cases. Attempts to use serum protein markers for the early diagnosis of lung cancer have not yielded satisfactory results for routine screening, and newly developed early diagnostic methods using serum DNA as a diagnostic marker await further validation.

In general, anti-cancer agents and modalities are plagued by side effects and limited responses. These limitations are in turn linked with inadequate circulation half-lives, insufficient tumor uptake of drug, toxicities to normal tissues, and the occurrence of drug-drug interactions, which lead, for example, to sub-optimal dosing regimens or patient noncompliance.

Microbes cause infectious and non-infectious diseases in humans. While anti-microbial agents provide a benefit to many patients, there is still a need for better therapeutic agents to treat various types of diseases and disorders involving infection. Limitations of existing therapies include inadequate circulation half-lives, toxicities to normal tissues, and the occurrence of drug-drug interactions. These limitations can lead, for example, to sub-optimal dosing regimens or patient noncompliance, both of which can contribute to the emergence of anti-microbial resistant microbes.

The present invention provides new formulations containing therapeutic agents that can be administered to a patient, which may be used in cancer therapy, treatment of diseases and disorders involving infection, and other applications as described herein below.

SUMMARY

The present disclosure provides compositions and methods for administering a therapeutic agent to a patient, such as pharmaceutical compositions containing a blood product and a therapeutic agent, such as anthracycline anti-cancer agent (e.g., doxorubicin), a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent (e.g. paclitaxel), a nucleoside analog, an EGFR inhibitor, or an anti-microbial agent. One exemplary composition contains whole blood and doxorubicin, which may be administered intravenously to a patient, such as for use in treating cancer in a patient. Another exemplary composition contains whole blood and imipenem, which may be administered intravenously to a patient, such as for use in treating a disease or disorder involving infection in a patient (e.g. sepsis). *Ex vivo* mixing of a therapeutic agent with a blood product to form a pharmaceutical composition can provide benefits to the patient, such as, in certain instances, improvement in the efficacy of the therapeutic agent and/or reduction of adverse side effects. In various examples, the blood product is from or is derived from the patient who is to receive a pharmaceutical composition of

the present disclosure. The present disclosure having been generally described is explained in more detail in the aspects and examples below and in the detailed description.

In one aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, and an anti-microbial agent, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

In another aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, an anti-mitotic agent, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

In a further aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

In another aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, and an EGFR inhibitor, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

In a further aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, and a nucleoside analog, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

In another aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, and an anti-mitotic agent, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

In a further aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

In another aspect, the present disclosure refers to a use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent that is an anti-microbial agent, to thereby treat the disease or disorder involving infection, in the manufacture of a medicament for treating a disease or disorder involving infection in a patient, wherein the medicament is to be parenterally administered to the patient.

In a further aspect, the present disclosure refers to a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, or an anti-microbial agent.

In another aspect, the present disclosure refers to a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, or an anti-microbial agent.

In a further aspect, the present disclosure refers to a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, or an anti-microbial agent.

In another aspect, the present disclosure refers to a pharmaceutical composition formulated for parenteral administration, the pharmaceutical composition comprising:

(i) a blood product; and

(ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator

selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor.

The present disclosure also provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, and an anti-microbial agent. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, and an anti-microbial agent. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, and an anti-microbial agent. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, an anti-mitotic agent, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutically effective amount of an agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a halo-aliphatic alkylating agent, an organo-nitrate ester compound, an organo-platinum compound, an anti-mitotic agent, an alkylating agent, cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a phosphodiesterase inhibitor, a cardiac glycoside, and an anti-malarial agent. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical

composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method for administering a therapeutic agent to a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a halo-aliphatic alkylating agent, an organo-nitrate ester compound, an organo-platinum compound, cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a phosphodiesterase inhibitor, a cardiac glycoside, and an anti-malarial agent. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method of treating cancer in a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, and an EGFR inhibitor, to thereby treat the cancer. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method of treating cancer in a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, and a nucleoside analog, to thereby treat the cancer. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method of treating cancer in a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, and an anti-mitotic agent, to thereby treat the cancer. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method of treating cancer in a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, to thereby treat the cancer. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure also provides a method of treating cancer in a patient. The method comprises parenterally administering to a patient in need thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a halo-aliphatic alkylating agent, an organo-nitrate ester compound, an organo-platinum compound, cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, and a phosphodiesterase inhibitor, to thereby treat the cancer. The blood product may be an erythrocyte cell, or may be whole blood. Desirably, the pharmaceutical composition can be administered by intravenous administration. Exemplary anthracycline anti-cancer agents include doxorubicin and epirubicin.

