CLAIMS

1. An orally administrable composition for forming a polymer *in situ* in a subject and enhancing permeation of an agent, comprising:

a polymer precursor;

an oxygen source; and

a combination of permeation enhancers comprising at least one of an ammonium salt, a carbonate salt, or a bicarbonate salt, and at least one of a bile salt or bile acid.

2. The composition of claim 1, further comprising one or more agents; optionally wherein the one or more agents comprise one or more active pharmaceutical ingredients.

3. The composition of claim 1 or claim 2, wherein the ammonium salt, carbonate salt, or bicarbonate salt is

(a) an ammonium salt,

optionally wherein the ammonium salt is ammonium carbonate (NHCO), ammonium sulfate (NHSO), ammonium citrate (NHCA), ammonium phosphate (NHPO), diammonium phosphate (DAP), monoammonium phosphate (MAP), ammonium bicarbonate (NHHCO), or ammonium chloride (NHCl);

optionally wherein the ammonium salt is ammonium carbonate;

optionally wherein the ammonium salt is ammonium bicarbonate;

(b) a carbonate salt,

optionally wherein the carbonate salt is sodium carbonate or potassium carbonate;

(c) a bicarbonate salt,

optionally wherein the bicarbonate salt is sodium bicarbonate or potassium bicarbonate;

(d) an ammonium salt being ammonium carbonate, and wherein the bile salt or bile acid is a bile acid, and the bile acid is glycocholic acid

(e) an ammonium salt being ammonium bicarbonate, wherein the bile salt or bile acid is a bile acid, and the bile acid is glycocholic acid;

(f) an ammonium salt being ammonium carbonate, wherein the bile salt or bile acid is a bile salt, and the bile salt is a salt of glycocholic acid;

(g) an ammonium salt being ammonium bicarbonate, wherein the bile salt or bile acid is a bile salt, and the bile salt is a salt of glycocholic acid;

(h) an ammonium salt being ammonium carbonate, wherein the bile salt or bile acid is a bile salt, and the bile salt is sodium glycocholate; or

(i) an ammonium salt being ammonium bicarbonate, wherein the bile salt or bile acid is a bile salt, and the bile salt is sodium glycocholate.

4. The composition of any one of claims 1-3, wherein the bile salt or bile acid is a bile salt; optionally

(a) a salt of cholic acid, a salt of glycocholic acid, a salt of deoxycholic acid, a salt of glychochenodeoxychlic acid, a salt of glycodeoxycholic acid, a salt of taurodeoxycholic acid, a salt of taurocholic acid, a salt of bovine bile, a salt of chenodeoxycholic acid, a salt of taurochenodeoxycholic acid, a salt of lithocholic acid, a salt of glycolithocholate, a salt of glycohyocholate, a salt of taurolithocholate, a salt of ursodeoxycholic acid, a salt of tauroursodeoxycholic acid, a salt of glycoursodeoxycholic acid, a salt of 12-monoketocholic acid, a salt of 7-monoketocholic acid, a salt of 7,12-diketocholic acid, a salt of 3,7,12-triketocholic acid, a salt of 12-monoketodeoxycholic acid, or a salt of 3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate;

(b) a salt of glycocholic acid;

(c) sodium cholate, sodium glycocholate, sodium deoxycholate, sodium glychochenodeoxychlate, sodium glycodeoxycholate, sodium taurodeoxycholate, sodium taurocholate, a sodium salt of bovine bile, sodium chenodeoxycholate, sodium taurochenodeoxycholate, sodium lithocholate, sodium glycolithocholate, sodium glycohyocholate, sodium taurolithocholate, sodium ursodeoxycholate, sodium tauroursodeoxycholate, sodium glycoursodeoxycholate, sodium 12-monoketocholate, sodium 7-monoketocholate, sodium 7,12-diketocholate, sodium 3,7,12-triketocholate, sodium 12-monoketodeoxycholate, or sodium 3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate; or

(d) sodium glycocholate.

5. The composition of any one of claims 1-4, wherein the bile salt or bile acid is a bile acid; optionally

(a) cholic acid (CHA), glycocholic acid (GCA), deoxycholic acid (DCA), glychochenodeoxychlic acid (GCDCA), glycodeoxycholic acid (GDCA), taurodeoxycholic acid (TDCA), taurocholic acid (TCA), bovine bile (OX), chenodeoxycholic acid (CDCA), taurochenodeoxycholic acid (TCDCA), lithocholic acid (LCA), glycolithocholate (GLC),

glycohyocholate (GHC), taurolithocholate (TLC), ursodeoxycholic acid (UDCA), tauroursodeoxycholic acid (TUDCA), glycoursodeoxycholic acid (GUDCA), 12-monoketocholic acid (12-MKC), 7-monoketocholic acid (7-MKC), 7,12-diketocholic acid (7,12-DKC), 3,7,12-triketocholic acid (3,7,12-TKC), 12-monoketodeoxycholic acid (12-MKDC), or 3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonate (CHAPS); or

(b) glycocholic acid.

6. The composition of any one of claims 1-5, further comprising a buffering agent.

7. The composition of any one of claims 1-6, wherein the polymer precursor comprises one or both of a monomer and an oligomeric precursor to a polymer and/or wherein the polymer precursor is selected from Table 1 or Table 2, or combinations thereof;
optionally

(a) wherein the monomer is dopamine, levodopa, norepinephrine, methyldopa, levodopa methyl ester, levodopa ethyl ester, or combinations thereof;

(b) wherein the monomer is dopamine;

(c) wherein the oligomeric precursor to a polymer is an oligomer of dopamine, an oligomer of levodopa, an oligomer of norepinephrine, an oligomer of methyldopa, an oligomer of levodopa methyl ester, an oligomer of levodopa ethyl ester, or an oligomer of any combination of dopamine, levodopa, norepinephrine, methyldopa, levodopa methyl ester, or levodopa ethyl ester;

(d) wherein the oligomeric precursor to a polymer is an oligomer of dopamine; and/or

(e) wherein the monomer is dopamine and the oligomeric precursor to a polymer is an oligomer of dopamine.

