hormone, and derivatives of the foregoing drugs.

In some embodiments, the substance that promotes mucosal immune absorption or mucosal adhesion is one or more selected from the group consisting of anionic surfactants (such as carboxylates, sulfonates, sulfates, phosphates, etc.), cationic surfactants (such as amine salts, quaternary ammonium salts, heterocycles, onium salts, etc.), zwitterionic surfactants (such as carboxylate type, sulfonate type, phosphate type, betaine type, imidazoline type, amino acid type, etc.), non-ionic surfactants (such as alkyl polyglycoside type, polyoxyethylene type, polyol type, alkanolamide type, block polyether type), special surfactants (such as fluorine-containing type, silicon-containing type, boron-containing type, polymer type, etc.), chelating agents (such as polyphosphate, aminocarboxylic acid, 1,3-diketone, hydroxycarboxylic acid, polyamine, etc.), adhesives [water-soluble adhesives (such as starch, dextrin, polyvinyl alcohol, carboxymethyl cellulose, etc.), hot melt adhesives (such as polyurethane, polystyrene, polyacrylate, ethylene-vinyl acetate copolymer, etc.), solvent adhesives (such as shellac, butyl rubber, etc.), emulsion adhesives (such as vinyl acetate resin, acrylic resin, chlorinated rubber, etc.), solvent-free liquid adhesives (such as epoxy resin, etc.)], polylactic acid-hydroxyacetic acid copolymer, dextran, and polysaccharide.

In some embodiments, the immunomodulator is one or more selected from the group consisting of cytokines, chemokines, stem cell growth factors, lymphotoxins, hematopoietic factors, colony stimulating factors (CSFs), interferons, erythropoietins, thrombopoietins, tumor necrosis factors (TNFs), interleukins (ILs), granulocyte-colony stimulating factors (G-CSFs), granulocyte macrophage-colony stimulating factors (GM-CSFs) and stem cell growth factors.

In some embodiments, the pathogenic antigen is selected from the group consisting of tumors, virus, bacterium, fungi or parasite antigens.

In some embodiments, the tumors include: tumors arising from any lesions in bone, bone connection, muscle, lung, trachea, pharynx, nose, heart, spleen, artery, vein, blood, capillary, lymph node, lymphatic vessel, lymphatic fluid, oral cavity, pharynx, esophagus, stomach, duodenum, small intestine, colon, rectum, anus, appendix, liver, gallbladder, pancreas, parotid gland, sublingual gland, urinary kidney, ureter, bladder, urethra, ovary, fallopian tube, uterus, vagina, vulva, scrotum, testes, vas deferens, penis, eyes, ears, nose, tongue, skin, brain, brainstem, medulla oblongata, spinal cord, cerebro-spinal fluid, nerves, thyroid, parathyroid gland, adrenal gland, pituitary gland, pineal gland, pancreatic islet, thymus, gonad, sublingual gland, and parotid gland.

In some embodiments, the bacterium includes one or more of *Staphylococcus*, *Streptococcus, Listeria*, *Erysipelothrix*,*Renibacterium*, *Bacillus*, *Clostridium*, *Mycobacterium*, *Actinomyces*, *Nocardia*, *Corynebacterium*, *Rhodococcus*, *Bacillus anthracis*, *erysipelas bacillus*, *Bacillus tetani*, *listeria monocytogenes*, *Bacillus perfringens*, *Bacillus gangraenae emphysematosae, tuberculosis*, *Escherichia coli*, *Bacterium proteus*, *Shigella dysenteriae*, *Pneumobacillus*, *Bacterium burgeri*, *Clostridium perfringens, Haemophilus influenzae*, *Haemophilus parainfluenzae*, *Moraxella catarrhalis*, *Acinetobacter*, *Yersinia, Legionella pneumophila*, *Bordetella pertussis*, *Bordetella parapertussis*, *Shigella, Pasteurella*, *Vibrio cholerae*, *and Vibrio Parahemolyticus*.

