(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 May 2012 (24.05.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/068032 A1

(51) International Patent Classification:
A61K 31/337 (2006.01) *A61K 31/513* (2006.01)
A61K 31/475 (2006.01) *A61K 31/555* (2006.01)
A61K 31/519 (2006.01) *A61K 31/704* (2006.01)
A61K 38/18 (2006.01) *A61K 31/7048* (2006.01)
A61K 45/06 (2006.01) *A61K 33/24* (2006.01)
A61P 35/00 (2006.01) *A61K 38/17* (2006.01)
A61K 39/395 (2006.01) *C07K 19/00* (2006.01)
A61K 31/4745 (2006.01)

(21) International Application Number:
PCT/US2011/060666

(22) International Filing Date:
14 November 2011 (14.11.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/413,940 15 November 2010 (15.11.2010) US
61/421,462 9 December 2010 (09.12.2010) US

(71) Applicant *(for all designated States except US)*: **FIVE PRIME THERAPEUTICS, INC.** [US/US]; Two Corporate Drive, South San Francisco, California 94080 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **LONG, Li** [CA/US]; 3209 Greenhills Drive, Lafayette, California 94549 (US). **BRENNAN, Thomas** [US/US]; 5294 Amelia Drive, San Jose, California 95118 (US).

(74) Agent: **FORDIS, Jean B.**; Finnegan, Henderson, Farabow, Garrett & Dunner LLP, 901 New York Avenue, NW, Washington, DC 20001-4413 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

— *with sequence listing part of description (Rule 5.2(a))*

(54) **Title**: FGFR1 EXTRACELLULAR DOMAIN COMBINATION THERAPIES

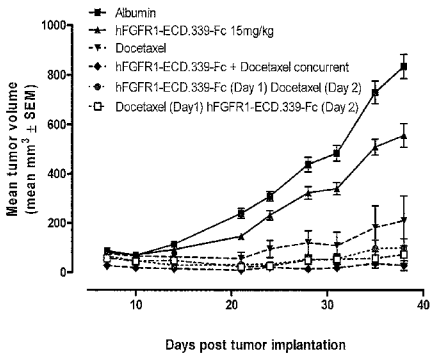


FIGURE 1

(57) **Abstract**: Methods of treating cancer comprising administering a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) and/or an FGFR1 ECD fusion molecule in combination with at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, and bevacizumab are provided. Dosage packs comprising an FGFR1 ECD and/or an FGFR1 ECD fusion molecule and/or at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, and bevacizumab are also provided. In some embodiments, a dosage pack comprises instructions for administering FGFR1 ECD and/or FGFR1 ECD fusion molecule with at least one additional therapeutic agent.

WO 2012/068032 A1

FGFR1 EXTRACELLULAR DOMAIN COMBINATION THERAPIES

RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional application numbers 61/413,940 filed November 15, 2010, and 61/421,462 filed December 9, 2010, the content of which are incorporated herein by reference.

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] Soluble forms of Fibroblast Growth Factor Receptor 1 (FGFR1) have been shown to inhibit tumor cell growth *in vitro* and *in vivo*. *See, e.g.*, U.S. Patent No. 7,678,890. Combining an anti-cancer therapeutic molecule, such as a soluble form of FGFR1, with another anti-cancer therapeutic molecule, can result in antagonistic, additive, or synergistic effects on the efficacy of each of the anti-cancer therapeutics.

[0003] The inventors have discovered that administration of an FGFR1 ECD and docetaxel in a mouse xenograft model of non-small cell lung cancer shows synergistic anti-tumor activity of the therapeutic agents. In addition, the inventors have discovered that administration of an FGFR1 ECD and at least one additional therapeutic molecule selected from paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, and bevacizumab, has at least additive activity relative to each molecule administered alone in certain mouse xenograft models.

[0004] In some embodiments, methods of treating cancer comprising administering to a subject a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, sorafenib, etoposide, topotecan, a vascular endothelial growth factor (VEGF) antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab are provided. In some embodiments, the at least one additional therapeutic agent is docetaxel. In some embodiments, the at least one additional therapeutic agent is pemetrexed. In some embodiments, the at least one additional therapeutic agent is cisplatin. In some embodiments, the at least one additional therapeutic agent is paclitaxel. In some embodiments, the at least one additional therapeutic agent is 5-FU. In some embodiments, the at least one additional therapeutic agent is topotecan. In some embodiments, the at least one additional therapeutic agent is viscristine. In some embodiments, the at least one additional therapeutic agents is a VEGF antagonist, such as an anti-VEGF antibody or a VEGF trap. In some embodiments, the at least one additional therapeutic agent is bevacizumab. In

some embodiments, the at least one additional therapeutic agent is sorafenib. In some embodiments, the FGFR1 ECD comprises a sequence selected from SEQ ID NOs: 1 to 4.

[0005] In some embodiments, methods of treating cancer comprising administering to a subject a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) fusion molecule and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, sorafenib, etoposide, topotecan, a vascular epithelial growth factor (VEGF) antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab are provided, wherein the FGFR1 ECD fusion molecule comprises an FGFR1 ECD and a fusion partner. In some embodiments, the at least one additional therapeutic agent is docetaxel. In some embodiments, the at least one additional therapeutic agent is pemetrexed. In some embodiments, the at least one additional therapeutic agent is cisplatin. In some embodiments, the at least one additional therapeutic agent is paclitaxel. In some embodiments, the at least one additional therapeutic agent is 5-FU. In some embodiments, the at least one additional therapeutic agent is viscristine. In some embodiments, the at least one additional therapeutic agent is topotecan. In some embodiments, the at least one additional therapeutic agent is a VEGF antagonist, such as an anti-VEGF antibody or a VEGF trap. In some embodiments, the at least one additional therapeutic agent is bevacizumab. In some embodiments, the at least one additional therapeutic agent is sorafenib.

[0006] In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD or FGFR1 ECD fusion molecule and at least two additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, sorafenib, etoposide, topotecan, a vascular epithelial growth factor (VEGF) antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab are provided, wherein the FGFR1 ECD fusion molecule comprises an FGFR1 ECD and a fusion partner. In some embodiments, at least one of the two additional therapeutic agents is paclitaxel. In some embodiments, at least one of the two additional therapeutic agents is cisplatin. In some embodiments, at least one of the two additional therapeutic agents is carboplatin. In some embodiments, at least one of the two additional therapeutic agents is oxaliplatin. In some embodiments, at least one of the two additional therapeutic agents is 5-FU. In some embodiments, at least one of the two additional therapeutic agents is doxorubicin. In some embodiments, at least one of the two additional therapeutic agents is etoposide. In some embodiments, at least one of the two additional therapeutic agents is topotecan. In some embodiments, at least one of the two additional therapeutic agents is a VEGF

antagonist, such as an anti-VEGF antibody or a VEGF trap. In some embodiments, at least one of the two additional therapeutic agents is bevacizumab. In some embodiments, the two additional therapeutic agents are paclitaxel and carboplatin. In some embodiments, the two additional therapeutic agents are doxorubicin and paclitaxel. In some embodiments, the two additional therapeutic agents are cisplatin and etoposide. In some embodiments, the two additional therapeutic agents are oxaliplatin and 5-FU. In some embodiments, the two additional therapeutic agents are 5-FU and leucovorin. In some embodiments, the two additional therapeutic agents are 5-FU and bevacizumab. In some embodiments, the two additional therapeutic agents are paclitaxel and bevacizumab. In some embodiments, the two additional therapeutic agents are cisplatin and etoposide.

[0007] In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD or FGFR1 ECD fusion molecule and at least three additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, sorafenib, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, and bevacizumab are provided, wherein the FGFR1 ECD fusion molecule comprises an FGFR1 ECD and a fusion partner. In some embodiments, at least one of the three additional therapeutic agents is oxaliplatin. In some embodiments, at least one of the three additional therapeutic agents is 5-FU. In some embodiments, at least one of the three additional therapeutic agents is leucovorin. In some embodiments, at least one of the three additional therapeutic agents is carboplatin. In some embodiments, at least one of the three additional therapeutic agents is paclitaxel. In some embodiments, at least one of the three additional therapeutic agents is bevacizumab. In some embodiments, the three additional therapeutic agents are oxaliplatin, 5-FU and leucovorin. In some embodiments, the three additional therapeutic agents are bevacizumab, 5-FU and leucovorin. In some embodiments, at least two of the three additional therapeutic agents are cisplatin and etoposide.

[0008] The invention also relates, in some embodiments, to a combination of an FGFR1 ECD or FGFR1 ECD fusion molecule and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, sorafenib, etoposide, topotecan, a vascular endothelial growth factor (VEGF) antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab, for treatment of cancer. The invention further relates, in some embodiments to a combination of an FGFR1 ECD or FGFR1 ECD fusion molecule and at least two additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-

fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, sorafenib, etoposide, topotecan, a vascular epithelial growth factor (VEGF) antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab, for treatment of cancer. The invention also relates, in some embodiments, to a combination of an FGFR1 ECD or FGFR1 ECD fusion molecule and at least three additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, sorafenib, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, and bevacizumab, for treatment of cancer.

[0009] In some embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule is packaged separately from the at least one, at least two, or at least three additional therapeutic agents. In some embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule is not mixed with the at least one, at least two, or at least three additional therapeutic agents prior to administration.

[0010] In some embodiments, a method of treating cancer comprising administering to a subject an FGFR1-ECD.339-Fc and docetaxel is provided, wherein the FGFR1-ECD.339-Fc comprises the amino acid sequence of SEQ ID NO: 6. In some embodiments, a method of treating cancer comprising administering to a subject an FGFR1-ECD.339-Fc and docetaxel is provided, wherein the FGFR1-ECD.339-Fc consists of the amino acid sequence of SEQ ID NO: 6.

[0011] In some embodiments, an FGFR1 ECD or FGFR1 ECD fusion molecule is glycosylated and/or sialylated. In some embodiments, an FGFR1 ECD or the polypeptide portion of the FGFR1 ECD fusion molecule is expressed in Chinese hamster ovary (CHO) cells. In some embodiments, an FGFR1 ECD comprises an amino acid sequence selected from SEQ ID NO: 1 and SEQ ID NO: 3.

[0012] In some embodiments, at least one dose of an FGFR1 ECD and/or an FGFR1 ECD fusion molecule and at least one dose of at least one additional therapeutic agent are administered concurrently. In some embodiments, at least one dose of an FGFR1 ECD and/or an FGFR1 ECD fusion molecule and at least one dose of at least one additional therapeutic agent are administered at the same time.