8. The composition of any one of claims 1-7, wherein the oxygen source is a substrate for an endogenous catalyst and/or wherein the oxygen source is urea hydrogen peroxide or hydrogen peroxide.

9. The composition of any one of claims 1-8, wherein the composition is in an oral dosage form; optionally

(a) wherein the oral dosage form is a solution, a gel, a tablet, a powder, or a capsule;

(b) wherein the oral dosage form comprises one or more solutions, gels, tablets, powders, or capsules; or

(c) wherein the oral dosage form comprises an enteric dosage form.

10. The composition of any one of claims 2-9 wherein the agent is a macromolecule having a molecular weight between about 1 kD and about 160 kD,
optionally wherein the macromolecule is a polypeptide or polynucleotide;
and optionally

(a) wherein the polypeptide has a molecular weight of between about 1 kD and about 10 kD;

(b) wherein the polypeptide comprises between about 8 and about 80 amino acids;

(c) wherein the polypeptide comprises insulin, a GLP-1 receptor agonist, liraglutide, desmopressin, octreotide, an analgesic peptide, difelikefalin, H-20, an antibiotic, cyclosporin, vancomycin, lactase, beta galactosidase, exenatide, teriparatide, nafarelin, buserelin, captopril, daptomycin, an antibody, caplacizumab, ozoralizumab, brolucizumab, ranibizumab, bevacizumab, trastuzumab, rituximab, adalimumab, an enzyme, lipase, a protease, phenylalanine hydroxylase, carbamoylphosphate synthetase I, glucose oxidase, or L-asparaginase;

(d) wherein the polypeptide comprises semaglutide;

(e) wherein the polypeptide comprises tirzepatide;

(f) wherein the polynucleotide has a molecular weight of between about 5 kD and about 1500 kD;

(g) wherein the polynucleotide is single-stranded;

(h) wherein the polynucleotide is double-stranded;

(i) wherein the polynucleotide is single-stranded and comprises between about 10 and about 5000 bases;

(j) wherein the polynucleotide is single-stranded and comprises between about 10 and about 1000 bases;

(k) wherein the polynucleotide is single-stranded and comprises between about 10 and about 30 bases;

(l) wherein the polynucleotide is double-stranded and comprises between about 5 and about 2500 base pairs;

(m) wherein the polynucleotide is double-stranded and comprises between about 5 and about 500 base pairs;

(n) wherein the polynucleotide is double-stranded and comprises between about 5 and about 15 base pairs; or

(o) wherein the polynucleotide comprises an antisense oligonucleotide, mipomersen, patisiran, exondys, an siRNA, or an inflammatory bowel disease (IBD) targeting siRNA.

11. The composition of any one of claims 2-9, wherein the agent is a small molecule having a molecular weight of 1 kD or less.

12. The composition of any one of claims 1-11 for use in a method of forming a polymer coating in the gastrointestinal tract of a subject, the method comprising orally administering to a subject the composition; optionally

(a) wherein the polymer coating is formed in the small intestine of the subject; and/or

(b) wherein the polymer coating is formed in the duodenum of the subject.

13. A polymer precursor, an oxygen source and a permeation enhancer combination for use in a method of forming a polymer coating in the gastrointestinal tract of a subject, the method comprising orally administering to a subject the polymer precursor, oxygen source; and permeation enhancer combination;

wherein the permeation enhancer combination comprises at least one of an ammonium salt, a carbonate salt, or a bicarbonate salt, and at least one of a bile salt or bile acid;

wherein the polymer precursor and the oxygen source contact a catalyst endogenous to the subject and the catalyst polymerizes the polymer precursor;

optionally

(a) wherein the polymer coating is formed in the small intestine of the subject;

(b) wherein the polymer coating is formed in the duodenum of the subject;

(c) further comprising administering one or more agents to the subject;

(d) wherein the polymer precursor, the oxygen source, and the permeation enhancer combination are administered as a single composition;

(e) wherein the polymer precursor, the oxygen source, the permeation enhancer combination, and the one or more agents are administered as a single composition;

(f) wherein the one or more agents are administered in a separate composition from the administration of the polymer precursor, the oxygen source, and the permeation enhancer combination; and/or

(g) wherein the agent is an active pharmaceutical ingredient.

14. The orally administrable composition of claim 1, comprising:

a polymer precursor;

an oxygen source;

a combination of permeation enhancers comprising a first permeation enhancer and a second permeation enhancer;

wherein the combination of the first permeation enhancer and the second permeation enhancer increase the permeation of the agent in comparison to the sum of the permeation of the agent by each enhancer individually;

optionally

(a) wherein the first permeation enhancer is an ammonium salt, a carbonate salt or a bicarbonate salt; and/or

(b) wherein the second permeation enhancer is a bile salt or a bile acid; and/or

(c) further comprising an agent,

(c-i) optionally wherein the agent is an active pharmaceutical ingredient; or

(c-ii) optionally wherein the agent comprises semaglutide; or

(c-iii) optionally wherein the agent comprises tirzepatide; and/or

(d) further comprising one or more additional agents.