In some embodiments, the parasite includes one or more of parasites in the digestive tract (such as roundworms, hookworms, tapeworms, endoamoeba histolytica, and Yal's flagellum, etc.), intraluminal parasites (such as trichomonas vaginalis) , intrahepatic parasites (such as liver fluke, echinococcus), intrapulmonary parasites (such as paragonimus westermani), brain tissue parasites (such as Cysticercus cellulosae, toxoplasma gondii), intravascular parasites (such as schistosomiasis), intralymphatic parasites (such as filaria), muscle tissue parasites (such as Trichinella larvae), intracellular parasites (such as plasmodium, Leishmania), bone tissue parasites (such as hydatid; skin parasites, such as sarcoptid, follicle mite), and intraocular parasites (such as thelazia callipaeda, Cysticerecus cellulosaes).

In some embodiments, the viruse includes one or more of adeniviridae, arenaviridae, astroviridae, bunyaviridae, cliciviridae, flaviviridae, hepatitis delta virus, hepeviridae, mononegavirales, nidovirales, picornaviridae, orthomyxoviridae, papillomaviridae, parvoviridae, polyomaviridae, poxviridae, reoviridae, retroviridae, or togaviridae.

In some embodiments, the virus is Human papillomavirus.

In some embodiments, the fungus include one or more of *Coccidioides immitis*, *Coccidioides posadasii*, *Histoplasma capsulatum*, *Histoplasma duboisii*, *Blastomyces lobo*, *Paracoccidiodes brasiliensis*, *Blastomyces*

CLAIMS

1. A method for preparing a complex for potentiating an immune response, comprising:

contacting a polyinosinic-polycytidylic acid, at least one cationic stabilizer, and a soluble calcium salt in a liquid reaction system;

wherein the cationic stabilizer is a graft formed by a chitosan oligosaccharide and one or more of methoxypolyethylene glycol, polyethylene glycol, and polyethylenimine, or

wherein the cationic stabilizer is chitosan oligosaccharide and polyethyleneimine.

2. The method according to claim 1, wherein the graft has a molecular weight of less than or equal to 50 kDa.

3. The method according to claim 1 or 2, wherein in the liquid reaction system, the polyinosinic-polycytidylic acid has a concentration of 0.1 mg/ml~10 mg/ml;

optionally, in the liquid reaction system, the concentration of the polyinosinic-polycytidylic acid is 0.5 mg/ml~5 mg/ml.

4. The method according to any one of claims 1-3, wherein in the liquid reaction system, the cationic stabilizer has a concentration of 0.5 mg/ml~51.2 mg/ml;

optionally, in the liquid reaction system, the concentration of the cationic stabilizer is 0.8 mg/ml~25.6 mg/ml.

5. The method according to any one of claims 1-4, wherein in the liquid reaction system, the concentration of calcium ions in the soluble calcium salt is 0.1 mM~1 mM.

6. The method according to any one of claims 1-5, wherein the chitosan oligosaccharide has a degree of deacetylation that is greater than or equal to 70%.

7. The method according to any one of claims 1-6, wherein the soluble calcium salt is $CaCl_2$ and/or $Ca(NO_3)_2$.

8. The method according to any one of claims 1-7, wherein the polyinosinic-polycytidylic acid is prepared with polycytidylic acid and polyinosinic acid via a base pairing reaction.

9. The method according to claim 8, wherein the polycytidylic acid and polyinosinic acid have a molecular weight that is greater than 23,000 Daltons;

optionally, the molecular weight of the polycytidysic acid is in a range from 66,000 Daltons~660,000 Daltons;

optionally, the molecular weight of the polyinosinic acid is in a range from 66,000 Daltons~660,000 Daltons.

10. The method according to claim 8 or 9, wherein the base pairing reaction is carried out at a temperature of 40 °C~50 °C.