[0013] In some embodiments, the FGFR1 ECD comprises an amino acid sequence selected from SEQ ID NOs: 1 to 4. In some embodiments, at least one fusion partner is selected from an Fc, albumin, and polyethylene glycol. In some embodiments, at least one fusion partner is an Fc. In some embodiments, the Fc comprises an amino acid sequence selected from SEQ ID NOs: 8 to 10. In some embodiments, the FGFR1 ECD fusion molecule comprises a sequence selected

from SEQ ID NO: 5 and SEQ ID NO: 6. In some embodiments, the at least one fusion partner is an Fc and polyethylene glycol. In some embodiments, the at least one fusion partners is polyethylene glycol. In some embodiments, the fusion molecule comprises a linker between the FGFR1 ECD and one or more fusion partners. In some embodiments, the FGFR1 ECD comprises a signal peptide. In some embodiments, the signal peptide comprises the amino acid sequence of SEQ ID NO: 7.

[0014] In some embodiments, the FGFR1 ECD fusion molecule is an amount in the range of about 0.5 mg/kg body weight to about 20 mg/kg body weight, such as an amount in the range of about 8 to about 16 mg/kg body weight. In some embodiments, the therapeutically effective amount of the FGFR1 ECD fusion molecule is a dose of about 8 mg/kg body weight, while in some embodiments, the therapeutically effective amount of the FGFR1 ECD fusion molecule is a dose of about 16 mg/kg body weight (or at about 10 mg/kg body weight or about 20 mg/kg body weight, respectively, when calculated using an extinction coefficient of 1.11 mL/mg*cm). In some embodiments, the therapeutically effective amount of FGFR1 ECD fusion molecule is a dose of about 20 mg/kg body weight. In some embodiments, dosages may be administered twice a week, weekly, every other week, at a frequency between weekly and every other week, every three weeks, every four weeks, or every month.

[0015] The invention also relates, in some embodiments, to a dosage pack. In some embodiments, a dosage pack comprising at least one component selected from: (i) a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD), (ii) a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) fusion molecule, and (iii) at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, bevacizumab, and sorafenib; and instructions for administering an FGFR1 ECD or FGFR1 ECD fusion molecule and the at least one additional therapeutic to a patient is provided. In some embodiments, the instructions included with the dosage pack comprise instructions for administering a therapeutically effective amount of FGFR1 ECD fusion molecule. In some embodiments, the therapeutically effective amount of the FGFR1 ECD fusion molecule is an amount in the range of about 0.5 mg/kg body weight to about 20 mg/kg body weight, such as an amount in the range of about 8 to about 16 mg/kg body weight. In some embodiments, the therapeutically effective amount of the FGFR1 ECD fusion molecule is a dose of about 8 mg/kg body weight. In some embodiments, the therapeutically effective amount of the FGFR1 ECD fusion molecule is a dose of about 16 mg/kg body weight. In some embodiments, the therapeutically effective amount of FGFR1 ECD fusion

molecule is a dose of about 20 mg/kg body weight. In some embodiments, dosages may be administered twice a week, weekly, every other week, at a frequency between weekly and every other week, every three weeks, every four weeks, or every month.

[0016] In some embodiments, the dosage pack comprises an FGFR1 ECD and does not comprise the at least one additional therapeutic agent, e.g., docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, VEGF antagonist, anti-VEGF antibody, VEGF trap, bevacizumab, or sorafenib. In some embodiments, the dosage pack comprises an FGFR1 ECD fusion molecule and does not comprise the at least one additional therapeutic agent, e.g., docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, VEGF antagonist, anti-VEGF antibody, VEGF trap, bevacizumab, or sorafenib. In some embodiments, the dosage pack comprises at least one additional therapeutic agent, but does not comprise an FGFR1 ECD or an FGFR1 ECD fusion molecule. In some embodiments, the dosage pack comprises: (i) an FGFR1 ECD or an FGFR1 ECD fusion molecule, and (ii) at least one additional therapeutic agent. In some embodiments, the at least one additional therapeutic agent is docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, bevacizumab, or sorafenib. In some embodiments, the at least one additional therapeutic agent is docetaxel. In some embodiments, the at least one additional therapeutic agent is pemetrexed. In some embodiments, the at least one additional therapeutic agent is cisplatin. In some embodiments, the at least one additional therapeutic agent is paclitaxel. In some embodiments, the at least one additional therapeutic agent is 5-FU. In some embodiments, the at least one additional therapeutic agent is viscristine. In some embodiments, the at least one additional therapeutic agent is bevacizumab. In some embodiments, the at least one additional therapeutic agent is sorafenib. In some embodiments, the dosage pack comprises at least two additional therapeutic agents, but does not comprise an FGFR1 ECD or an FGFR1 ECD fusion molecule. In some embodiments, the at least two additional therapeutic agents are chosen from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, bevacizumab, and sorafenib.

[0017] In some embodiments described above, the FGFR1 ECD or the FGFR1 ECD portion of the FGFR1 ECD fusion molecule comprises a sequence selected from SEQ ID NOs: 1 to 4. In some embodiments, at least one fusion partner is selected from an Fc, albumin, and polyethylene

glycol. In some embodiments, at least one fusion partner is an Fc. In some embodiments, the Fc comprises an amino acid sequence selected from SEQ ID NOs: 8 to 10. In some embodiments, the FGFR1 ECD fusion molecule comprises a sequence selected from SEQ ID NO: 5 and SEQ ID NO: 6. In some embodiments, the FGFR1 ECD fusion molecule consists of a sequence selected from SEQ ID NO: 5 and SEQ ID NO: 6. In some embodiments, the at least one fusion partner is an Fc and polyethylene glycol. In some embodiments, the at least one fusion partners is polyethylene glycol.

[0018] In certain embodiments, the cancer is prostate cancer, breast cancer, colorectal cancer, lung cancer, endometrial cancer, head and neck cancer, laryngeal cancer, liver cancer, renal cancer glioblastoma or pancreatic cancer. In certain embodiments, the cancer is lung cancer. In certain embodiments, the cancer is renal cancer. In certain embodiments, the cancer is colon cancer. In certain embodiments, the cancer is breast cancer. In certain embodiments, the cancer is endometrial cancer. In certain embodiments, the cancer is prostate cancer.

[0019] Any embodiment described herein or any combination of additional therapeutic agents thereof applies to any and all methods of the invention described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] **FIG. 1** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, docetaxel alone, FGFR1-ECD.339-Fc and docetaxel sequentially, and FGFR1-ECD.339-Fc and docetaxel concurrently, as described in Example 1.

[0021] **FIG. 2** shows the mean tumor volume (A) and body weight (B) of mice administered FGFR1-ECD.339-Fc alone, pemetrexed alone (62.5 mg/kg dose), or FGFR1-ECD.339-Fc and pemetrexed (62.5 mg/kg dose), as described in Example 2.

[0022] **FIG. 3** shows the mean tumor volume (A) and body weight (B) of mice administered FGFR1-ECD.339-Fc alone, pemetrexed alone (125 mg/kg dose), or FGFR1-ECD.339-Fc and pemetrexed (125 mg/kg dose), as described in Example 2.

[0023] **FIG. 4** shows the mean tumor volume (A) and body weight (B) of mice administered FGFR1-ECD.339-Fc alone, pemetrexed alone (250 mg/kg dose), or FGFR1-ECD.339-Fc and pemetrexed (250 mg/kg dose), as described in Example 2.

[0024] **FIG. 5** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, cisplatin alone, or the combination of FGFR1-ECD.339-Fc and cisplatin, as described in Example 3A.

[0025] **FIG. 6** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, paclitaxel alone, or the combination of FGFR1-ECD.339-Fc and paclitaxel, as described in Example 3B.

[0026] **FIG. 7** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, 5-FU alone, or the combination of FGFR1-ECD.339-Fc and 5-FU, as described in Example 3C.

[0027] **FIG. 8** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, docetaxel alone, or the combination of FGFR1-ECD.339-Fc and docetaxel, at two different dosages of docetaxel, 3 mg/kg (A) and 10 mg/kg (B), as described in Example 3D.

[0028] **FIG. 9** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, vincristine alone, or the combination of FGFR1-ECD.339-Fc and vincristine, at two different dosages of vincristine, 1 mg/kg beginning on day 1 (A) and 1.5 mg/kg beginning on day 19 (B), as described in Example 3E. The mean body weight of mice administered 1.5 mg/kg beginning on day 19 is also shown (C).

[0029] **FIG. 10** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, carboplatin alone, paclitaxel alone, the combination of carboplatin and paclitaxel, and the combination of FGFR1-ECD.339-Fc, carboplatin, and paclitaxel, as described in Example 3F.

[0030] **FIG. 11** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, the combination of 5-FU (10 mg/kg) and leucovorin (10 mg/kg), and the combination of FGFR1-ECD.339-Fc, 5-FU (10 mg/kg), and leucovorin (10 mg/kg) (A); FGFR1-ECD.339-Fc alone, the combination of 5-FU (20 mg/kg) and leucovorin (20 mg/kg), and the combination of FGFR1-ECD.339-Fc, 5-FU (20 mg/kg), and leucovorin (20 mg/kg) (B); FGFR1-ECD.339-Fc alone, the combination of 5-FU (30 mg/kg) and leucovorin (30 mg/kg), and the combination of FGFR1-ECD.339-Fc, 5-FU (30 mg/kg), and leucovorin (30 mg/kg) (C); FGFR1-ECD.339-Fc alone, bevacizumab alone, and the combination of FGFR1-ECD.339-Fc and bevacizumab (D); and FGFR1-ECD.339-Fc alone, the combination of bevacizumab, 5-FU, and leucovorin, and the combination of FGFR1-ECD.339-Fc, bevacizumab, 5-FU, and leucovorin (E), as described in Example 4A.

[0031] **FIG. 12** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, oxaliplatin plus 5-FU and leucovorin (LV) alone, and the combination of FGFR1-ECD.339-Fc and oxaliplatin plus 5-FU/LV, at different dosages of oxaliplatin, 5 mg/kg (A), 10 mg/kg (B), and 15 mg/kg (C), as described in Example 4B.

[0032] **FIG. 13** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, the combination of doxorubicin and paclitaxel, and the combination of FGFR1-ECD.339-Fc, doxorubicin, and paclitaxel, as described in Example 5.

[0033] **FIG. 14** shows the mean tumor volume in mice administered FGFR1-ECD.339-Fc alone, a Kinase Insert Domain Receptor (KDR)-ECD fusion molecule alone, and the combination of FGFR1-ECD.339-Fc and the KDR-ECD fusion molecule, as described in Example 6.

