CLAIMS

1. A method of inducing differentiation of stem cells into glucose-sensing insulin-secreting pancreatic beta cells, comprising the steps of:

(a) culturing induced pluripotent stem cells as starting cells under conditions for differentiation;

(b) inducing said starting cells to exit the pluripotent state towards the mesendoderm lineage;

(c) directing the differentiating cells towards endoderm cells through culture cell transfection with first mRNAs at an effective dose and within specific time windows, wherein the first mRNAs comprise FoxA2 mRNAs or Sox17 mRNAs;

(d) further directing said endoderm cells towards pancreatic progenitor cells through transfection with second mRNAs, wherein the second mRNAs comprise at least one of PDX1, Hlxb9, Ptf1a, ixl1, HNF1a and b, and Sox9 mRNAs;

(e) further maturing said pancreatic progenitor cells into pancreatic endocrine cells with third mRNAs, wherein the third mRNAs comprise at least one of PDX1, NKX6.1, NKX2.2, Pax6, Pax4, Hlxb9, and Ngn3 mRNAs; and

(f) collecting clusters enriched with pancreatic beta cells that are responsive to environment glucose and able to secrete insulin in response.

2. The method of claim 1, wherein said first mRNAs comprise FoxA2 mRNAs.

3. The method of claim 1, wherein said first mRNAs comprise Sox17 mRNAs.

4. The method of claim 1, wherein said first mRNAs comprise FoxA2 and Sox17 mRNAs.

5. The method of claim 1, wherein said first mRNAs comprise FoxA2, Sox17, GATA4, and GATA6 mRNAs.

6. The method of claim 1, wherein said second mRNAs comprise at least PDX1 mRNAs.

7. The method of claim 1, wherein said third mRNAs comprise at least PDX1 and NKX6.1 mRNAs.

8. The method of claim 1, further comprising effecting a pancreatic beta cell fate commitment with fourth mRNAs which comprise at least one of NKX6.1, MAFA, or MAFA mRNAs.

9. The method of claim 1, wherein said induced pluripotent stem cells are generated from a body fluid or tissue of a subject.

10. A method of producing induced glucose-sensing insulin-secreting pancreatic beta cells, comprising the steps of:

(a) culturing induced pluripotent stem cells as starting cells under conditions for differentiation;

(b) inducing said starting cells to exit the pluripotent state towards the mesendoderm lineage;

(c) directing the differentiating cells towards endoderm cells through culture cell transfection with first mRNAs at an effective dose and within the specific time windows, wherein the first mRNAs comprise FoxA2 mRNAs or Sox17 mRNAs;

(d) further directing said endoderm cells towards pancreatic progenitor cells through transfection with second mRNAs, wherein the second mRNAs comprise at least one of PDX1, Hlxb9, Ptf1a, ixl1, HNF1a and b, and Sox9 mRNAs;

(e) further maturing said pancreatic progenitor cells into pancreatic endocrine cells with third mRNAs, wherein the third mRNAs comprise at least one of PDX1, NKX6.1, NKX2.2, Pax6, Pax4, Hlxb9, and Ngn3 mRNAs; and

(f) collecting clusters enriched with pancreatic beta cells that are responsive to environment glucose and able to secrete insulin in response.