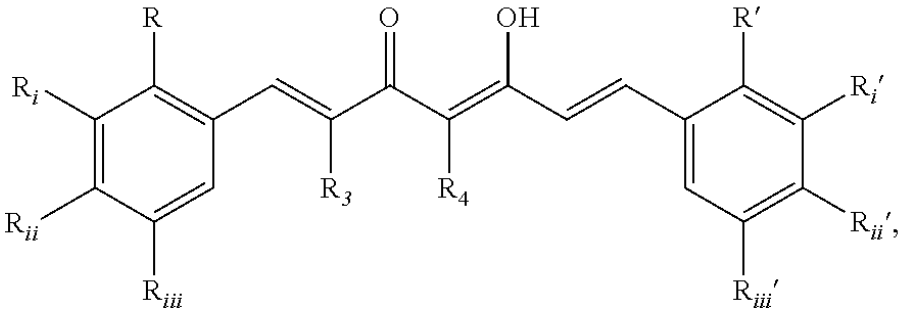
WHAT IS CLAIMED IS:

1. A composition comprising a compound and isolated cells capable of differentiating into bone cells, wherein the compound has the structure of

VI



wherein R, R_i, R_{iii}, R′, R_i', and R_{iii}' are hydro;

R_{ii} and R_{ii}' are independently selected from the group consisting of glycine-O-carboxylate, sarcosine-O-carboxylate, alanine-O-carboxylate, valine-O-carboxylate, leucine-O-carboxylate, isoleucine-O-carboxylate, phenylalanine-O-carboxylate, tyrosine-O-carboxylate, tryptophan-O-carboxylate, asparagine-O-carboxylate, glutamine-O-carboxylate, lysine-O-carboxylate, and proline-O-carboxylate; and

R_3 and R_4 are independently hydro, methyl, trideuteromethyl, trifluoromethyl, ethyl, propyl, isopropyl, butyl, sec-butyl, iso-butyl, tert-butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, or

R_3 and R_4 are taken with an alkyl chain to define a 5-membered or 6-membered carbocyclic ring,

wherein the composition further comprises a calcium phosphate matrix, and the compound is non-covalently associated onto the calcium phosphate matrix.

2. The composition of claim 1, wherein the isolated cells capable of differentiating into bone cells are isolated human bone marrow-derived mesenchymal stem cells, human mesenchymal stem cells of adipose tissue, human mesenchymal stem cells of blood, human mesenchymal stem cells of bone allograft or autograft tissues, human mesenchymal stem cells of dental pulp, human pericytes, human myoblasts, and human chondrocytes, human osteoprogenitor cells, urine stem cells, or their respective progenitor cells, or wherein the isolated cells capable of differentiating into bone cells are as stem cells isolated from amniotic fluid or cord blood, embryonic stem cells, or induced pluripotent stem cells.

3. The composition of claim 1, wherein the calcium phosphate matrix is a tricalcium phosphate ceramic.

4. The composition of claim 1 wherein the compound is (2S,2′S)-O,O′-(3-hydroxy-5-oxohepta-1,3,6-triene-1,7-diyl)bis(4,1-phenylene) bis(2-amino-3-methylbutanoate) HCl salt, the isolated cells are human bone marrow-derived mesenchymal stem cells, and the calcium phosphate matrix is a tricalcium phosphate ceramic.

5. The composition of claim 1 wherein the compound is 4-((1E,3Z)-3-(3-((E)-4-((L-valyl)oxy)benzylidene)-2-oxocyclohexylidene)-3-hydroxyprop-1-en-1-yl)phenyl L-valinate HCl salt, the isolated cells are human bone marrow-derived mesenchymal stem cells, and the calcium phosphate matrix is a tricalcium phosphate ceramic.

6. The composition of claim 4 further comprising one or more components selected from the group consisting of bone morphogenetic proteins, fibroblast growth factors, platelet-derived growth factors, Wnt proteins, transforming growth factors, stromal derived factor-1, parathyroid growth hormone, vitamin D, 1,25-dihydroxy vitamin D, deoxycholic acid, teriparatide, ascorbic acid, ascorbic acid 2-phosphate, beta-glycerol phosphate, dexamethasone, and their respective salts.

7. A method of inducing bone formation comprising the steps of:
(a) treating isolated cells capable of differentiating into bone cells with a compound having the structure of Formula VI of claim 1, and
(b) administering the treated cells from step (a) to a subject.

8. The method of claim 7, further comprising the step (a′) of seeding the cells from step (a) onto a calcium phosphate matrix prior to said administration of step (b).

9. A bone graft material prepared by combining isolated cells capable of differentiating into bone cells, a calcium phosphate matrix, and a compound having the structure of Formula VI of claim 1 into a surgical cage.

10. A method of inducing bone formation comprising the steps of (a) and (b) or (a) and (c), wherein the steps are as follows:
(a) combining the composition of claim 1 with a bioadhesive
(b) administering the composition of step (a) to a subject
(c) adding the composition of step (a) to a surgical cage suitable for implantation in a subject.