DETAILED DESCRIPTION

[0034] The section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

Definitions

[0035] Unless otherwise defined, scientific and technical terms used in connection with the present invention shall have the meanings that are commonly understood by those of ordinary skill in the art. Further, unless otherwise required by context, singular terms shall include pluralities and plural terms shall include the singular.

[0036] Certain techniques used in connection with recombinant DNA, oligonucleotide synthesis, tissue culture and transformation (e.g., electroporation, lipofection), enzymatic reactions, and purification techniques are known in the art. Many such techniques and procedures are described, e.g., in Sambrook et al. *Molecular Cloning: A Laboratory Manual* (2nd ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y. (1989)), among other places. In addition, certain techniques for chemical syntheses, chemical analyses, pharmaceutical preparation, formulation, and delivery, and treatment of patients are also known in the art.

[0037] In this application, the use of "or" means "and/or" unless stated otherwise. In the context of a multiple dependent claim, the use of "or" refers back to more than one preceding independent or dependent claim in the alternative only. Also, terms such as "element" or "component" encompass both elements and components comprising one unit and elements and components that comprise more than one subunit unless specifically stated otherwise.

[0038] As used herein, all numbers are approximate, and may be varied to account for measurement error and the rounding of significant digits. The use of "**about**" before certain measured quantities includes variations due to sample impurities, measurement error, human error, and statistical variation, as well as the rounding of significant digits.

[0039] As utilized in accordance with the present disclosure, the following terms, unless otherwise indicated, shall be understood to have the following meanings:

[0040] The terms "**nucleic acid molecule**" and "**polynucleotide**" may be used interchangeably, and refer to a polymer of nucleotides. Such polymers of nucleotides may contain natural and/or non-natural nucleotides, and include, but are not limited to, DNA, RNA, and PNA. "**Nucleic acid sequence**" refers to the linear sequence of nucleotides that comprise the nucleic acid molecule or polynucleotide.

[0041] The terms "**polypeptide**" and "**protein**" are used interchangeably to refer to a polymer of amino acid residues, and are not limited to a minimum length. Such polymers of amino acid residues may contain natural or non-natural amino acid residues, and include, but are not limited to, peptides, oligopeptides, dimers, trimers, and multimers of amino acid residues. Both full-length proteins and fragments thereof are encompassed by the definition. The terms also include post-expression modifications of the polypeptide, for example, glycosylation, sialylation, acetylation, phosphorylation, and the like. Furthermore, for purposes of the present invention, a "polypeptide" refers to a protein which includes modifications, such as deletions, additions, and substitutions (generally conservative in nature), to the native sequence, as long as the protein maintains the desired activity. These modifications may be deliberate, as through site-directed mutagenesis, or may be accidental, such as through mutations of hosts which produce the proteins or errors due to PCR amplification. When a polypeptide "consists of" a particular amino acid sequence, it may still contain post-translational modifications, such as glycosylation and sialylation.

[0042] The term "**FGFR1 extracellular domain**" ("**FGFR1 ECD**") includes full-length FGFR1 ECDs, FGFR1 ECD fragments, and FGFR1 ECD variants. As used herein, the term "**FGFR1 ECD**" refers to an FGFR1 polypeptide that lacks the intracellular and transmembrane domains, with or without a signal peptide. In some embodiment, the FGFR1 ECD is a human full-length FGFR1 ECD having an amino acid sequence selected from SEQ ID NOs: 1 and 2. The term "**full-length FGFR1 ECD**", as used herein, refers to an FGFR1 ECD that extends to the last amino acid of the extracellular domain, and may or may not include an N-terminal signal peptide. As defined herein, the last amino acid of the full-length FGFR1 ECD is at position 353. Thus, a human full-length FGFR1 ECD may consist of the amino acid sequence corresponding to SEQ ID NO.: 2 (mature form) or to SEQ ID NO.: 1 (with the signal peptide). As used herein, the term "**FGFR1 ECD fragment**" refers to an FGFR1 ECD having one or more residues deleted from the N and/or C terminus of the full-length ECD and that retains the ability to bind to FGF-2. The FGFR1 ECD fragment may or may not include an N-terminal signal peptide. In some embodiments, the FGFR1 ECD fragment is a human FGFR1 ECD fragment having an amino

acid sequence corresponding to SEQ ID NO.: 4 (mature form) or to SEQ ID NO.: 3 (with the signal peptide).

[0043] As used herein, the term "**FGFR1 ECD variants**" refers to FGFR1 ECDs that contain amino acid additions, deletions, and substitutions and that remain capable of binding to FGF-2. Such variants may be at least 90%, 92%, 95%, 97%, 98%, or 99% identical to the parent FGFR1 ECD. The % identity of two polypeptides can be measured by a similarity score determined by comparing the amino acid sequences of the two polypeptides using the Bestfit program with the default settings for determining similarity. Bestfit uses the local homology algorithm of Smith and Waterman, *Advances in Applied Mathematics* 2:482-489 (1981) to find the best segment of similarity between two sequences. In some embodiments, an FGFR1 ECD variant is at least 95% identical to the sequence of SEQ ID NO: 4.

[0044] A polypeptide having an amino acid sequence at least, for example, 95% identical to a reference amino acid sequence of an FGFR1 ECD polypeptide is one in which the amino acid sequence of the polypeptide is identical to the reference sequence except that the polypeptide sequence may include up to five amino acid alterations per each 100 amino acids of the reference polypeptide. In other words, to obtain a polypeptide having an amino acid sequence at least 95% identical to a reference amino acid sequence, up to 5% of the amino acid residues in the reference sequence may be deleted or substituted with another amino acid, or a number of amino acids, up to 5% of the total amino acid residues in the reference sequence, may be inserted into the reference sequence. These alterations of the reference sequence may occur at the N- or C-terminal positions of the reference amino acid sequence or anywhere between those terminal positions, interspersed either individually among residues in the reference sequence, or in one or more contiguous groups within the reference sequence.

[0045] As a practical matter, whether any particular polypeptide is at least 70%, 80%, 90%, or 95% identical to, for instance, an amino acid sequence or to a polypeptide sequence encoded by a nucleic acid sequence set forth in the Sequence Listing can be determined conventionally using known computer programs, such the Bestfit program. When using Bestfit or other sequence alignment program to determine whether a particular sequence is, for instance, 95% identical to a reference sequence according to the present invention, the parameters are set, of course, that the percentage of identity is calculated over the full length of the reference amino acid sequence and that gaps in homology of up to 5% of the total number of amino acid residues in the reference sequence are allowed.

[0046] As used herein, the terms "**hFGFR1-ECD.353**" and "**hFGFR1.353**" may be used interchangeably to refer to the full-length human FGFR1 ECD corresponding to SEQ ID NO: 1 (with signal peptide) or to SEQ ID NO: 2 (without signal peptide; mature form).

[0047] As used herein, the terms "**hFGFR1-ECD.339**" and "**hFGFR1.339**" may be used interchangeably to refer to the human FGFR1 ECD corresponding to SEQ ID NO: 3 (with signal peptide) or to SEQ ID NO: 4 (without signal peptide; mature form).

[0048] Additional hFGFR1 ECDs are described, for example, in U.S. Patent No. 7,678,890, which is incorporated by reference herein in its entirety for any purpose.

[0049] The term "**FGFR1 ECD fusion molecule**" refers to a molecule comprising an FGFR1 ECD, and one or more "**fusion partners.**" In some embodiments, the FGFR1 ECD and the fusion partner are covalently linked ("**fused**"). If the fusion partner is also a polypeptide ("**the fusion partner polypeptide**"), the FGFR1 ECD and the fusion partner polypeptide may be part of a continuous amino acid sequence, and the fusion partner polypeptide may be linked to either the N terminus or the C terminus of the FGFR1 ECD. In such cases, the FGFR1 ECD and the fusion partner polypeptide may be translated as a single polypeptide from a coding sequence that encodes both the FGFR1 ECD and the fusion partner polypeptide (the "**FGFR1 ECD fusion protein**"). In some embodiments, the FGFR1 ECD and the fusion partner are covalently linked through other means, such as, for example, a chemical linkage other than a peptide bond. Many known methods of covalently linking polypeptides to other molecules (for example, fusion partners) may be used. In other embodiments, the FGFR1 ECD and the fusion partner may be fused through a "**linker**," which is comprised of at least one amino acid or chemical moiety.

[0050] In some embodiments, the FGFR1 ECD polypeptide and the fusion partner are noncovalently linked. In some such embodiments, they may be linked, for example, using binding pairs. Exemplary binding pairs include, but are not limited to, biotin and avidin or streptavidin, an antibody and its antigen, etc.

[0051] Exemplary fusion partners include, but are not limited to, an immunoglobulin Fc domain, albumin, and polyethylene glycol. The amino acid sequences of some exemplary Fc domains are shown in SEQ ID NOs: 8 to 10. In some embodiments, an FGFR1 ECD fused to an Fc is referred to as an "**hFGFR1 ECD-Fc.**" In some embodiments, the Fc domain is selected from an IgG1 Fc, an IgG2 Fc, an IgG3 Fc, and an IgG4 Fc.

[0052] As used herein, the terms "**hFGFR1-ECD.339-Fc**" and "**hFGFR1.339-Fc**" may be used interchangeably to refer to an amino acid sequence selected from SEQ ID NO: 6 (without signal peptide, mature form) and SEQ ID NO: 5 (with signal peptide). Nonlimiting exemplary cancers that may be treated with hFGFR1-ECD.339-Fc include, but are not limited to, non-small

cell lung cancer, colon cancer, breast cancer, gastric cancer, head and neck cancer, prostate cancer, endometrial cancer, sarcoma, small cell lung cancer, ovarian cancer, Kaposi's sarcoma, Hodgkin's disease, leukemia, non-Hodgkin's lymphoma, neuroblastoma (brain cancer), rhabdomyosarcoma, Wilms' tumor, acute lymphoblastic leukemia, acute lymphoblastic leukemia, bladder cancer, testicular cancer, lymphomas, germ cell tumors, cancers of the colon and rectum, gastrointestinal cancers, thyroid cancer, multiple myeloma, pancreatic cancer, mesothelioma, malignant pleural mesothelioma, hematological/lymphatic cancers, malignant peritoneal mesothelioma, esophageal cancer, renal cell carcinoma, glioblastoma multiforme, and liver cancer.

[0053] The term "**signal peptide**" refers to a sequence of amino acid residues located at the N terminus of a polypeptide that facilitates secretion of a polypeptide from a mammalian cell. A signal peptide may be cleaved upon export of the polypeptide from the mammalian cell, forming a mature protein. Signal peptides may be natural or synthetic, and they may be heterologous or homologous to the protein to which they are attached. Exemplary signal peptides include, but are not limited to, FGFR1 signal peptides, such as, for example, the amino acid sequence of SEQ ID NO: 7. Exemplary signal peptides also include signal peptides from heterologous proteins. A "**signal sequence**" refers to a polynucleotide sequence that encodes a signal peptide. In some embodiments, an FGFR1 ECD lacks a signal peptide. In some embodiments, an FGFR1 ECD includes at least one signal peptide, which may be a native FGFR1 signal peptide or a heterologous signal peptide.

