CLAIMS

Claim 1.

Use of Mycl gene or its gene product in the manufacture of a medicament for preventing, treating, or preventing and treating diabetes or its associated diseases, or a reagent for proliferating islet cells;

wherein the associated disease is impaired glucose tolerance, hyperglycemia, diabetic complication, impaired insulin secretion or metabolic syndrome.

Claim 2.

The use according to claim 1, wherein the Mycl gene includes:

(1) a nucleic acid including the nucleotide sequence represented by SEQ ID NO: 1 or 3; or

(2) a nucleic acid that hybridizes with a nucleic acid including the nucleotide sequence represented by complementary sequence of SEQ ID NO: 1 or 3 under stringent conditions and encodes a polypeptide having activity of promoting insulin production when its expression is induced by the Mycl gene, or

(3) a nucleic acid encoding the polypeptide represented by SEQ ID NO: 2 or 4, or

(4) a nucleic acid encoding a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having

(i) an effect of causing proliferation of pancreatic islet-like cells,

(ii) activity of promoting insulin production, or

(iii) the effect of (i) and the activity of (ii).

Claim 3.

The use according to claim 1, wherein the Mycl gene product is:

(1) a polypeptide including the amino acid sequence represented by SEQ ID NO: 2 or 4; or

(2) a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having:

(i) an effect of causing proliferation of pancreatic islet-like cells,

(ii) activity of promoting insulin production, or

(iii) the effect of (i) and the activity of (ii).

Claim 4.

The use according to any one of claims 1 to 3, wherein the medicament comprises pancreatic islet cells in which the Mycl gene or its gene product has been introduced or its

expression has been induced.

Claim 5.

The use according to any one of claims 1 to 4, wherein the Mycl gene is transiently expressed.

Claim 6.

The use according to claim 4 or 5, wherein the pancreatic islet cells are derived from primary pancreatic islet cells isolated from a pancreas, cultured pancreatic islet cells or stem cells.

Claim 7.

The use according to claim 6, wherein the stem cells are selected from the group consisting of iPS cells, ES cells and somatic stem cells.

Claim 8.

Use of a pharmaceutical composition in the manufacture of a medicament for preventing, treating, or preventing and treating diabetes or its associated disease, the pharmaceutical composition including

(i) (a) a Mycl gene or its gene product;

(b) a vector in which the Mycl gene has been incorporated;

(c) pancreatic islet cells in which the Mycl gene or its gene product has been introduced or its expression has been induced; or

(d) a combination of any of (a) to (c);

and

(ii) a pharmaceutically acceptable excipient, diluent or carrier.

wherein the associated disease is impaired glucose tolerance, hyperglycemia, diabetic complication, impaired insulin secretion or metabolic syndrome.

Claim 9.

The use according to claim 8, wherein the diabetes or its associated disease is selected from among diseases, disorders or symptoms associated with type I diabetes, type II diabetes, impaired glucose tolerance, hyperglycemia, heterolipidemia, obesity and metabolic syndrome.

Claim 10.

The use according to claim 8 or 9, wherein the Mycl gene includes:

(1) a nucleic acid including the nucleotide sequence represented by SEQ ID NO: 1 or 3; or

(2) a nucleic acid that hybridizes with a nucleic acid including the nucleotide sequence represented by complementary sequence of SEQ ID NO: 1 or 3 under stringent conditions and encodes a polypeptide having activity of promoting insulin production when its expression is induced by the Mycl gene, or

(3) a nucleic acid encoding the polypeptide represented by SEQ ID NO: 2 or 4, or

(4) a nucleic acid encoding a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having

(i) an effect of causing proliferation of pancreatic islet-like cells,

(ii) activity of promoting insulin production, or

(iii) the effect of (i) and the activity of (ii).

Claim 11.

The use according to claim 8 or 9, wherein the Mycl gene product includes:

(1) a polypeptide including the amino acid sequence represented by SEQ ID NO: 2 or 4; or

(2) a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having:

(i) an effect of causing proliferation of pancreatic islet-like cells,

(ii) activity of promoting insulin production, or

(iii) the effect of (i) and the activity of (ii).

Claim 12.

Use of a kit in the manufacture of a medicament for preventing, treating or preventing and treating of diabetes or its associated disease, the kit including a pharmaceutical composition including:

(i) (a) a Mycl gene or its gene product;

(b) a vector in which the Mycl gene has been incorporated;

(c) pancreatic islet cells in which the Mycl gene or its gene product has been introduced or its expression has been induced; or

(d) a combination of any of (a) to (c);

and

(ii) a pharmaceutically acceptable excipient, diluent or carrier.

wherein the associated disease is impaired glucose tolerance, hyperglycemia, diabetic complication, impaired insulin secretion or metabolic syndrome.

Claim 13.

The use according to claim 12, the kit further including an activator for activation of the Mycl gene.

Claim 14.

The use according to claim 13, wherein the activator for activation of the Mycl gene is selected from the group consisting of promoters, enhancers, promoter-activating enzymes or factors, enhancer-activating enzymes or factors, nucleic acid-protein complexes and low molecular compounds.

Claim 15.

A method for proliferating pancreatic islet-like cells, the method including a step of expressing the Mycl gene.

Claim 16.

The method according to claim 15, the method including a step of preparing pancreatic islet cells in which the Mycl gene or its gene product has been introduced.

Claim 17.

The method according to claim 16, wherein the pancreatic islet cells are derived from primary pancreatic islet cells isolated from a pancreas, cultured pancreatic islet cells or stem cells.

Claim 18.

The method according to claim 16 or 17, the method including:

(a) a step of incorporating the Mycl gene into a recombination plasmid, recombination viral vector, minicircle or episomal vector; and

(b) a step of introducing the recombination plasmid, recombination viral vector, minicircle or episomal vector obtained in step (a) into pancreatic islet cells.

Claim 19.

The method according to claim 16 or 17, the method including a step of introducing RNA encoding the Mycl gene into pancreatic islet cells.

Claim 20.

The method according to claim 18 or 19, wherein the Mycl gene includes:

(1) a nucleic acid including the nucleotide sequence represented by SEQ ID NO: 1 or 3; or

(2) a nucleic acid that hybridizes with a nucleic acid including the nucleotide sequence represented by complementary sequence of SEQ ID NO: 1 or 3 under stringent conditions and encodes a polypeptide having activity of promoting insulin production when its expression is induced by the Mycl gene, or

(3) a nucleic acid encoding the polypeptide represented by SEQ ID NO: 2 or 4, or

(4) a nucleic acid encoding a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having

(i) an effect of causing proliferation of pancreatic islet-like cells,

(ii) activity of promoting insulin production, or

(iii) the effect of (i) and the activity of (ii).

Claim 21.

The method according to claim 16 or 17, the method including a step of introducing Mycl protein into pancreatic islet cells.

Claim 22.

The method according to claim 21, wherein the Mycl protein is:

(1) a polypeptide including the amino acid sequence represented by SEQ ID NO: 2 or 4; or

(2) a polypeptide having at least 80%, 85%, 90%, 95%, 97%, 98% or 99% sequence identity with the amino acid sequence represented by SEQ ID NO: 2 or 4, and having an effect of causing proliferation of pancreatic islet-like cells and/or activity of promoting insulin production.

Claim 23.

The method according to any one of claims 15 to 22, wherein expression of the Mycl gene is transient.