The present disclosure further provides a method of treating a disease or disorder involving infection in a patient. The method comprises parenterally administering to a patient in need

thereof a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent that is an anti-microbial agent, to thereby treat the disease or disorder involving infection.

The present disclosure further provides a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, or an anti-microbial agent. The blood product can be from or derived from the patient who is to receive the pharmaceutical composition.

The present disclosure also provides a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, or an anti-microbial agent.

The present disclosure further provides a pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, or an anti-microbial agent.

The present disclosure also provides a pharmaceutical composition formulated for parenteral administration, comprising (i) a blood product, and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a halo-aliphatic alkylating agent, an organo-nitrate ester compound, an organo-platinum compound, cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a phosphodiesterase inhibitor, a cardiac glycoside, and an anti-malarial agent. The blood product may be erythrocyte cells, or may be whole blood. Desirably, the pharmaceutical composition can be formulated for intravenous administration.

In various examples of the methods and pharmaceutical compositions of the present disclosure, the blood product or the components of the blood product (e.g., red blood cells) are not modified or

manipulated to load the therapeutic agent thereon and/or therein but rather the blood product and the therapeutic agent are mixed, optionally incubated for a time and under appropriate conditions as described herein, and then administered to a patient. Such modifications of the blood product include, but are not limited to, genetically engineered expression of a target-binding agent or addition of a molecular marker, a fusion molecule, a photosensitive agent, a positive marker, a target recognition moiety, and/or an antibody aptamer; and such manipulations of the cells include, but are not limited to, electroporation, conjugation, endocytosis and/or hypo-osmotic dialysis. In various examples where the blood product comprises erythrocyte cells, the erythrocyte cells have not undergone any modification or manipulation such as genetic modification, electroporation, conjugation through biotin, conjugation to a cell-penetrating peptide, conjugation to hemoglobin, dimethyl sulfoxide osmotic pulse, endocytosis and hypotonic preswelling, hypotonic dilution, and/or hypo-osmotic dialysis.

DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts activity of control, carboplatin (Carbo, 50 mg/kg), and whole blood mixed with carboplatin (Blood-mix-Carbo, either 50 mg/kg or 100 mg/kg) in treating xenografted A549 lung tumor, as measured by tumor volume after each treatment.

FIGS. 2A and 2B depict myelosuppression toxicity of control, carboplatin (Carbo, 50 mg/kg), and whole blood mixed with carboplatin (Blood-mix-Carbo, either 50 mg/kg or 100 mg/kg) in treating xenografted A549 lung tumor, as measured by white blood cell number either 2 weeks (FIG. 2A) or 3 weeks (FIG. 2B) after each treatment.

FIGS. 3A and 3B depict myelosuppression toxicity of control, carboplatin (Carbo, 50 mg/kg), and whole blood mixed with carboplatin (Blood-mix-Carbo, either 50 mg/kg or 100 mg/kg) in treating xenografted A549 lung tumor, as measured by red blood cell number either two weeks (FIG. 3A) or three weeks (FIG. 3B) after each treatment.

FIGS. 4A and 4B depict myelosuppression toxicity of control, carboplatin (Carbo, 5 mg/kg), and whole blood mixed with carboplatin (Blood-mix-Carbo, either 50 mg/kg or 100 mg/kg) in treating xenografted A549 lung tumor, as measured by platelet number either two weeks (FIG. 4A) or three weeks (FIG. 4B) after each treatment.

FIG. 5 depicts activity of control, oxaliplatin (L-OHP, 12 mg/kg), and whole blood mixed with oxaliplatin (Blood-mix-L-OHP, either 12 mg/kg or 24 mg/kg) in treating xenografted HT-29 colorectal tumor, as measured by tumor volume over time (0-40 days) after each treatment.

Claims:

1. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, and an anti-microbial agent, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

2. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, an anti-mitotic agent, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

3. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for administering a therapeutic agent to a patient, wherein the medicament is to be parenterally administered to the patient.