[0054] The term "**vector**" is used to describe a polynucleotide that may be engineered to contain a cloned polynucleotide or polynucleotides that may be propagated in a host cell. A vector may include one or more of the following elements: an origin of replication, one or more regulatory sequences (such as, for example, promoters and/or enhancers) that regulate the expression of the polypeptide of interest, and/or one or more selectable marker genes (such as, for example, antibiotic resistance genes and genes that may be used in colorimetric assays, e.g., β-galactosidase). The term "**expression vector**" refers to a vector that is used to express a polypeptide of interest in a host cell.

[0055] A "**host cell**" refers to a cell that may be or has been a recipient of a vector or isolated polynucleotide. Host cells may be prokaryotic cells or eukaryotic cells. Exemplary eukaryotic cells include mammalian cells, such as primate or non-primate animal cells; fungal cells; plant cells; and insect cells. Exemplary mammalian cells include, but are not limited to, 293 and CHO cells, and their derivatives, such as 293 -6E and DG44 cells, respectively.

[0056] The term "**isolated**" as used herein refers to a molecule that has been separated from at least some of the components with which it is typically found in nature. For example, a polypeptide is referred to as "isolated" when it is separated from at least some of the components of the cell in which it was produced. Where a polypeptide is secreted by a cell after expression, physically separating the supernatant containing the polypeptide from the cell that produced it is considered to be "isolating" the polypeptide. Similarly, a polynucleotide is referred to as "isolated" when it is not part of the larger polynucleotide (such as, for example, genomic DNA or mitochondrial DNA, in the case of a DNA polynucleotide) in which it is typically found in nature, or is separated from at least some of the components of the cell in which it was produced, e.g., in the case of an RNA polynucleotide. Thus, a DNA polynucleotide that is contained in a vector inside a host cell may be referred to as "isolated" so long as that polynucleotide is not found in that vector in nature.

[0057] The term "**anti-neoplastic composition**" refers to a composition useful in treating cancer comprising at least one active therapeutic agent, *e.g.*, an "**anti-cancer agent**." Examples of therapeutic agents (anti-cancer agents) include, but are limited to, *e.g.*, chemotherapeutic agents, growth inhibitory agents, cytotoxic agents, agents used in radiation therapy, anti-angiogenic agents, apoptotic agents, anti-tubulin agents, and other agents to treat cancer, such as anti-VEGF antibodies (*e.g.,* bevacizumab, AVASTIN®),, anti-HER-2 antibodies (*e.g.,* trastuzumab, HERCEPTIN®), anti-CD20 antibodies (*e.g.,* rituximab, RITUXAN®), an epidermal growth factor receptor (EGFR) antagonist (*e.g.*, a tyrosine kinase inhibitor), HER1/EGFR inhibitors (*e.g.*, erlotinib (TARCEVA®), platelet derived growth factor inhibitors (*e.g.*, GLEEVEC® (Imatinib Mesylate)), COX-2 inhibitors (*e.g.*, celecoxib), interferons, cytokines, antagonists (*e.g.*, neutralizing antibodies) that bind to one or more of the following targets ErbB2, ErbB3, ErbB4, PDGFR-beta, BlyS, APRIL, BCMA or VEGF receptor(s), TRAIL/Apo2, and other bioactive and organic chemical agents, etc. Combinations thereof are also included in the invention.

[0058] A "**chemotherapeutic agent**" refers to a chemical compound useful in the treatment of cancer. Examples of chemotherapeutic agents include alkylating agents such as thiotepa and cyclosphosphamide (CYTOXAN®); alkyl sulfonates such as busulfan, improsulfan and piposulfan; aziridines such as benzodopa, carboquone, meturedopa, and uredopa; ethylenimines and methylamelamines including altretamine, triethylenemelamine, triethylenephosphoramide, triethylenethiophosphoramide and trimethylomelamine; acetogenins (especially bullatacin and bullatacinone); delta-9-tetrahydrocannabinol (dronabinol, MARINOL®); beta-lapachone; lapachol; colchicines; betulinic acid; a camptothecin (including the synthetic analogue topotecan

(HYCAMTIN®), CPT-11 (irinotecan, CAMPTOSAR®), acetylcamptothecin, scopolectin, and 9-aminocamptothecin); bryostatin; callystatin; CC-1065 (including its adozelesin, carzelesin and bizelesin synthetic analogues); podophyllotoxin; podophyllinic acid; teniposide; cryptophycins (particularly cryptophycin 1 and cryptophycin 8); dolastatin; duocarmycin (including the synthetic analogues, KW-2189 and CB1-TM1); eleutherobin; pancratistatin; a sarcodictyin; spongistatin; nitrogen mustards such as chlorambucil, chlornaphazine, chlorophosphamide, estramustine, ifosfamide, mechlorethamine, mechlorethamine oxide hydrochloride, melphalan, novembichin, phenesterine, prednimustine, trofosfamide, uracil mustard; nitrosoureas such as carmustine, chlorozotocin, fotemustine, lomustine, nimustine, and ranimnustine; antibiotics such as the enediyne antibiotics (e. g., calicheamicin, especially calicheamicin gamma1I and calicheamicin omegaI1 (see, e.g., Nicolaou *et al.*, *Angew. Chem Intl. Ed. Engl.*, 33: 183-186 (1994)); CDP323, an oral alpha-4 integrin inhibitor; dynemicin, including dynemicin A; an esperamicin; as well as neocarzinostatin chromophore and related chromoprotein enediyne antibiotic chromophores), aclacinomysins, actinomycin, authramycin, azaserine, bleomycins, cactinomycin, carabicin, carminomycin, carzinophilin, chromomycins, dactinomycin, daunorubicin, detorubicin, 6-diazo-5-oxo-L-norleucine, doxorubicin (including ADRIAMYCIN®, morpholino-doxorubicin, cyanomorpholino-doxorubicin, 2-pyrrolino-doxorubicin, doxorubicin HCl liposome injection (DOXIL®), liposomal doxorubicin TLC D-99 (MYOCET®), pegylated liposomal doxorubicin (CAELYX®), and deoxydoxorubicin), epirubicin, esorubicin, idarubicin, marcellomycin, mitomycins such as mitomycin C, mycophenolic acid, nogalamycin, olivomycins, peplomycin, porfiromycin, puromycin, quelamycin, rodorubicin, streptonigrin, streptozocin, tubercidin, ubenimex, zinostatin, zorubicin; anti-metabolites such as methotrexate, gemcitabine (GEMZAR®), pemetrexed (ALIMTA®); tegafur (UFTORAL®), capecitabine (XELODA®), an epothilone, and 5-fluorouracil (5-FU); folic acid analogues such as denopterin, methotrexate, pteropterin, trimetrexate; purine analogs such as fludarabine, 6-mercaptopurine, thiamiprine, thioguanine; pyrimidine analogs such as ancitabine, azacitidine, 6-azauridine, carmofur, cytarabine, dideoxyuridine, doxifluridine, enocitabine, floxuridine; androgens such as calusterone, dromostanolone propionate, epitiostanol, mepitiostane, testolactone; anti-adrenals such as aminoglutethimide, mitotane, trilostane; folic acid replenisher such as folinic acid; aceglatone; aldophosphamide glycoside; aminolevulinic acid; eniluracil; amsacrine; bestrabucil; bisantrene; edatraxate; defofamine; demecolcine; diaziquone; elfornithine; elliptinium acetate; an epothilone; etoglucid; gallium nitrate; hydroxyurea; lentinan; lonidainine; maytansinoids such as maytansine and ansamitocins; mitoguazone; mitoxantrone; mopidanmol; nitraerine; pentostatin; phenamet; pirarubicin;

losoxantrone; 2-ethylhydrazide; procarbazine; PSK® polysaccharide complex (JHS Natural Products, Eugene, OR); razoxane; rhizoxin; sizofiran; spirogermanium; tenuazonic acid; triaziquone; 2,2',2'-trichlorotriethylamine; trichothecenes (especially T-2 toxin, verracurin A, roridin A and anguidine); urethan; vindesine (ELDISINE®, FILDESIN®); dacarbazine; mannomustine; mitobronitol; mitolactol; pipobroman; gacytosine; arabinoside ("Ara-C"); thiotepa; taxoid, *e.g.*, paclitaxel (TAXOL®), albumin-engineered nanoparticle formulation of paclitaxel (ABRAXANE™), and docetaxel (TAXOTERE®); chloranbucil; 6-thioguanine; mercaptopurine; methotrexate; platinum agents such as cisplatin, oxaliplatin (e.g., ELOXATIN®), and carboplatin; vincas, which prevent tubulin polymerization from forming microtubules, including vinblastine (VELBAN®), vincristine (ONCOVIN®), vindesine (ELDISINE®, FILDESIN®), and vinorelbine (NAVELBINE®); etoposide (VP-16); ifosfamide; mitoxantrone; leucovorin; novantrone; edatrexate; daunomycin; aminopterin; ibandronate; topoisomerase inhibitor RFS 2000; difluoromethylornithine (DMFO); retinoids such as retinoic acid, including bexarotene (TARGRETIN®); bisphosphonates such as clodronate (for example, BONEFOS® or OSTAC®), etidronate (DIDROCAL®), NE-58095, zoledronic acid/zoledronate (ZOMETA®), alendronate (FOSAMAX®), pamidronate (AREDIA®), tiludronate (SKELID®), or risedronate (ACTONEL®); troxacitabine (a 1,3-dioxolane nucleoside cytosine analog); antisense oligonucleotides, particularly those that inhibit expression of genes in signaling pathways implicated in aberrant cell proliferation, such as, for example, PKC-alpha, Raf, H-Ras, and epidermal growth factor receptor (EGF-R); vaccines such as THERATOPE® vaccine and gene therapy vaccines, for example, ALLOVECTIN® vaccine, LEUVECTIN® vaccine, and VAXID® vaccine; topoisomerase 1 inhibitor (*e.g.*, LURTOTECAN®); rmRH (*e.g.*, ABARELIX®); BAY439006 (sorafenib, NEXAVAR®; Bayer); SU-11248 (sunitinib, SUTENT®, Pfizer); perifosine, COX-2 inhibitor (*e.g.* celecoxib or etoricoxib), proteosome inhibitor (*e.g.* PS341); bortezomib (VELCADE®); CCI-779; tipifarnib (R11577); orafenib, ABT510; Bcl-2 inhibitor such as oblimersen sodium (GENASENSE®); pixantrone; EGFR inhibitors (see definition below); tyrosine kinase inhibitors (see definition below); serine-threonine kinase inhibitors such as rapamycin (sirolimus, RAPAMUNE®); farnesyltransferase inhibitors such as lonafarnib (SCH 6636, SARASAR™); and pharmaceutically acceptable salts, acids or derivatives of any of the above; as well as combinations of two or more of the above such as CHOP, an abbreviation for a combined therapy of cyclophosphamide, doxorubicin, vincristine, and prednisolone; and FOLFOX, an abbreviation for a treatment regimen with oxaliplatin (ELOXATIN™) combined with 5-FU and leucovorin.

