【CLAIMS】

【Claim 1】

A medium composition inducing of selective differentiation into only muscle from musculoskeletal stem cells (MSSCs) that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the medium composition comprises heparin and the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 2】

A pharmaceutical composition for preventing or treating a musculoskeletal disease, comprising the medium composition for inducing differentiation according to claim 1 and musculoskeletal stem cells (MSSCs) as active ingredients.

【Claim 3】

A method for inducing selective differentiation from musculoskeletal stem cells (MSSCs) into only muscle, comprising a step of treating heparin in the musculoskeletal stem cells that can be differentiate into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 4】

A medium composition for selectively inducing differentiation into only tendon or ligament from musculoskeletal stem cells (MSSCs) that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose wherein the medium composition comprises connective tissue growth factor (CTGF) and ascorbic acid and the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 5】

A pharmaceutical composition for preventing or treating a musculoskeletal disease, comprising musculoskeletal stem cells (MSSCs) pretreated with the medium composition for inducing differentiation according to claim 4 as active ingredients.

【Claim 6】

A method for inducing selective differentiation from musculoskeletal stem cells (MSSCs) into only tendon or ligament, comprising a step of treating connective tissue growth factor (CTGF) and ascorbic acid in musculoskeletal stem cells that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 7】

A medium composition for selectively inducing differentiation into only bone from musculoskeletal stem cells (MSSCs) that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the medium composition comprises insulin, hyaluronic acid and ascorbic acid and the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 8】

A pharmaceutical composition for preventing or treating a musculoskeletal disease, comprising musculoskeletal stem cells (MSSCs) pretreated with the medium composition for inducing differentiation according to claim 7 as active ingredients.

【Claim 9】

A method for inducing selective differentiation from musculoskeletal stem cells (MSSCs) into only bone, comprising a step of treating insulin, hyaluronic acid and ascorbic acid in the musculoskeletal stem cells that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 10】

A medium composition for selectively inducing differentiation into only tooth from musculoskeletal stem cells (MSSCs) that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the medium composition comprises dental epithelial cells and the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 11】

A method for inducing selective differentiation from musculoskeletal stem cells (MSSCs) into only tooth, comprising a step of coating with dental epithelial cells for musculoskeletal stem cells that can be differentiated into bone, tooth, cartilage, tendon, ligament, muscle and adipose, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 12】

The medium composition according to claim 1, 4, 7 or 10, wherein the musculoskeletal stem cells further have the following characteristics:

e) negative for the mesenchymal stem cell marker CD90;

f) negative for the mesenchymal stem cell marker CD271;

g) positive for the pluripotency marker DPPA4;

h) negative for the mesodermal markers T and nodal;

i) positive for the neuroectodermal marker Pax6;

j) positive for the intestinal stem cell marker LGR5;

k) negative for the chondrocyte marker SOX9; or

l) negative for the myoblast marker MyoD.

【Claim 13】

Use of musculoskeletal stem cells (MSSCs) that can differentiate into bone, tooth, cartilage, tendon, ligament, muscle and adipose to a damaged tendon or ligament area of a subject in a manufacture of a medicament for treating damaged tendon or ligament, wherein the musculoskeletal stem cells are to be administered to the subject, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 14】

Use of musculoskeletal stem cells (MSSCs) that can differentiate into bone, tooth, cartilage, tendon, ligament, muscle and adipose into the articular cavity of a subject in the manufacture of a medicament for treating arthritis, wherein the musculoskeletal stem cells are to be administered to the subject, wherein the musculoskeletal stem cells have the following characteristics:

a) positive for the ectodermal marker nestin (NES);

b) positive for the myogenic satellite marker Pax7;

c) positive for the mesodermal marker α-SMA; and

d) negative for the pluripotency marker LIN28.

【Claim 15】

The method according to claim 3, 6, 9 or 11, and the use according to claim 13 or 14, wherein the musculoskeletal stem cells further have the following characteristics:

e) negative for the mesenchymal stem cell marker CD90;

f) negative for the mesenchymal stem cell marker CD271;

g) positive for the pluripotency marker DPPA4;

h) negative for the mesodermal markers T and nodal;

i) positive for the neuroectodermal marker Pax6;

j) positive for the intestinal stem cell marker LGR5;

k) negative for the chondrocyte marker SOX9; or

l) negative for the myoblast marker MyoD.

【Claim 16】

Use of a pharmaceutical composition in the manufacture of a medicament for preventing or treating a musculoskeletal disease, wherein the pharmaceutical composition comprises the medium composition for inducing differentiation according to claim 1 and the musculoskeletal stem cells (MSSCs) as active ingredients.

【Claim 17】

Use of a pharmaceutical composition in the manufacture of a medicament for preventing or treating a musculoskeletal disease, wherein the pharmaceutical composition comprises the musculoskeletal stem cells (MSSCs) pretreated with the medium composition for inducing differentiation according to claim 4 or 7 as active ingredients.

【Claim 18】

The medium composition according to claim 1, 4, 7, 10 or 12 for use in therapy.

【Claim 19】

The musculoskeletal stem cells (MSSCs) pretreated with the medium composition for inducing differentiation according to claim 1, 4, 7, 10 or 12 for use in therapy.