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 a first combination of mRNAs at an effective dose and within specific time windows;

(d) further directing said endoderm cells towards pancreatic progenitor cells through transfection with a second combination of mRNAs;

(e) further maturing said pancreatic progenitor cells into pancreatic endocrine cells with a third combination of mRNAs; and

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

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

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

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

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

6. The method of claim 1, wherein said second combination of mRNAs comprises at least one of PDX1, Hlxb9, Ptf1a, ixl1, HNF1a and b, and Sox9 mRNAs.

7. The method of claim 1, wherein said third combination of mRNAs comprises at least one of PDX1, NKX6.1, NKX2.2, Pax6, Pax4, Hlxb9, and Ngn3 mRNAs.

8. The method of claim 1, wherein the mRNA to effect a pancreatic beta cell fate commitment comprises at least one of NKX6.1, MAFA, or MAFA mRNAs.

9. The method of claim 1, wherein said starting cells are harvested from a body fluid or tissue of a subject.

10. A cell obtained by the method of claim 1.

11. A composition for treating disease, disorder or malformation comprising the cell of claim 10.

12. A cell of claim 10 or a composition comprising the cell of claim 10 for use in therapy.

13. The cell or composition of claim 12, wherein the cell of claim 10 is derived from the recipient of the therapy.

14. The cell or composition of claim 12, wherein the cell of claim 10 is harvested from the recipient of the therapy.

15. Use of a cell of claim 10 in the manufacture of a medicament for treating a deficiency of pancreatic beta cells.

16. Use of claim 15, wherein the cell of claim 10 is derived from the recipient of the treatment.

17. Use of claim 15, wherein the cell of claim 10 is harvested from the recipient of the treatment.

18. 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 a first combination of mRNAs at an effective dose and within the specific time windows;

(d) further directing said endoderm cells towards pancreatic progenitor cells through transfection with a second combination of mRNAs;

(e) further maturing said pancreatic progenitor cells into pancreatic endocrine cells with a third combination of mRNAs; and

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