

CLAIMS

WHAT IS CLAIMED IS:

1. A composition comprising a therapeutic agent and at least one ionic liquid, wherein the therapeutic agent comprises an antibody or an antibody reagent; and wherein the at least one ionic liquid comprises an anionic component selected from the group consisting of malonic acid, 3-phenylpropanoic acid, mandelic acid, DL-2-phenylpropionic acid, glycolic acid, malic acid, tartaric acid, 3-(4-hydroxyphenyl)propionic acid, decanoic acid, lactic acid, cinnamic acid, acetic acid, citric acid, phosphoric acid, 2-octenoic acid, citronellic acid, succinic acid, salicylic acid, and benzoic acid.
2. The composition of claim 1, wherein the at least one ionic liquid comprises choline as a cation component.
3. The composition of claim 1 or 2, wherein the at least one ionic liquid comprises a cationic component and an anionic component in the molar ratio of 1:1, 1:2, 1:3, 1:4, 2:1, 3:1, or 4:1.
4. The composition of any one of claims 1-3, wherein the at least one ionic liquid comprises:
 - (i) choline-3-phenylpropanoic acid in the molar ratio of 1:1;
 - (ii) choline-glycolic acid in the molar ratio of 1:1;
 - (iii) choline-glycolic acid in the molar ratio of 2:1;
 - (iv) choline-glycolic acid in the molar ratio of 1:2;
 - (v) choline-malic acid in the molar ratio of 2:1;
 - (vi) choline-malic acid in the molar ratio of 1:1;
 - (vii) choline-tartaric acid in the molar ratio of 2:1;
 - (viii) choline-lactic acid in the molar ratio of 1:1;
 - (ix) choline-cinnamic acid in the molar ratio of 1:1;
 - (x) choline-citric acid in the molar ratio of 3:1;
 - (xi) choline-succinic acid in the molar ratio of 2:1; or
 - (xii) any combination thereof.
5. The composition of any one of claims 1-4, wherein the composition comprises a first ionic liquid and a second ionic liquid, wherein the first ionic liquid and the second ionic liquid are different.
6. The composition of claim 5, wherein:
 - (i) the first ionic liquid comprises choline as a cation component, the second ionic liquid comprises choline as a cation component, or a combination thereof; and/or

(ii) the first ionic liquid and the second ionic liquid independently comprise an anionic component selected from the group consisting of malonic acid, 3-phenylpropanoic acid, mandelic acid, DL-2-phenylpropionic acid, glycolic acid, malic acid, tartaric acid, 3-(4-hydroxyphenyl)propionic acid, decanoic acid, lactic acid, cinnamic acid, acetic acid, citric acid, phosphoric acid, 2-octenoic acid, citronellic acid, succinic acid, salicylic acid, and benzoic acid.

7. The composition of claim 5 or 6, wherein the first ionic liquid and the second ionic liquid comprise:

(i) choline-3-phenylpropanoic acid in the molar ratio of 1:2 and choline-glycolic acid in the molar ratio of 2:1, respectively;

(ii) choline-3-phenylpropanoic acid in the molar ratio of 1:1 and choline-glycolic acid in the molar ratio of 2:1, respectively; or

(iii) choline-3-phenylpropanoic acid in the molar ratio of 1:1 and choline-glycolic acid in the molar ratio of 1:1, respectively.

8. The composition of any one of claims 1-7, wherein the composition further comprises glycerol.

9. The composition of claim 8, wherein the composition comprises the at least one ionic liquid and the glycerol in the ratio of 95%:5%, 90%:10%, 85%:15%, 80%:20%, 75%:25%, 70%:30, 65%:35%, 60%:40%, 55%:45%, 50%:50%, 45%:55%, 40%:60%, 35%:65%, 30%:70%, 25%:75%, 20%:80%, 15%:85%, 10%:90%, or 5%:95%, respectively.

