CLAIMS

1. A composition comprising a therapeutic amount of a conjugate, wherein the conjugate comprises a quantum dot and a therapeutically effective peptide or protein.

2. The composition of claim 1, wherein the peptide or protein is less than about 30 kDa in size.

3. The composition of claim 1 or claim 2, wherein the peptide or protein is selected from the group consisting of insulin, growth hormone, fibroblast growth factor 21 (FGF21) a glucagon-like peptide-1 (GLP-1) agonist, a glucagon-like peptide-2 (GLP-2) agonist, a platelet derived growth factor (PDGF) beta receptor modulator, and an integrin alpha-4/beta-7 antagonist, a PYY(3-36) analogue, vasopressin, interleukins (less than 30 kDa in size), enkephalins, endorphins and combinations thereof.

4. The composition of claim 3, wherein:
the GLP-1 agonist is liraglutide or exenatide; and/or
the GLP-2 agonist is apraglutide; and/or
the PDGF beta receptor modulator is BOT191; and/or
the integrin alpha-4/beta-7 antagonist is PN-10943.

5. The composition of any one of claims 1 to 4, wherein the composition is formulated for oral administration.

6. The composition of any one of claims 1 to 5, wherein the quantum dot is an Ag_2S quantum dot.

7. The composition of any one of claims 1 to 6, wherein the average diameter of the quantum dot is between about 1 nm and about 20 nm.

8. The composition of claim 7, wherein the average diameter is less than 10 nm.

9. The composition of any one of claims 1 to 8, wherein the conjugate further comprises a polymer.

10. The composition of claim 9, wherein the polymer is a biopolymer.

11. The composition of claim 10, wherein the biopolymer is selected from the group consisting of heparin, gelatin, hyaluronic acid, chitosan, galactose, glucose, and any combination thereof.

12. The composition of claim 11, wherein the biopolymer is chitosan, galactose, glucose, or any combination thereof.

13. The composition of any one of claims 9 to 12, wherein the polymer or the biopolymer covers at least part of the conjugate.

14. The composition of any one of claims 1 to 13, wherein the conjugate accumulates on/in a hepatocyte of the subject after oral administration.

15. The composition of any one of claims 1 to 14, wherein the composition is for administration to a subject that has been diagnosed with a condition related to insufficient endogenous peptide or protein production.

16. The composition of claim 15, wherein the condition is type I or type II diabetes.

17. The composition of any one of claims 1 to 14, wherein the composition is for administration to a subject that has been diagnosed with a condition requiring exogenous therapeutic peptide or protein administration.

18. The composition of claim 17, wherein the condition is selected from diabetic nephrology, liver fibrosis, non-alcoholic steatohepatitis (NASH), renal fibrosis, celiac disease, inflammatory bowel disease (IBD), ulcerative colitis or another gastrointestinal disease.

19. The composition of any one of claims 1 to 18, wherein the composition comprises a pharmaceutically acceptable excipient.

20. A method of treating hyperglycemia in a subject in need thereof, the method comprising administering to the subject a therapeutic amount of a conjugate comprising a quantum dot and insulin.

21. A method of treating insufficient endogenous peptide production in a subject in need thereof, the method comprising administering to the subject a therapeutic amount of a conjugate comprising a quantum dot and a protein or peptide effective in replacing the insufficient endogenous peptide.

22. A method of treating a subject suffering from a condition, wherein the condition is treatable with administration of a therapeutic exogenous peptide or protein, the method comprising administering to the subject a therapeutic amount of a conjugate comprising a quantum dot and the therapeutic exogenous peptide or protein.

23. The method of any one of claims 20 to 22, wherein the conjugate is administered to the subject orally.

24. The method of claim 21, wherein the condition is type I or type II diabetes.

25. The method of any one of claims 20 to 24, wherein the quantum dot is a Ag_2S quantum dot.

26. The method of any one of claims 20 to 25, wherein the average diameter of the quantum dot is between about 5nm and about 20nm.

27. The method of any one of claim 20 to 26, wherein the conjugate further comprises a polymer.

28. The method of claim 27, wherein the polymer is a biopolymer.

29. The method of claim 28, wherein the biopolymer at least partially coats the conjugate.

30. The method of claim 28 or claim 29, wherein the biopolymer is selected from the group consisting of heparin, gelatin, hyaluronic acid, chitosan, galactose, glucose, and any combination thereof.

31. The method of claim 30, wherein the biopolymer is chitosan, galactose, glucose, or any combination thereof.

32. A method of delivering a peptide or protein to an organ of a subject, the method comprising orally administering a conjugate comprising a quantum dot and the peptide or protein to the subject, wherein the organ is selected from the liver, pancreas, small bowel or kidneys.

33. The method of claim 32, wherein the quantum dot is an Ag_2S quantum dot.

34. The method of claim 33, wherein the Ag_2S quantum dot is between about 5nm and about 20 nm in diameter.

35. The method of any one of claims 32 to 34, wherein the conjugate optionally comprises a biopolymer selected from the group consisting of gelatin, chitosan, galactose, glucose, and any combination thereof.

36. A method of lowering blood glucose in a subject, the method comprising orally administering a conjugate comprising a quantum dot and insulin to the subject, wherein the quantum dot is an Ag_2S quantum dot between about 5nm and about 20 nm in diameter, wherein the conjugate is metabolized in a hepatocyte, thereby releasing the insulin into the blood stream of the subject.

37. Use of a conjugate comprising a quantum dot and insulin for the manufacture of a medicament effective in the treatment of type I or type II diabetes.

38. Use of a conjugate comprising a quantum dot and a protein or peptide in the preparation of a medicament.

39. The use of claim 38, wherein the medicament is for treating insufficient endogenous production of the peptide or protein in a subject.

40. The use of any one of claims 37 to 39, wherein the medicament is formulated for oral administration.

41. The use of any one of claims 37 to 40, wherein the conjugate further comprises a polymer or a biopolymer.