4. The use of any one of claims 1-3, wherein the blood product comprises erythrocyte cells.

5. The use of any one of claims 1-4, wherein the patient suffers from cancer.

6. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, and an EGFR inhibitor, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

7. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, and a nucleoside analog, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

8. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, and an anti-mitotic agent, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

9. The use of claim 1 or 6, wherein the therapeutic agent is

(a) an EGFR inhibitor, wherein optionally the EGFR inhibitor is erlotinib, gefitinib, lapatinib, vandetanib, neratinib, or osimertinib;

(b) a nucleoside analog, wherein optionally the nucleoside analog is gemcitabine, didanosine, vidarabine, cytarabin, emtricitabine, lamivudine, zalcitabine, abacavir, acyclovir, entecavir, idoxuridine, trifluridine, or any combination thereof;

(c) a thiol-reactive functional-group agent, wherein optionally the thiol-reactive functional-group agent is selected from the group consisting of 3-bromopyruvate, 2-iodoacetamide, 2-bromoacetamide, chloroacetic acid, iodoacetic acid, chloroacetamide, bromoacetic acid, maleimide, vinyl pyridine, disulfide, pyridyl disulfide, isocyanate, and isothiocyanate;

(d) a nitric oxide modulator, wherein optionally the nitric oxide modulator is nitroglycerin, nitroprusside, diethylamine/NO, diethylenetriamine/NO, amyl nitrite, isosorbide dinitrate, isosorbide 5-mononitrate, nicorandil, nitroaspirins, S-nitroso-NSAIDs, phosphodiesterase inhibitors , ACE inhibitors, calcium channel blockers, statins, or any combination thereof.;

(e) an anti-mitotic agent, wherein optionally the anti-mitotic agent is paclitaxel; or

(f) a cardiac glycoside, wherein optionally the cardiac glycoside is digoxin, digitoxin, ouabain, or oleandrin.

10. The use of claim 6, wherein

(a) the therapeutic agent is erlotinib, and the cancer is non-small cell lung cancer or pancreatic cancer;

(b) the therapeutic agent is gemicitabine, and the cancer is ovarian cancer, breast cancer, non-small cell lung cancer, or pancreatic cancer;

(c) the therapeutic agent is paclitaxel, and the cancer is ovarian cancer, breast cancer, lung cancer, Kaposi sarcoma, cervical cancer, or pancreatic cancer; or

(d) the therapeutic agent is cyclophosphamide, and the cancer is lymphoma, multiple myeloma, leukemia, ovarian cancer, breast cancer, small cell lung cancer, neuroblastoma, or sarcoma.

11. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, and a nitric oxide modulator selected from the group consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor, in the manufacture of a medicament for treating cancer in a patient, wherein the medicament is to be parenterally administered to the patient.

12. The use of any one of claims 6-11, wherein the blood product comprises erythrocyte cells.

13. The use of any one of claims 5-9, 11, and 12, wherein the cancer is

(a) a solid tumor, wherein optionally the solid tumor is optionally a sarcoma or carcinoma;

(b) brain cancer, bladder cancer, breast cancer, cervical cancer, cholangiocarcinoma, colon cancer, colorectal cancer, endometrial cancer, esophageal cancer, lung cancer, liver cancer, melanoma, ovarian cancer, pancreatic cancer, prostate cancer, rectal cancer, renal cancer, stomach cancer, testicular cancer, uterine cancer, or Kaposi's sarcoma;

(c) a leukemia or lymphoma;

(d) breast cancer, bladder cancer, or Kaposi's sarcoma; or

(e) lymphoma or acute lymphocytic leukemia.

14. The use of any one of claims 1-8 or 11-13, wherein the therapeutic agent is

(a) an anthracycline anti-cancer agent, wherein optionally the anthracycline anti-cancer agent is doxorubicin, daunorubicin, idarubicin, liposomal doxorubicin, or any combination thereof;

wherein optionally the topoisomerase inhibitor is irinotecan, topotecan, etoposide, teniposide, mitoxantrone, or any combination thereof;

(c) an oxazaphosphinanyl anti-cancer agent, wherein optionally the oxazaphosphinanyl anti-cancer agent is ifosfamide, cyclophosphamide, trofosfamide, or any combination thereof;

(b) a nitro-aryl anti-cancer agent, wherein optionally the nitro-aryl anti-cancer agent comprises iniparib or 2,4,6-trinitrotoluene;

(e) a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, wherein optionally the halo-aliphatic alkylating agent comprises 3-bromopyruvate, 2-iodoacetamide, 2-bromoacetamide, iodoacetic acid, or bromoacetic acid;

(f) a nitric oxide modulator that is an organo-nitrate ester compound, wherein optionally the organo-nitrate ester compound comprises nitroglycerin; or

(g) a platinum-based antineoplastic compound, wherein optionally the platinum-based antineoplastic compounds is cisplatin, carboplatin, oxaliplatin, nedaplatin, or any combination thereof.