10. The composition of claim 8 or 9, wherein:

(1) the composition comprises the at least one ionic liquid and the glycerol in the ratio of:

(i) 10%:90%, respectively, wherein the at least one ionic liquid comprises choline-3-phenylpropanoic acid in the molar ratio of 1:1;

(ii) 25%:75%, respectively, wherein the at least one ionic liquid comprises choline-3-phenylpropanoic acid in the molar ratio of 1:1, choline-glycolic acid in the molar ratio of 1:2, or choline-cinnamic acid in the molar ratio of 1:1;

(iii) 50%:50%, respectively, wherein the at least one ionic liquid comprises choline-glycolic acid in the molar ratio of 1:1, 2:1, or 1:2, choline-malic acid in the molar ratio of 2:1 or 1:1, choline-tartaric acid in the molar ratio of 2:1, choline-lactic acid in the molar ratio of 1:1, or choline-succinic acid in the molar ratio of 2:1;

(iv) 75%:25%, respectively, wherein the at least one ionic liquid comprises choline-tartaric acid in the molar ratio of 2:1 or choline-citric acid in the molar ratio of 3:1; or

(v) 90%:10%, respectively, wherein the at least one ionic liquid comprises choline-tartaric acid in the molar ratio of 2:1; or

(2) the composition comprises a first ionic liquid, a second ionic liquid, and the glycerol, and wherein the composition comprises the first ionic liquid, the second ionic liquid, and glycerol in the ratio of:

(i) 10%:45%:45%, respectively, and

optionally, wherein the first ionic liquid comprises choline-3-phenylpropanoic acid in the molar ratio of 1:2 and the second ionic liquid comprises choline-glycolic acid in the molar ratio of 2:1, or wherein the first ionic liquid comprises choline-3-phenylpropanoic acid in the molar ratio of 1:1 and the second ionic liquid comprises choline-glycolic acid in the molar ratio of 2:1; or

(ii) 10%:40%:50%, respectively, and

optionally, wherein the first ionic liquid comprises choline-3-phenylpropanoic acid in the molar ratio of 1:1 and the second ionic liquid comprises choline-glycolic acid in the molar ratio of 1:1.

11. The composition of any one of claims 1-10, wherein:

(i) the antibody or the antibody reagent is selected from the group consisting of abciximab, adalimumab, adlimumab-atto, ado-trastuzumab, ado-trastuzumab emtansine, alemtuzumab, alirocumab, atezolizumab, avelumab, basiliximab, belimumab, bevacizumab, bezlotoxumab, blinatumomab, brentuximab, brentuximab vedotin, brodalumab, canakinumab, capromab, capromab pendetide, certolizumab, certolizumab pegol, cetuximab, daclizumab, daratumumab, denosumab, dinutuximab, dupilumab, durvalumab, eculizumab, elotuzumab, evolocumab, etanercept, etanercept-szszs, golimumab, ibritumomab, ibritumomab tiuxetan, idarucizumab, infliximab, infliximab-abda, infliximab-dyyb, ipilimumab, ixekizumab, mepolizumab, natalizumab, necitumumab, nivolumab, obiltoxaximab, obinutuzumab, ocrelizumab, ofatumumab, olaratumab, omalizumab, palivizumab, panitumumab, pembrolizumab, pertuzumab, ramucirumab, ranibizumab, raxibacumab, reslizumab, rituximab, secukinumab, siltuximab, tocilizumab, trastuzumab, ustekinumab, vedolizumab, sarilumab, guselkumab, inotuzumab ozogamicin, inotuzumab, adalimumab- adbm, gemtuzumab ozogamicin, gemtuzumab, bevacizumab-awwb, benralizumab, emicizumab, emicizumab-kxwh, trastuzumab-dkst, infliximab-qbtx, ibalizumab, ibalizumab-uiyk, tildrakizumab, tildrakizumab-asmn, burosumab, burosumab-twza, erenumab, erenumab-aooe, tositumomab,

mogamulizumab, moxetumomab, moxetumomab pasudotox, cemiplimab, polatuzumab, catumaxomab, polatuzumab vedotin, and any combinations thereof;

(ii) the antibody or the antibody reagent is anti-TNF- α antibody or anti-TNF- α antibody reagent; or

(iii) the antibody or the antibody reagent is infliximab or a biosimilar thereof, adalimumab or a biosimilar thereof, or any combination thereof.