11. The method according to any one of claims 8-10, wherein the base pairing reaction is carried out at pH = 6.8 ~7.6.

12. The method according to any one of claims 1-11, wherein before contacting, the polyinosinic-polycytidylic acid is heated at 80 °C~99 °C for 70 min~120 min;

optionally, before contacting, the polyinosinic-polycytidylic acid is heated at 88 °C~92 °C for 70 min~120 min.

13. The method according to any one of claims 1-12, wherein the liquid reaction system is at a temperature of 40 °C~50 °C.

14. The method according to any one of claims 1-13, wherein a method for preparing the graft comprises:

firstly activating one or more of methoxypolyethylene glycol, polyethylene glycol, polyethylenimine, folic acid and galactose using carbonyl diimidazole, and then grafting an activated product with the water-soluble non-antibiotic amino compound in ionic liquid [bmim]Cl;

optionally, the graft is a graft of chitosan oligosaccharide and methoxypolyethylene glycol, firstly activating methoxypolyethylene glycol (MPEG) using carbonyl diimidazole (CDI), and then grafting an activated MPEG with the chitosan oligosaccharide (COS) in ionic liquid [bmim]Cl;

optionally, the grafting is performed at 60 °C~80 °C under a non-oxidizing atmosphere.

15. The method according to any one of claims 1-14, wherein, the method further comprises:

adding a cross-linking agent solution dropwise to the obtained complex while stirring until Tyndall effect appeares in the reaction system, and then stirring to obtain nanoparticles;

the cross-linking agent is at least one selected from the group consisting of sodium tripolyphosphate, sodium alginate, phenylboronic acid, and catechol;

optionally, the cross-linking agent solution further comprises one or more of an immune cell therapy drug, an antibody therapy drug, a chemical drug, a substance that promotes mucosal immune absorption or

mucosal adhesion, an immunomodulator, an antigen, a pattern recognition receptor-ligand, and a pharmaceutically acceptable salt or excipient;

optionally, the method further comprises: co-incubating the complex or the nanoparticles with one or more of the immune cell therapy drug, the antibody therapy drug, the chemical drug, the substance that promotes mucosal immune absorption or mucosal adhesion, the immunomodulator, the antigen, the pattern recognition receptor-ligand, and the pharmaceutically acceptable salt or excipient;

optionally, the antigen is a protein or a polypeptide antigen;

optionally, the antigen includes a tumor, a virus, a bacterium, a fungus or a parasite antigen;

optionally, the tumor includes those arising from any lesions in bone, bone connection, muscle, lung, trachea, pharynx, nose, heart, spleen, artery, vein, blood, capillary, lymph node, lymphatic vessel, lymphatic fluid, oral cavity, pharynx, esophagus, stomach, duodenum, small intestine, colon, rectum, anus, appendix, liver, gallbladder, pancreas, parotid gland, sublingual gland, urinary kidney, ureter, bladder, urethra, ovary, fallopian tube, uterus, vagina, vulva, scrotum, testes, vas deferens, penis, eyes, ears, nose, tongue, skin, brain, brainstem, medulla oblongata, spinal cord, cerebro-spinal fluid, nerves, thyroid, parathyroid gland, adrenal gland, pituitary gland, pineal gland, pancreatic islet, thymus, gonad, sublingual gland, and parotid gland;

optionally, the bacterium includes one or more of *Staphylococcus*, *Streptococcus, Listeria*, *Erysipelothrix*,*Renibacterium*, *Bacillus*, *Clostridium*, *Mycobacterium*, *Actinomyces*, *Nocardia*, *Corynebacterium*, *Rhodococcus*, *Bacillus anthracis*, *erysipelas bacillus*, *Bacillus tetani*, *listeria monocytogenes*, *Bacillus perfringens*, *Bacillus gangraenae emphysematosae, tuberculosis*, *Escherichia coli*, *Bacterium proteus*, *Shigella dysenteriae*, *Pneumobacillus*, *Bacterium burgeri*, *Clostridium perfringens, Haemophilus influenzae*, *Haemophilus parainfluenzae*, *Moraxella catarrhalis*, *Acinetobacter*, *Yersinia, Legionella pneumophila*, *Bordetella pertussis*, *Bordetella parapertussis*, *Shigella, Pasteurella*, *Vibrio cholerae*, *and Vibrio Parahemolyticus*;