15. The use of any one of claims 1-8 or 11-13, wherein the therapeutic agent is (a) cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, or bis(4-fluorobenzyl)trisulfide; or

(b) a nitric oxide modulator that is a phosphodiesterase inhibitor, wherein optionally the phosphodiesterase inhibitor comprises avanafil, lodenafil, mirodenafil, sildenafil, tadalafil, vardenafil, udenafil, or zaprinast.

16. The use of any one of claims 5-8, 11, and 12, wherein

(a) the therapeutic agent is doxorubicin, and the cancer is breast cancer, bladder cancer, Kaposi's sarcoma, lymphoma, or acute lymphocytic leukemia;

(b) the therapeutic agent is cisplatin, and the cancer is testicular cancer, ovarian cancer, cervical cancer, breast cancer, bladder cancer, head and neck cancer, esophageal cancer, lung cancer, mesothelioma, brain tumors or neuroblastoma;

(c) the therapeutic agent is carboplatin, and the cancer is ovarian cancer, lung cancer, head and neck cancer, brain cancer, or neuroblastoma;

(d) the therapeutic agent is oxaliplatin, and the cancer is colorectal cancer; or

(e) the therapeutic agent is irinotecan, and the cancer is colon cancer or small cell lung cancer.

17. The use of any one of claims 1-4, wherein the patient suffers from sickle cell disease, pulmonary hypertension, or an ischemic condition.

18. Use of a pharmaceutical composition that comprises (i) a blood product and (ii) a therapeutic agent that is an anti-microbial agent, to thereby treat the disease or disorder involving infection, in the manufacture of a medicament for treating a disease or disorder involving infection in a patient, wherein the medicament is to be parenterally administered to the patient.

19. The use of claim 18, wherein the blood product comprises erythrocyte cells.

20. The use of any one of claims 1-19, wherein the parenterally administering is intravenous administration.

21. The use of any one of claims 18-20, wherein

(a) the disease or disorder involving infection is sepsis;

(b) the disease or disorder involving infection is an infectious disease that affects macrophages,wherein the infectious disease that affects macrophages is mycoplasma tuberculosis, mycoplasma seprae, leprosy, zika virus infection, Q fever, HIV, leishmaniasis, toxoplasmosis, babesia, or bartonella infection; or

(c) the disease or disorder involving infection is a microbial infection.

22. The use of claim 21, wherein the microbial infection is

(a) an infection with a virus, wherein optionally the virus is hepatitis C virus, hepatitis B virus, hepatitis A virus, dengue virus, west nile virus, yellow fever virus, Japanese encephalitis virus, St. Louis encephalitis virus, human immunodeficiency virus (HIV), zika virus, Ebola virus, Marburg virus, chikungunya virus, Semliki forest virus, pichinde virus, influenza A virus, respiratory syncytial virus, vaccinia virus, herpes simplex virus type 1, herpes simplex virus type 2, human cytomegalovirus, rabies virus, paramyxovirus, varicella-zoster virus, human T cell lymphocytic virus, human herpes virus-6, human herpes virus-7, or human herpes virus-8;

(b) an intracellular infection with a microbial species, wherein optionally the microbial species is *Mycobacterium tuberculosis, Mycobacterium leprae, Mycobacterium bovis, Klebsiella pneumonia, Salmonella, Chlamydia muridarum, Chlamydia pneumonia, Burkholderia cenocepacia, Staphylococcus aureus, Coxiella burnetti,* or *Shigella flexneri;*

(c) antibiotic resistant, wherein optionally the antibiotic resistant microbial infection is methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin intermediate resistant *Staphylococcus aureus* (VISA), vancomycin resistant *Staphylococcus aureus* (VRSA), vancomycin-resistant *Enterococci* (VRE), antibiotic resistant *Neisseria gonorrhoeae*, carbapenem-resistant *Enterobacteriaceae* (CRE), VRE endocarditis, pan-resistant *Acinetobacter*, drug resistant

Escherichia coli, chronic osteomyelitis, extensively drug resistant tuberculosis, Shiga toxin-producing *Escherichia coli*, antimicrobial-resistant sepsis, or multi-drug resistant *Pseudomonas*;

(d) *Toxoplasma gondii* infection or *Leishmania amazonensis* infection;

(e) malaria; or

(f) infection with *Histoplasma capsulatum* or *Candida albicans*.