[0059] Chemotherapeutic agents as defined herein include "anti-hormonal agents" or "endocrine therapeutics" which act to regulate, reduce, block, or inhibit the effects of hormones that can promote the growth of cancer. They may be hormones themselves, including, but not limited to: anti-estrogens with mixed agonist/antagonist profile, including, tamoxifen (NOLVADEX®), 4-hydroxytamoxifen, toremifene (FARESTON®), idoxifene, droloxifene, raloxifene (EVISTA®), trioxifene, keoxifene, and selective estrogen receptor modulators (SERMs) such as SERM3; pure anti-estrogens without agonist properties, such as fulvestrant (FASLODEX®), and EM800 (such agents may block estrogen receptor (ER) dimerization, inhibit DNA binding, increase ER turnover, and/or suppress ER levels); aromatase inhibitors, including steroidal aromatase inhibitors such as formestane and exemestane (AROMASIN®), and nonsteroidal aromatase inhibitors such as anastrazole (ARIMIDEX®), letrozole (FEMARA®) and aminoglutethimide, and other aromatase inhibitors include vorozole (RIVISOR®), megestrol acetate (MEGASE®), fadrozole, and 4(5)-imidazoles; lutenizing hormone-releasing hormone agonists, including leuprolide (LUPRON® and ELIGARD®), goserelin, buserelin, and tripterelin; sex steroids, including progestins such as megestrol acetate and medroxyprogesterone acetate, estrogens such as diethylstilbestrol and premarin, and androgens/retinoids such as fluoxymesterone, all transretinoic acid and fenretinide; onapristone; anti-progesterones; estrogen receptor down-regulators (ERDs); anti-androgens such as flutamide, nilutamide and bicalutamide; and pharmaceutically acceptable salts, acids or derivatives of any of the above; as well as combinations of two or more of the above.

[0060] An "**angiogenic factor or agent**" refers to a growth factor which stimulates the development of blood vessels, *e.g.*, promote angiogenesis, endothelial cell growth, stability of blood vessels, and/or vasculogenesis, *etc.* For example, angiogenic factors, include, but are not limited to, *e.g.*, VEGF and members of the VEGF family (VEGF-B, VEGF-C and VEGF-D), PlGF, PDGF family, fibroblast growth factor family (FGFs), TIE ligands (Angiopoietins), ephrins, delta-like ligand 4 (DLL4), del-1, fibroblast growth factors: acidic (aFGF) and basic (bFGF), follistatin, granulocyte colony-stimulating factor (G-CSF), hepatocyte growth factor (HGF) /scatter factor (SF), interleukin-8 (IL-8), leptin, midkine,neuropilins, placental growth factor, platelet-derived endothelial cell growth factor (PD-ECGF), platelet-derived growth factor, especially PDGF-BB or PDGFR-beta, pleiotrophin (PTN), progranulin, proliferin, transforming growth factor-alpha (TGF-alpha), transforming growth factor-beta (TGF-beta), tumor necrosis factor-alpha (TNF-alpha), etc. It would also include factors that accelerate wound healing, such as growth hormone, insulin-like growth factor-I (IGF-I), VIGF, epidermal growth factor (EGF), CTGF and members of its family, and TGF-alpha and TGF-beta. *See, e.g.*, Klagsbrun and

D'Amore (1991) *Annu. Rev. Physiol.* 53:217-39; Streit and Detmar (2003) *Oncogene* 22:3172-3179; Ferrara & Alitalo (1999) *Nature Medicine* 5(12):1359-1364; Tonini *et al.* (2003) *Oncogene* 22:6549-6556 (*e.g.*, Table 1 listing known angiogenic factors); and, Sato (2003) *Int. J. Clin. Oncol.* 8:200-206.

[0061] An "**anti-angiogenic agent**" or "**angiogenesis inhibitor**" refers to a small molecular weight substance, a polynucleotide (including, *e.g.*, an inhibitory RNA (RNAi or siRNA)), a polypeptide, an isolated protein, a recombinant protein, an antibody, or conjugates or fusion proteins thereof, that inhibits angiogenesis, vasculogenesis, or undesirable vascular permeability, either directly or indirectly. It should be understood that the anti-angiogenic agent includes those agents that bind and block the angiogenic activity of the angiogenic factor or its receptor. For example, an anti-angiogenic agent is an antibody or other antagonist to an angiogenic agent as defined above, *e.g.*, fusion proteins that binds to VEGF-A such as ZALTRAP™ (Aflibercept), antibodies to VEGF-A such as AVASTIN® (bevacizumab) or to the VEGF-A receptor (*e.g.*, KDR receptor or Flt-1 receptor), anti-PDGFR inhibitors such as GLEEVEC® (Imatinib Mesylate), small molecules that block VEGF receptor signaling (*e.g.*, PTK787/ZK2284, SU6668, SUTENT®/SU11248 (sunitinib malate), AMG706, or those described in, *e.g.*, international patent application WO 2004/113304). Anti-angiogenic agents also include native angiogenesis inhibitors, *e.g.*, angiostatin, endostatin, *etc.* *See, e.g.*, Klagsbrun and D'Amore (1991) *Annu. Rev. Physiol.* 53:217-39; Streit and Detmar (2003) *Oncogene* 22:3172-3179 (*e.g.*, Table 3 listing anti-angiogenic therapy in malignant melanoma); Ferrara & Alitalo (1999) *Nature Medicine* 5(12):1359-1364; Tonini *et al.* (2003) *Oncogene* 22:6549-6556 (*e.g.*, Table 2 listing known anti-angiogenic factors); and, Sato (2003) *Int. J. Clin. dOncol.* 8:200-206 (*e.g.*, Table 1 listing anti-angiogenic agents used in clinical trials).

[0062] "**Docetaxel**" refers to 1,7β,10β-trihydroxy-9-oxo-5β,20-epoxytax-11-ene-2α,4,13α-triyl 4-acetate 2-benzoate 13-{(2R,3S)-3-[(tert-butoxycarbonyl)amino]-2-hydroxy-3-phenylpropanoate}, which, in some embodiments, may be sold under the brand name Taxotere®. In some embodiments, docetaxel is effective for treating at least one cancer selected from breast cancer and non small-cell lung cancer. Nonlimiting exemplary cancers that may be treated with docetaxel include breast cancer, colorectal cancer, lung cancer, ovarian cancer, prostate cancer, liver cancer, renal cancer, gastric cancer, head and neck cancers, and melanoma.

[0063] "**Paclitaxel**" refers to (2α,4α,5β,7β,10β,13α)-4,10-bis(acetyloxy)-13-{[(2R,3S)- 3-(benzoylamino)-2-hydroxy-3-phenylpropanoyl]oxy}- 1,7-dihydroxy-9-oxo-5,20-epoxytax-11-en-2-yl benzoate, which, in some embodiments, may be sold under the brand name TAXOL®.

Nonlimiting exemplary cancers that may be treated with paclitaxel include breast cancer, lung cancer, and Kaposi's sarcoma.

[0064] "**Carboplatin**" refers to *cis*-diammine(cyclobutane-1,1-dicarboxylate-O,O')platinum(II), which, in some embodiments, may be sold under the brand name Paraplatin®. Nonlimiting exemplary cancers that may be treated with paclitaxel include, ovarian cancer, non-small cell lung cancer, testicular cancer, stomach cancer, and bladder cancer.

[0065] "**Oxaliplatin**" refers to [(1R,2R)-cyclohexane-1,2-diamine](ethanedioato-O,O')platinum(II), which, in some embodiments, may be sold under the brand name Eloxatin®. Nonlimiting exemplary cancers that may be treated with oxaliplatin include colorectal cancer, gastric cancer, and ovarian cancer.

[0066] "**Cisplatin**" refers to (SP-4-2)-diamminedichloridoplatinum. Nonlimiting exemplary cancers that may be treated with cisplatin include sarcomas, small cell lung cancer, ovarian cancer, bladder cancer, testicular cancer, lymphomas, and germ cell tumors.

[0067] "**Vincristine**" refers to methyl (1R,9R,10S,11R,12R,19R)- 11-(acetyloxy)- 12-ethyl- 4-[(13S,15S,17S)- 17-ethyl- 17-hydroxy- 13-(methoxycarbonyl)- 1,11-diazatetracyclo[13.3.1.$0^{4,12}$.$0^{5,10}$]nonadeca- 4(12),5,7,9-tetraen- 13-yl]- 8-formyl- 10-hydroxy- 5-methoxy- 8,16-diazapentacyclo[10.6.1.$0^{1,9}$.$0^{2,7}$.$0^{16,19}$]nonadeca- 2,4,6,13-tetraene- 10-carboxylate, which, in some embodiments, may be sold under the brand name Vincasar®. Nonlimiting exemplary cancers that may be treated with vincristine include Hodgkin's disease, leukemia, non-Hodgkin's lymphoma, neuroblastoma, rhabdomyosarcoma, acute lymphoblastic leukemia, and Wilms' tumor.

[0068] "**Pemetrexed**" refers to (S)-2-[4-[2-(4-amino-2-oxo-3,5,7-triazabicyclo[4.3.0] nona-3,8,10-trien-9-yl)ethyl] benzoyl] aminopentanedioic acid, which, in some embodiments, may be sold under the brand name Alimta®. Nonlimiting exemplary cancers that may be treated with pemetrexed include non small cell lung cancer, mesothelioma, and esophageal cancer.

[0069] "**Doxorubicin**" refers to (8S,10S)-10-(4-amino-5-hydroxy-6-methyl-tetrahydro-2H-pyran-2-yloxy)-6,8,11-trihydroxy-8-(2-hydroxyacetyl)-1-methoxy-7,8,9,10-tetrahydrotetracene-5,12-dione, which, in some embodiments, may be sold under the brand name Adriamycin®. Nonlimiting exemplary cancers that may be treated with doxorubicin include bladder cancer, breast cancer, lung cancer, ovarian cancer, stomach cancer, thyroid cancer, soft tissue sarcoma, multiple myeloma, Hodgkin's disease, leukemia, non-Hodgkin's lymphoma, neuroblastoma, sarcoma, and Wilms' tumor.

