

CLAIMS

1. A recombinant cell comprising
a nucleic acid construct comprising a promoter which is responsive to carbohydrate metabolism of said recombinant cell, wherein the promoter is operably linked to a gene coding for a therapeutic protein, wherein the recombinant cell further comprises a nucleic acid construct coding for a cellular component for sensing extracellular carbohydrates, wherein the cellular component for sensing extracellular carbohydrates is a voltage-gated calcium channel and wherein the promoter which is responsive to carbohydrate metabolism is responsive to a physiological effect of membrane depolarization caused by the carbohydrate metabolism of said recombinant cell.
2. The recombinant cell of claim 1, wherein the promoter which is responsive to carbohydrate metabolism is a calcium-responsive promoter.
3. The recombinant cell of claim 1 or claim 2, wherein the promoter which is responsive to carbohydrate metabolism is a calcium-responsive promoter comprising nucleic acid sequences bound by transcription factors of the NFAT family, the NFkB family, the AP-1 family, and/or the CREB family and/or cFOS.
4. The recombinant cell of any one of claims 1-3, wherein the therapeutic protein is an insulinogenic agent selected from the group consisting of GLP1R-agonists, insulin, insulin analogues, growth hormones, insulin-like growth factors; an anorexic hormone; or a protein that activates brown fat metabolism.
5. The recombinant cell of any one of claims 1-4, wherein the therapeutic protein is an agent against a metabolic disease, wherein the metabolic disease is selected from the group consisting of T1D (type-1 diabetes), T2D (type-2 diabetes), diabetic ketoacidosis, obesity, cardiovascular disease, the metabolic syndrome and cancer.
6. An encapsulated cell comprising the recombinant cell of any one of claims 1-5 and a semi-permeable membrane.

7. The recombinant cell of any one of claims 1-5 or the encapsulated cell of claim 6 for use as a medicament.
8. Use of the recombinant cell of any one of claims 1-5 or the encapsulated cell of claim 6 in the manufacture of a medicament for the prevention, delay of progression or treatment of a metabolic disease elected from the group consisting of T1D (type-1 diabetes), T2D (type-2 diabetes), diabetic ketoacidosis, obesity, cardiovascular disease, metabolic syndrome and cancer in a subject.
9. An in vitro method of producing a recombinant cell expressing a therapeutic protein, said method comprising the steps of:
 - (a) obtaining a population of cells;
 - (b) transfecting said population of cells with a nucleic acid construct comprising a promoter which is responsive to a physiological effect of membrane depolarization caused by a product of the carbohydrate metabolism of said cell, wherein the promoter is operably linked to a gene coding for a therapeutic protein ,
and wherein said population of cells is further transfected with a nucleic acid construct encoding a cellular component for sensing extracellular carbohydrates, wherein the cellular component for sensing extracellular carbohydrates is a voltage-gated calcium channel;
 - (c) incubating the population of transfected cell in the presence of carbohydrates for a sufficient time to permit the transfected cells to express a therapeutic protein.