacetate, allyl chloride, ally(chloro)dimethylsilane, allyl glycidyl ether, allyl bromide, allyl methacrylate, and combinatins thereof.

17. The method according to claim 1, wherein the linkers are allyl ether (AGE).