23. The use of any one of claims 1-4 and 18-22, wherein the therapeutic agent is an anti-microbial agent, wherein

(a) the anti-microbial agent is an antibiotic, an antiviral agent, an anti-fungal agent, or an anti-parasitic agent,

wherein optionally the antibiotic is vancomycin orimipenem; or

(b) the anti-microbial agent is an anti-malarial agent, wherein optionally the anti-malarial agent is artemisinin, artesunate, quinine, quinidine, hydroxychloroquine, primaquine, lumefantrine, atovaquone, dapsone, proguanil, chloroquine, sulfadoxine–pyrimethamine, mefloquine, piperaquine, or amodiaquine.

24. The use of any one of claims 1-23, wherein the pharmaceutical composition is prepared by mixing the blood product and the therapeutic agent wherein optionally

(a) the pharmaceutical composition is incubated for about 30 minutes to about 240 minutes at a temperature that ranges from about 18°C to about 25°C after mixing before being administered to the patient, or

(b) the pharmaceutical composition is incubated for over 4 hours at a refrigerated condition, or for up to about 60 minutes at about 37°C, after mixing before being administered to the patient.

25. The use of any one of claims 1-23, wherein the pharmaceutical composition further comprises an anticoagulant

wherein optionally the anticoagulant comprises one or more of heparin and a citrate salt, wherein optionally the anticoagulant is present in the pharmaceutical composition in an amount ranging from about 0.1% wt/wt to about 15% wt/wt.

26. The use of any one of claims 1-25, wherein the pharmaceutical composition contains at least one therapeutic agent at a concentration of at least 10 μg/mL.

27. The use of any one of claims 1-26, wherein the blood product constitutes at least 30% wt/wt of the pharmaceutical composition or from about 60% wt/wt to about 99% wt/wt of the pharmaceutical composition.

28. The use of any one of claims 1-27, wherein an aliquot of whole blood is to be obtained from the patient, and said aliquot is used to prepare the pharmaceutical composition for administration to the patient.

29. The use of any one of claims 1-28, wherein the patient is an adult human.

30. The use of any one of claims 1-29, wherein the patient does not suffer from anemia or have reduced blood volume,

or the patient has at least 95% of the amount of their average daily blood volume.

31. A pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, an EGFR inhibitor, or an anti-microbial agent.

32. A pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, a nucleoside analog, or an anti-microbial agent.

33. A pharmaceutical composition, comprising a blood product and one or more therapeutic agents, wherein the therapeutic agent is an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent, a nitric oxide modulator, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-mitotic agent, or an anti-microbial agent.

34. The pharmaceutical composition of claim 33, wherein the therapeutic agent is

(a) an EGFR inhibitor, wherein optionally the EGFR inhibitor is erlotinib, gefitinib, lapatinib, vandetanib, neratinib, or osimertinib;

(b) a nucleoside analog, wherein optionally the nucleoside analog is gemcitabine, didanosine, vidarabine, cytarabin, emtricitabine, lamivudine, zalcitabine, abacavir, acyclovir, entecavir, idoxuridine, trifluridine, or any combination thereof;

(c) a thiol-reactive functional-group agent,

wherein optionally the thiol-reactive functional-group agent is selected from the group consisting of 3-bromopyruvate, 2-iodoacetamide, 2-bromoacetamide, chloroacetic acid, iodoacetic acid, chloroacetamide, bromoacetic acid, maleimide, vinyl pyridine, disulfide, pyridyl disulfide, isocyanate, and isothiocyanate;

(d) a nitric oxide modulator, wherein optionally the nitric oxide modulator is nitroglycerin, nitroprusside, diethylamine/NO, diethylenetriamine/NO, amyl nitrite, isosorbide dinitrate, isosorbide 5-mononitrate, nicorandil, nitroaspirins, S-nitroso-NSAIDs, phosphodiesterase inhibitors , ACE inhibitors, calcium channel blockers, statins, or any combination thereof;

(d) an anti-mitotic agent, wherein optionally the anti-mitotic agent is paclitaxel; or

(e) an anti-microbial agent, wherein optionally the anti-microbial agent is an antibiotic selected from vancomycin and imipenem or an anti-malarial agent.