[0070] "**5-FU**" and "**5-fluorouracil**" refer to 5-fluoro-1H-pyrimidine-2,4-dione, which, in some embodiments, may be sold under the brand name Adrucil®. Nonlimiting exemplary

cancers that may be treated with 5-FU include colorectal cancer, pancreatic cancer, breast cancer, esophageal cancer, gastric cancer, head and neck cancer, hepatoma, and ovarian cancer.

[0071] "**Leucovorin**" is also known as folinic acid, and refers to (S)-2-[4-[(2-amino-5-formyl-4-oxo-5,6,7,8-tetrahydro-1H-pteridin-6-yl)methylamino]benzoyl] aminopentanedioic acid. In some embodiments, leucovorin is administered with 5-fluorouracil.

[0072] The term "**VEGF**" or "**VEGF-A**" as used herein refers to the 165-amino acid human vascular endothelial cell growth factor and related 121-, 189-, and 206- amino acid human vascular endothelial cell growth factors, as described by Leung *et al.* (1989) Science 246:1306, and Houck *et al.* (1991) Mol. Endocrin, 5:1806, together with the naturally occurring allelic and processed forms thereof. The term "VEGF" also refers to VEGFs from non-human species such as mouse, rat or primate. Sometimes the VEGF from a specific species are indicated by terms such as hVEGF for human VEGF, mVEGF for murine VEGF, and *etc.* The term "VEGF" is also used to refer to truncated forms of the polypeptide comprising amino acids 8 to 109 or 1 to 109 of the 165-amino acid human vascular endothelial cell growth factor. Reference to any such forms of VEGF may be identified in the present application, *e.g.,* by "VEGF (8-109)," "VEGF (1-109)," "VEGF-A_{109}" or "VEGF165." The amino acid positions for a "truncated" native VEGF are numbered as indicated in the native VEGF sequence. For example, amino acid position 17 (methionine) in truncated native VEGF is also position 17 (methionine) in native VEGF. The truncated native VEGF has binding affinity for the KDR and Flt-1 receptors comparable to native VEGF.

[0073] A "**VEGF antagonist**" refers to a molecule capable of neutralizing, blocking, inhibiting, abrogating, reducing or interfering with VEGF activities including, but not limited to, its binding to one or more VEGF receptors. VEGF antagonists include, without limitation, anti-VEGF antibodies and antigen-binding fragments thereof, receptor molecules and derivatives which bind specifically to VEGF thereby sequestering its binding to one or more receptors, anti-VEGF receptor antibodies, VEGF receptor antagonists such as small molecule inhibitors of the VEGFR tyrosine kinases, and immunoadhesins that binds to VEGF such as VEGF trap (e.g., aflibercept). The term "VEGF antagonist," as used herein, specifically includes molecules, including antibodies, antibody fragments, other binding polypeptides, peptides, and non-peptide small molecules, that bind to VEGF and are capable of neutralizing, blocking, inhibiting, abrogating, reducing or interfering with VEGF activities. Thus, the term "VEGF activities" specifically includes VEGF mediated biological activities of VEGF.

[0074] The term "**VEGF trap**" as used herein means a protein, such as a fusion molecule, that binds to VEGF and is capable of neutralizing, blocking, inhibiting, abrogating, reducing or interfering with VEGF activities. An example of a VEGF trap is aflibercept.

[0075] The term "**anti-VEGF antibody**" or "**an antibody that binds to VEGF**" refers to an antibody that is capable of binding to VEGF with sufficient affinity and specificity that the antibody is useful as a diagnostic and/or therapeutic agent in targeting VEGF. Anti-VEGF antibodies suppress the growth of a variety of human tumor cell lines in nude mice (Kim *et al., Nature* 362:841-844 (1993); Warren *et al., J. Clin. Invest.* 95:1789-1797 (1995); Borgström *et al., Cancer Res.* 56:4032-4039 (1996); Melnyk *et al., Cancer Res.* 56:921-924 (1996)) and also inhibit intraocular angiogenesis in models of ischemic retinal disorders. Adamis *et al., Arch. Ophthalmol.* 114:66-71 (1996). For example, the anti-VEGF antibody can be used as a therapeutic agent in targeting and interfering with diseases or conditions wherein the VEGF activity is involved. *See, e.g.,* U.S. Patents 6,582,959, 6,703,020; WO98/45332; WO 96/30046; WO94/10202, WO2005/044853; EP 0666868B1; US Patent Applications 20030206899, 20030190317, 20030203409, 20050112126, 20050186208, and 20050112126; Popkov *et al., Journal of Immunological Methods* 288:149-164 (2004); and WO2005012359. The antibody selected will normally have a sufficiently strong binding affinity for VEGF. For example, the antibody may bind hVEGF with a K_d value of between 100 nM-1 pM. Antibody affinities may be determined by a surface plasmon resonance based assay (such as the BIAcore assay as described in PCT Application Publication No. WO2005/012359); enzyme-linked immunoabsorbent assay (ELISA); and competition assays (e.g. RIA's), for example. The antibody may be subjected to other biological activity assays, *e.g.*, in order to evaluate its effectiveness as a therapeutic. Such assays are known in the art and depend on the target antigen and intended use for the antibody. Examples include the HUVEC inhibition assay; tumor cell growth inhibition assays (as described in WO 89/06692, for example); antibody-dependent cellular cytotoxicity (ADCC) and complement-mediated cytotoxicity (CDC) assays (US Patent 5,500,362); and agonistic activity or hematopoiesis assays (see WO 95/27062). An anti-VEGF antibody will usually not bind to other VEGF homologues such as VEGF-B, VEGF-C, VEGF-D or VEGF-E, nor other growth factors such as PlGF, PDGF or bFGF.

[0076] In one embodiment, anti-VEGF antibodies include a monoclonal antibody that binds to the same epitope as the monoclonal anti-VEGF antibody A4.6.1 produced by hybridoma ATCC HB 10709; a recombinant humanized anti-VEGF monoclonal antibody (*see* Presta *et al.* (1997) *Cancer Res.* 57:4593-4599), including but not limited to the antibody known as "**bevacizumab**" also known as "rhuMAb VEGF" or "AVASTIN®." AVASTIN® is presently commercially

available. Nonlimiting exemplary cancers that may be treated with bevacizumab include non-small cell lung cancer, colorectal cancer, breast cancer, renal cancer, ovarian cancer, glioblastoma multiforme, pediatric osteosarcoma, gastric cancer and pancreatic cancer. Bevacizumab comprises mutated human IgG_1 framework regions and antigen-binding complementarity-determining regions from the murine antibody A.4.6.1 that blocks binding of human VEGF to its receptors. Bevacizumab and other humanized anti-VEGF antibodies are further described in U.S. Pat. Nos. 6,884,879, and 7,169,901. Additional anti-VEGF antibodies are described in PCT Application Publication Nos. WO2005/012359 and WO2009/073160; U.S. Pat. Nos. 7,060,269, 6,582,959, 6,703,020; 6,054,297; WO98/45332; WO 96/30046; WO94/10202; EP 0666868B1; U.S. Patent Application Publication Nos. 2006009360, 20050186208, 20030206899, 20030190317, 20030203409, and 20050112126; and Popkov *et al.*, *Journal of Immunological Methods* 288:149-164 (2004).

[0077] The terms "**subject**" and "**patient**" are used interchangeably herein to refer to a mammal. In some embodiments, the subject or patient is a human. In other embodiments, methods of treating other mammals, including, but not limited to, rodents, simians, felines, canines, equines, bovines, porcines, ovines, caprines, mammalian laboratory animals, mammalian farm animals, mammalian sport animals, and mammalian pets, are also provided.

[0078] "**Cancer**" and "**tumor**," as used herein, are interchangeable terms that refer to any abnormal cell or tissue growth or proliferation in an animal. As used herein, the terms "cancer" and "tumor" encompass solid and hematological/lymphatic cancers and also encompass malignant, pre-malignant, and benign growth, such as dysplasia. Examples of cancer include but are not limited to, carcinoma, lymphoma, blastoma, sarcoma, and leukemia. More particular non-limiting examples of such cancers include squamous cell cancer, small-cell lung cancer, pituitary cancer, esophageal cancer, astrocytoma, soft tissue sarcoma, non-small cell lung cancer, adenocarcinoma of the lung, squamous carcinoma of the lung, cancer of the peritoneum, hepatocellular cancer, gastrointestinal cancer, pancreatic cancer, glioblastoma, cervical cancer, ovarian cancer, liver cancer, bladder cancer, hepatoma, breast cancer, colon cancer, colorectal cancer, endometrial or uterine carcinoma, salivary gland carcinoma, kidney cancer, renal cancer, liver cancer, prostate cancer, vulval cancer, thyroid cancer, hepatic carcinoma, brain cancer, endometrial cancer, testis cancer, cholangiocarcinoma, gallbladder carcinoma, gastric cancer, melanoma, and various types of head and neck cancer.

[0079] "**Treatment**," as used herein, includes any administration or application of a therapeutic for condition in a mammal, including a human, and includes inhibiting the condition or progression of the condition, inhibiting or slowing the condition or its progression, arresting its

development, partially or fully relieving the condition, or curing the condition, for example, by causing regression, or restoring or repairing a lost, missing, or defective function; or stimulating an inefficient process. In some embodiments, "treatment" refers to clinical intervention in an attempt to alter the natural course of the individual or cell being treated, and can be performed either for prophylaxis or during the course of clinical pathology. Desirable effects of treatment include preventing occurrence or recurrence of disease, alleviation of symptoms, diminishment of any direct or indirect pathological consequences of the disease, preventing metastasis, decreasing the rate of disease progression, amelioration or palliation of the disease state, and remission or improved prognosis.

[0080] An "**effective amount**" or "**therapeutically effective amount**" of a molecule or a combination of molecules means an amount that is sufficient to treat a condition and/or to inhibit growth of tumor cells in at least a subset of subjects when given alone or in combination with other treatments. In certain embodiments, a therapeutically effective amount refers to an amount effective, at dosages and for periods of time necessary, to achieve the desired therapeutic or prophylactic result. A therapeutically effective amount of FGFR1 fusion protein of the invention may vary according to factors such as the disease state, age, sex, and weight of the individual, and the ability of FGFR1 fusion protein to elicit a desired response in the individual. A therapeutically effective amount is also one in which any toxic or detrimental effects of the FGFR1 fusion proteins are outweighed by the therapeutically beneficial effects. In the case of cancer, the effective amount of the drug may reduce the number of cancer cells; reduce the tumor size; inhibit (*i.e.*, slow to some extent and typically stop) cancer cell infiltration into peripheral organs; inhibit (*i.e.*, slow to some extent and typically stop) tumor metastasis; inhibit, to some extent, tumor growth; allow for treatment of the tumor, and/or relieve to some extent one or more of the symptoms associated with the disorder. To the extent the drug may prevent growth and/or kill existing cancer cells, it may be cytostatic and/or cytotoxic.