optionally, the parasite includes one or more of parasites in the digestive tract, intraluminal parasites, intrahepatic parasites, intrapulmonary parasites, brain tissue parasites, intravascular parasites, intralymphatic parasites, muscle tissue parasites, intracellular parasites, bone tissue parasites, and intraocular parasites;

optionally, the viruse includes one or more of adeniviridae, arenaviridae, astroviridae, bunyaviridae, cliciviridae, flaviviridae, hepatitis delta virus, hepeviridae, mononegavirales, nidovirales, picornaviridae, orthomyxoviridae, papillomaviridae, parvoviridae, polyomaviridae, poxviridae, reoviridae, retroviridae or togaviridae;

optionally, the fungus include one or more of *Coccidioides immitis*, *Coccidioides posadasii*, *Histoplasma capsulatum*, *Histoplasma duboisii*, *Blastomyces lobo*, *Paracoccidiodes brasiliensis*, *Blastomyces dermatitis*, *Sporothrix schenckii*, *Penicillium marneffei*, *Candida albicans*, *Candida glabrata*, *Candida tropicalis*, *Candida lusitaniae*, *Pneumocystis carinii*, *Aspergillus*, *Exophiala jeanselmei*, *Fonsecaea Pedrosoi*, *Fonsecaea compacta*, *Chromomyces verruciformis*, *Pigmentation dermatitis*, *Geotrichum candidum*, *Pseudallescheria boydii*, *Cryptococcus neoformans*, *Trichosporon Cutaneum*, *Rhizopus oryzae*, *Mucor indicus*, *Absidia corymbifera*, *Syncephalastrum racemosum, Basidiobolus ranarum*, *Conidiobolus coronatus*, *Conidiobolus incongruus*, *Enterocytozoon bieneusi*, *Encephalitozoon intestinalis*, *Rhinosporidium seeberi*, *hyalohyphomycet*, and *phaeohyphomycete*.

optionally, the immune cell therapy drug is one or more selected from the group consisting of tumor infiltrating lymphocytes, dendritic cells, cytokine induced killer cells, dendritic cells-cytokine induced killer cells, natural killer cells, γδT cells, CD3AK, CAR-T and TCR-T;

optionally, the antibody therapeutic drug is selected from the group consisting of an anti-PD1 antibody, an anti-PDL1 antibody, an anti-CTLA4 antibody and an anti-CD antigen antibody;

optionally, the chemical drug is one or more selected from the group consisting of an alkylating agent, an antimetabolity, an antitumor antibiotic, a plant antitumor drug, a hormone drug and a miscellaneous drug;

wherein the miscellaneous drug is selected from the group consisting of L-asparaginase, cisplatin, carboplatin, oxaliplatin, dacarbazine, hexamethylmelamine drugs, and derivatives thereof;

optionally, the substance that promotes mucosal immune absorption or mucosal adhesion is one or more selected from the group consisting of anionic surfactants, cationic surfactants, zwitterionic surfactants, nonionic surfactants, special surfactants, chelating agents, adhesives, polylactic acid-glycolic acid copolymers, dextrans, and polysaccharides;

optionally, the immunomodulator is one or more selected from the group consisting of cytokines, chemokines, stem cell growth factors, lymphotoxins, hematopoietic factors, colony stimulating factors (CSFs), interferons, erythropoietins, thrombopoietins, tumor necrosis factors (TNFs), interleukins (ILs), granulocyte-colony stimulating factors (G-CSFs), granulocyte macrophage-colony stimulating factors (GM-CSFs) and stem cell growth factors;

optionally, the pattern recognition receptor-ligand is selected from the group consisting of a TLR receptor-ligand, a RLR receptor-ligand, a CLR receptor-ligand, and a NLR receptor-ligand.