35. A pharmaceutical composition formulated for parenteral administration, the pharmaceutical composition comprising:

(i) a blood product; and

(ii) a therapeutic agent selected from the group consisting of an anthracycline anti-cancer agent, a topoisomerase inhibitor, an oxazaphosphinanyl anti-cancer agent, a nitro-aryl anti-cancer agent, a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, a platinum-based antineoplastic compound, acrylamide, acrylonitrile, bis(4-fluorobenzyl)trisulfide, a cardiac glycoside, an anti-malarial agent, and a nitric oxide modulator selected from the group

consisting of an organo-nitrate ester compound, sodium nitroprusside, and a phosphodiesterase inhibitor.

36. The pharmaceutical composition of any one of claims 31-35, wherein the blood product comprises erythrocyte cells, wherein optionally the erythrocyte cells have not undergone any manipulation selected from the group consisting of genetic modification, electroporation, conjugation through biotin, conjugation to a cell-penetrating peptide, conjugation to hemoglobin, dimethyl sulfoxide osmotic pulse, endocytosis and hypotonic preswelling, hypotonic dilution, and hypo-osmotic dialysis.

37. The use or the pharmaceutical composition of any one of claims 31-36, wherein the blood product is a mixture of packed red blood cells.

38. The use or the pharmaceutical composition of any one of claims 31-36, wherein the blood product is whole blood.

39. The use or the pharmaceutical composition of claim 38, wherein the whole blood is autologous whole blood.

40. The pharmaceutical composition of any one of claims 31-39, wherein the therapeutic agent is

(a) an anthracycline anti-cancer agent, wherein optionally the anthracycline anti-cancer agent comprises doxorubicin or epirubicin;

(b) a topoisomerase inhibitor, wherein optionally the topoisomerase inhibitor comprises irinotecan;

(c) an oxazaphosphinanyl anti-cancer agent, wherein optionally the oxazaphosphinanyl anti-cancer agent comprises ifosfamide or the oxazaphosphinanyl anti-cancer agent is cyclophosphamide;

(d) a nitro-aryl anti-cancer agent, wherein optionally the nitro-aryl anti-cancer agent comprises iniparib or 2,4,6-trinitrotoluene;

(e) a thiol-reactive functional-group agent that is a halo-aliphatic alkylating agent, wherein optionally the halo-aliphatic alkylating agent comprises 3-bromopyruvate, 2-iodoacetamide, 2-bromoacetamide, iodoacetic acid, or bromoacetic acid;

(f) a nitric oxide modulator that is an organo-nitrate ester compound, wherein optionally the organo-nitrate ester compound comprises nitroglycerin;

(g) a platinum-based antineoplastic compound, wherein optionally the platinum-based antineoplastic compound comprises carboplatinum or wherein the platinum-based antineoplastic compound comprises oxaliplatin;

(h) cis-platin, sodium nitroprusside, acrylamide, acrylonitrile, or bis(4-fluorobenzyl)trisulfide;

(i) a nitric oxide modulator that is a phosphodiesterase inhibitor, wherein optionally the phosphodiesterase inhibitor comprises avanafil, lodenafil, mirodenafil, sildenafil, tadalafil, vardenafil, udenafil, or zaprinast; or

(j) a cardiac glycoside,

wherein optionally the cardiac glycoside is digoxin, digitoxin, ouabain, or oleandrin.

41. The pharmaceutical composition of any one of claims 31-40, wherein the pharmaceutical composition further comprises an anticoagulant, wherein the anticoagulant comprises one or more of heparin and a citrate salt or the anticoagulant is present in the pharmaceutical composition in an amount ranging from about 0.1% wt/wt to about 15% wt/wt.

42. The pharmaceutical composition of any one of claims 31-41, wherein the pharmaceutical composition contains at least one therapeutic agent at a concentration of at least 10 μg/mL.

43. The pharmaceutical composition of any one of claims 31-42, wherein the blood product constitutes at least 30% wt/wt of the pharmaceutical composition.