[0081] A "**prophylactically effective amount**" refers to an amount effective, at dosages and for periods of time necessary, to achieve the desired prophylactic result. Typically but not necessarily, since a prophylactic dose is used in subjects prior to or at an earlier stage of disease, the prophylactically effective amount will be less than the therapeutically effective amount.

[0082] The terms "**inhibition**" or "**inhibit**" refer to a decrease or cessation of any phenotypic characteristic or to the decrease or cessation in the incidence, degree, or likelihood of that characteristic. Nonlimiting exemplary inhibition includes inhibition of tumor growth.

[0083] Herein, "**concurrent**" dosing refers to the administration of two therapeutic molecules within an eight hour time period. In some embodiments, two therapeutic molecules are

administered at the same time. Two therapeutic molecules are considered to be administered at the same time (i.e. simultaneously) if at least a portion of a dose of each therapeutic molecule is administered within 1 hour. Two therapeutic molecules are administered concurrently if at least one dose is administered concurrently, even if one or more other doses are not administered concurrently. In some embodiments, concurrent administration includes a dosing regimen when the administration of one or more therapeutic molecule(s) continues after discontinuing the administration of one or more other therapeutic molecules(s).

[0084] Administration "**in combination with**" one or more further therapeutic agents includes concurrent (including simultaneous) and consecutive (i.e., sequential) administration in any order.

[0085] A "**pharmaceutically acceptable carrier**" refers to a non-toxic solid, semisolid, or liquid filler, diluent, encapsulating material, formulation auxiliary, or carrier conventional in the art for use with a therapeutic agent that together comprise a "**pharmaceutical composition**" for administration to a subject. A pharmaceutically acceptable carrier is non-toxic to recipients at the dosages and concentrations employed and is compatible with other ingredients of the formulation. The pharmaceutically acceptable carrier is appropriate for the formulation employed. For example, if the therapeutic agent is to be administered orally, the carrier may be a gel capsule. If the therapeutic agent is to be administered subcutaneously, the carrier ideally is not irritable to the skin and does not cause injection site reaction.

Therapeutic Compositions and Methods

Methods of Treating Cancer using FGFR1 ECDs and/or FGFR1 ECD Fusion Molecules in Combination with Other Therapeutic Agents

[0086] The invention features the combination of a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) or FGFR1 ECD fusion molecule with one or more additional anti-cancer therapies and the use of such combinations in cancer treatment. Examples of the additional anti-cancer therapies include, without limitation, surgery, radiation therapy (radiotherapy), biotherapy, immunotherapy, and chemotherapy or a combination of these therapies. In addition, cytotoxic agents, anti-angiogenic and anti-proliferative agents can be used in combination with the FGFR1 ECD or FGFR1 ECD fusion molecule. In certain aspects of any of the methods and uses, the invention provides treating cancer, by administering therapeutically effective amounts of an FGFR1 ECD and/or FGFR1 ECD fusion molecule and one or more chemotherapeutic agents to a subject diagnosed with or suffering from a previously untreated cancer. A variety of chemotherapeutic agents may be used in the combined treatment methods and uses of the invention. An exemplary and non-limiting list of chemotherapeutic agents

contemplated is provided herein under "Definitions" and in the "Summary of the Invention." In another aspect, the invention provides treating cancer, by administering therapeutically effective amounts of an FGFR1 ECD and/or FGFR1 ECD fusion molecule and one or more anti-angiogenic agent(s) to a subject diagnosed with a previously untreated cancer. In another aspect, the invention provides treating cancer, by administering therapeutically effective amounts of an FGFR1 ECD and/or FGFR1 ECD fusion molecule and one or more VEGF antagonists to a subject diagnosed with a previously untreated cancer. In yet another aspect, the invention provides treating cancer, by administering therapeutically effective amounts of an FGFR1 ECD and/or FGFR1 ECD fusion molecule and one or more VEGF antagonists in combination with one or more chemotherapeutic agents to a subject diagnosed with a previously untreated cancer. In some embodiments, the one or more VEGF antagonists are anti-VEGF antibodies and/or VEGF traps.

[0087] In one example, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule in combination with at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, sorafenib, etoposide, topotecan, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, and bevacizumab are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and docetaxel are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and pemetrexed are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and paclitaxel are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and cisplatin are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and vincristine are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and 5-FU are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and etoposide are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and topotecan are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and a VEGF antagonist are provided. In some embodiments, methods of

treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and an anti-VEGF antibody are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and a VEGF trap are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1 ECD and/or FGFR1 ECD fusion molecule and bevacizumab are provided. In some embodiments, at least one dose of the FGFR1 ECD and/or FGFR1 ECD fusion molecule and at least one dose of at least one additional therapeutic agent are administered concurrently. In some embodiments, at least one dose of the FGFR1 ECD and/or FGFR1 ECD fusion molecule and at least one dose of at least one additional therapeutic agent are administered at the same time (i.e., simultaneously). In some embodiments, at least one dose of the FGFR1 ECD and/or FGFR1 ECD fusion molecule and at least one dose of at least two additional therapeutic agents are administered concurrently or simultaneously . In some embodiments, at least one dose of the FGFR1 ECD and/or FGFR1 ECD fusion molecule and at least one dose of at least three additional therapeutic agents are administered concurrently or simultaneously. In another example, methods of treating cancer comprising administering to a subject an FGFR1-ECD.339-Fc in combination with at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, and etoposide, topotecan, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, sorafenib, and bevacizumab are provided. In some embodiments, methods of treating cancer comprising administering to a subject an FGFR1-ECD.339-Fc and docetaxel are provided. In some embodiments, at least one dose of an FGFR1-ECD.339-Fc and at least one dose of at least one additional therapeutic agent are administered concurrently. In some embodiments, at least one dose of an FGFR1-ECD.339-Fc and at least one dose of at least one additional therapeutic agent are administered at the same time.

[0088] Pharmaceutical compositions comprising FGFR1 ECD and/or FGFR1 ECD fusion molecules (e.g., FGFR1-ECD.339-Fc) are administered in a therapeutically effective amount for the specific indication. The therapeutically effective amount is typically dependent on the weight of the subject being treated, his or her physical or health condition, the extensiveness of the condition to be treated, and/or the age of the subject being treated. In general, an FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) is to be administered in an amount in the range of about 50 μg/kg body weight to about 100 mg/kg body weight per dose. Optionally, the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) can be administered in an amount in the range of about 100 μg/kg body weight to about 30 mg/kg body weight per dose. Further optionally, the FGFR1 ECD and/or FGFR1 ECD fusion

molecule (e.g., FGFR1-ECD.339-Fc) can be administered in an amount in the range of about 0.5 mg/kg body weight to about 20 mg/kg body weight per dose. In certain embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) is administered at a dose of about 8 mg/kg body weight to about 20 mg/kg body weight. In some embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) is administered at a dose of about 8 mg/kg body weight, about 10 mg/kg body weight, about 11 mg/kg body weight, about 12 mg/kg body weight, about 13 mg/kg body weight, about 14 mg/kg body weight, about 15 mg/kg body weight, about 16 mg/kg body weight, about 17 mg/kg body weight, about 18 mg/kg body weight, about 19 mg/kg body weight, or about 20 mg/kg body weight. The FGFR1 ECD and/or FGFR1 ECD fusion molecules may also be administered at ranges from one of the above doses to another. In some embodiments, dosages may be administered twice a week, weekly, every other week, at a frequency between weekly and every other week, every three weeks, every four weeks, or every month.

[0089] In certain embodiments, dosages of the FGFR1 ECD and/or FGFR1 ECD fusion molecules can be calculated in two ways depending on the extinction coefficient (EC) used. The extinction coefficient differs depending on whether the glycosylation of the protein is taken into account. In one embodiment, the extinction coefficient based on the amino acid composition of FGFR1-ECD.339-Fc, for example, is 1.42 mL/mg*cm. In another embodiment, when the carbohydrate portion as well as the amino acid portion of FGFR1-ECD.339-Fc is accounted for, the extinction coefficient is 1.11 mL/mg*cm. Calculation of the FGFR1-ECD.339-Fc dose using an EC of 1.11 mL/mg*cm increases the calculated dose by 28%, as shown in Table 1. Although the doses calculated using the two extinction coefficients are different, the molar concentrations, or the actual amounts of drug administered, are identical. Unless otherwise noted, the doses disclosed herein are each calculated using the extinction coefficient that does not take account of glycosylation. How these dosages compare to those calculated using the extinction coefficient that takes account of glycosylation for FGFR1-ECD.339-Fc is shown in Table 1. As can be seen from Table 1, a dosage of about 8 mg/kg (e.g., 7.8 and 8.0) using an EC of 1.42 mL/mg*cm herein corresponds to a dosage of about 10 mg/kg (e.g. 10.0 and 10.2) when calculated using an EC of 1.11 mL/mg*cm. A dosage of about 16 mg/kg (e.g. 15.6 and 16.0 mg/kg) using an EC of 1.42 mL/mg*cm herein corresponds to a dosage of about 20 mg/kg (e.g. 20.0 and 20.5) when calculated using an EC of 1.11 mL/mg*cm. As noted in the "Definitions" section above, measured numbers provided herein are approximate and encompass values having additional significant digits that are rounded off. For instance, 8 mg/kg encompasses values with two significant digits such as 7.6, 7.8, 8.0, 8.2, 8.4, and 8.45, each of which round to 8. Likewise, a

value such as 16 mg/kg encompasses values with three significant digits that round to 16, such as, for example 15.6 and 16.0.

Table 1. Conversion of FGFR1-ECD.339-FC Dose

Dose[a] **EC = 1.42 mL/mg*cm**	Dose[a] **EC = 1.11 mL/mg*cm**
0.5	0.6
0.75	1.0
1.0	1.3
2.0	2.6
3.0	3.8
4.0	5.1
5.0	6.4
6.0	7.7
7.0	9.0
7.8	10.0
8.0	10.2
9.0	11.5
10.0	12.8
11.0	14.1
12.0	15.4
13.0	16.6
14.0	17.9
15.0	19.2
15.6	20.0
16.0	20.5
17.0	21.8
18.0	23.0
19.0	24.3
20.0	25.6
30.0	38.4

[a] Doses shown in mg/kg.