12. The composition of claim 11, wherein:

(i) the infliximab or a biosimilar thereof is selected from the group consisting of infliximab, infliximab-dyyb, infliximab-abda, infliximab-qbtx, and infliximab-axxq; and/or

(ii) the adalimumab or a biosimilar thereof is selected from the group consisting of adalimumab, adalimumab-atto, adalimumab-adaz, adalimumab-afzb, and adalimumab-bwwd.

13. The composition of any one of claims 1-12, wherein the composition further comprises one or more additional agents,

optionally, wherein:

(i) the one or more additional agents are selected from the group consisting of a nucleic acid, a small molecule, and a polypeptide; and/or

(ii) the one or more additional agents are selected from the group consisting of a corticosteroid, an aminosaliclates, an immunomodulator, a monoclonal antibody, and a biologic.

14. The composition of any one of claims 1-13, wherein:

(i) the composition is formulated for delivery to a mucus membrane, across a mucus membrane, or a combination thereof,

optionally, wherein the mucus membrane is a nasal membrane, an oral membrane, a vaginal membrane, or any combination thereof; or

(ii) the composition is formulated for administration to a gastrointestinal tract.

15. The composition of any one of claims 1-14, wherein:

(i) the composition is formulated for subcutaneous administration, intravenous administration, topical administration, intrajejunal administration, oral administration, or any combination thereof; or

(ii) the composition is formulated for oral administration.

16. The composition of any one of claims 1-15, wherein:

(i) the composition is formulated in a form selected from the group consisting of a tablet, a pill, a caplet, a capsule, a spray, an aerosol, a syrup, a liquid, and any combination thereof; or

- (ii) the composition is encapsulated in a capsule.
- 17. A pharmaceutical composition comprising the composition of any one of claims 1-16, and a pharmaceutically acceptable excipient.
- 18. Use of a pharmaceutical composition comprising the composition of any one of claims 1-16 in the manufacture of a medicament for treating a disease or a disorder in a subject in need thereof, wherein the pharmaceutical composition comprises a therapeutically effective amount of the composition.
- 19. Use of the composition of any one of claims 1-16 for enhancing delivery of a therapeutic agent into a systemic circulation in a subject in need thereof, wherein the therapeutic agent is formulated as the composition; and optionally, wherein the subject has a disease or a disorder.
- 20. The use of claim 18 or 19, wherein:
 - (i) the disease or the disorder is an inflammatory disease, an autoimmune disease, or a combination thereof, optionally, wherein the inflammatory disease, the autoimmune disease, or a combination thereof is characterized by a hyperactive immune system; and/or the inflammatory disease, the autoimmune disease, or a combination thereof is selected from the group consisting of rheumatoid arthritis, Crohn's disease, ulcerative co-litis, psoriasis, psoriatic arthritis, ankylosing spondylitis, inflammatory bowel disease, and any combination thereof; or
 - (ii) the disease or the disorder is diabetes.
- 21. The use of any one of claims 18-20, wherein:
 - (i) the pharmaceutical composition or the composition is formulated for delivery to a mucus membrane, across a mucus membrane, or a combination thereof in the subject, optionally, wherein the mucus membrane is a nasal membrane, an oral membrane, a vaginal membrane, or any combination thereof;
 - (ii) the pharmaceutical composition or the composition is formulated for administration or delivery to a gastrointestinal tract in the subject; or
 - (iii) the pharmaceutical composition or the composition is formulated for subcutaneous administration, intravenous administration, topical administration, intrajejunal administration, oral administration, or any combination thereof; or
 - (iv) the pharmaceutical composition or the composition is formulated for oral administration.

22. The use of any one of claims 18-21, wherein the pharmaceutical composition or the composition is formulated for administration in a single dose or in multiple doses.
23. The pharmaceutical composition comprising the composition of any one of claims 1-16 for use in therapy.