[0090] The pharmaceutical compositions comprising FGFR1 ECDs, FGFR1 ECD fusion molecules, and/or at least one additional therapeutic agent can be administered as needed to subjects. In certain embodiments, an effective dose of a therapeutic molecule is administered to a subject one or more times. In various embodiments, an effective dose of a therapeutic molecule is administered to the subject at least once every two months, at least once a month, at least twice a month, once a week, twice a week, or three times a week. In various embodiments, an effective dose of a therapeutic molecule is administered to the subject for at least a week, at least a month, at least three months, at least six months, or at least a year.

[0091] In certain embodiments, the combined administration of an FGFR1 ECDs, FGFR1 ECD fusion molecule and at least one additional therapeutic agent includes concurrent administration, including simultaneous administration, using separate formulations or a single pharmaceutical formulation, as well as consecutive administration in any order. Optionally there

is a time period while both (or all) active agents simultaneously exert their biological activities. Therapeutically effective amounts of therapeutic agents administered in combination with the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) will be at the physician's or veterinarian's discretion. Dosage administration and adjustment is done to achieve maximal management of the conditions to be treated. The dose will additionally depend on such factors as the type of therapeutic agent to be used, the specific patient being treated, the stage of the disease, and the desired aggressiveness of the treatment regime.

[0092] In certain embodiments, a patient is treated with a combination of the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) and a VEGF antagonist. In some embodiments, the VEGF antagonist is a VEGF trap (e.g., aflibercept). In some embodiments, the VEGF antagonist is an anti-VEGF antibody. In some embodiments, the VEGF antibody is bevacizumab. One exemplary dosage of bevacizumab is in the range from about 0.05 mg/kg to about 20 mg/kg. Thus, one or more doses of about 0.5 mg/kg, 2.0 mg/kg, 4.0 mg/kg, 7.5 mg/kg, 10 mg/kg or 15 mg/kg (or any combination thereof) may be administered to the patient. Such doses may be administered intermittently, *e.g.,* every week, every two, or every three weeks.

[0093] In some embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule (e.g., FGFR1-ECD.339-Fc) is administered in combination with another therapeutic agent, such as chemotherapeutic agent or anti-angiogenic agent, at the recommended or prescribed dosage and/or frequency of the therapeutic agent.

Routes of Administration and Carriers

[0094] In some embodiments, an FGFR1 ECD and/or FGFR1 ECD fusion molecule can be administered intravenously and/or subcutaneously. In some embodiments, an FGFR1 ECD and/or FGFR1 ECD fusion molecule can be administered by another route, such as intra-arterial, parenteral, intranasal, intramuscular, intracardiac, intraventricular, intratracheal, buccal, rectal, intraperitoneal, intradermal, topical, transdermal, or intrathecal, or otherwise by implantation or inhalation. In various embodiments, at least one additional therapeutic agent can be administered *in vivo* by a variety of routes, including intravenous, intra-arterial, subcutaneous, parenteral, intranasal, intramuscular, intracardiac, intraventricular, intratracheal, buccal, rectal, intraperitoneal, intradermal, topical, transdermal, and intrathecal, or otherwise by implantation or inhalation. Each of the subject compositions can be formulated alone or in combination into preparations in solid, semi-solid, liquid, or gaseous forms, such as tablets, capsules, powders, granules, ointments, solutions, suppositories, enemas, injections, inhalants, and aerosols.

[0095] In various embodiments, compositions comprising an FGFR1 ECD, FGFR1 ECD fusion molecule, and/or at least one additional therapeutic agent are provided in formulation with pharmaceutically acceptable carriers, a wide variety of which are known in the art (see, e.g., Gennaro, *Remington: The Science and Practice of Pharmacy with Facts and Comparisons: Drugfacts Plus*, 20th ed. (2003); Ansel et al., *Pharmaceutical Dosage Forms and Drug Delivery Systems,* 7th ed., Lippencott Williams and Wilkins (2004); Kibbe et al., *Handbook of Pharmaceutical Excipients,* 3rd ed., Pharmaceutical Press (2000)). Various pharmaceutically acceptable carriers, which include vehicles, adjuvants, carriers, and diluents, are available to the public. Moreover, various pharmaceutically acceptable auxiliary substances, such as pH adjusting and buffering agents, tonicity adjusting agents, stabilizers, wetting agents and the like, are also available to the public. Certain non-limiting exemplary carriers include saline, buffered saline, dextrose, water, glycerol, ethanol, and combinations thereof. In some embodiments, a therapeutic agent is formulated as the brand-name drug indicated above in the Definitions section, or a generic equivalent. In some embodiments, docetaxel is formulated as Taxotere® (Sanofi Aventis) or a generic equivalent.

[0096] In various embodiments, compositions comprising FGFR1 ECDs, FGFR1 ECD fusion molecules, and/or at least one additional therapeutic agent can be formulated for injection by dissolving, suspending, or emulsifying them in an aqueous or nonaqueous solvent, such as vegetable or other oils, synthetic aliphatic acid glycerides, esters of higher aliphatic acids, or propylene glycol; and if desired, with conventional additives such as solubilizers, isotonic agents, suspending agents, emulsifying agents, stabilizers and preservatives. In various embodiments, the compositions may be formulated for inhalation, for example, using pressurized acceptable propellants such as dichlorodifluoromethane, propane, nitrogen, and the like. The compositions may also be formulated, in various embodiments, into sustained release microcapsules, such as with biodegradable or non-biodegradable polymers. A non-limiting exemplary biodegradable formulation includes poly lactic acid-glycolic acid polymer. A non-limiting exemplary non-biodegradable formulation includes a polyglycerin fatty acid ester. Certain methods of making such formulations are described, for example, in EP 1 125 584 A1.

[0097] Pharmaceutical dosage packs comprising one or more containers, each containing one or more doses of an FGFR1 ECD, an FGFR1 ECD fusion molecule, and/or at least one additional therapeutic agent are also provided. In some embodiments, the dosage packs contain an FGFR1 ECD and/or FGFR1 ECD fusion molecule but do not contain any additional therapeutic agent such as docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, sorafenib, a VEGF antagonist,

an anti-VEGF antibody, a VEGF trap, or bevacizumab. In other embodiments, the dosage packs contain at least one additional therapeutic agent but do not contain the FGFR1 ECD or FGFR1 ECD fusion molecule. In other embodiments, the dosage packs contain an FGFR1 ECD and/or FGFR1 ECD fusion molecule and at least one additional therapeutic agent, wherein the FGFR1 ECD and/or FGFR1 ECD fusion molecule is in a separate container from the at least one additional therapeutic agent. In other embodiments, the FGFR1 ECD and/or FGFR1 ECD fusion molecule is in the same container as the at least one additional therapeutic agent. In certain embodiments where two or more additional therapeutic agents are supplied, the two or more additional therapeutic agents may be in separate or in the same containers. In certain embodiments, a unit dosage is provided wherein the unit dosage contains a predetermined amount of a composition comprising an FGFR1 ECD, an FGFR1 ECD fusion molecule, and/or at least one additional therapeutic agent with or without one or more additional agents. In certain embodiments, such a unit dosage is supplied in single-use prefilled syringe for injection. In various embodiments, the composition contained in the unit dosage may comprise saline, sucrose, or the like; a buffer, such as phosphate, or the like; and/or be formulated within a stable and effective pH range. Alternatively, in certain embodiments, the composition may be provided as a lyophilized powder that can be reconstituted upon addition of an appropriate liquid, for example, sterile water. In certain embodiments, a composition comprises one or more substances that inhibit protein aggregation, including, but not limited to, sucrose and arginine. In certain embodiments, a composition of the invention comprises heparin and/or a proteoglycan. In some embodiments, a dosage pack comprises an FGFR1 ECD and/or an FGFR1 ECD fusion molecule and/or at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, sorafenib, a VEGF antagonist, an anti-VEGF antibody, a VEGF trap, and bevacizumab.

[0098] In some embodiments, a dosage pack further comprises instructions for administering an FGFR1 ECD and/or an FGFR1 ECD fusion molecule with at least one additional therapeutic agent to a patient. In some embodiments, the instructions indicate that at least one dose of the FGFR1 ECD and/or the FGFR1 ECD fusion molecule should be administered concurrently with the at least one additional therapeutic agent. In some embodiments, the instructions indicate that at least one dose of the FGFR1 ECD and/or the FGFR1 ECD fusion molecule should be administered at the same time as the at least one additional therapeutic agent.

[0099] The term "**instructions**," as used herein includes, but is not limited to, labels, package inserts, instructions available in electronic form such as on a computer readable medium (e.g., a

diskette, compact disk, or DVD), instructions available remotely such as over the internet, etc. A dosage pack is considered to include the instructions when the dosage pack provides access to the instructions, a link to the instructions (such as a uniform resource locator, or url), or other mechanism for obtaining a copy of the instructions (such as a return reply card, a physical address from which instructions may be requested, an e-mail address from which instructions may be requested, a phone number that may be called to obtain instructions, etc.).

FGFR1 ECDs and FGFR1 ECD fusion molecules

[0100] Nonlimiting exemplary FGFR1 ECDs include full-length FGFR1 ECDs, FGFR1 ECD fragments, and FGFR1 ECD variants. FGFR1 ECDs may include or lack a signal peptide. Exemplary FGFR1 ECDs include, but are not limited to, FGFR1 ECDs having amino acid sequences selected from SEQ ID NOs.: 1, 2, 3, and 4.

[0101] Non-limiting exemplary FGFR1 ECD fragments include human FGFR1 ECD ending at amino acid 339 (counting from the first amino acid of the mature form, without the signal peptide). In some embodiments, an FGFR1 ECD fragment ends at an amino acid between amino acid 339 and amino acid 360 (counting from the first amino acid of the mature form, without the signal peptide). Exemplary FGFR1 ECD fragments include, but are not limited to, FGFR1 ECD fragments having amino acid sequences selected from SEQ ID NOs.: 3 and 4.

[0102] In some embodiments, an FGFR1 ECD comprises a sequence selected from SEQ ID NOs: 1 to 4. In some embodiments, an FGFR1 ECD consists of a sequence selected from SEQ ID NOs: 1 to 4. When an FGFR1 ECD "consists of" a sequence selected from SEQ ID NOs: 1 to 4, the FGFR1 ECD may or may not contain various post-translational modifications, such as glycosylation and sialylation. In other words, when an FGFR1 ECD consists of a particular amino acid sequence, it does not contain additional amino acids in the contiguous amino acid sequence, but may contain modifications to amino acid side chains, the N-terminal amino group, and/or the C-terminal carboxy group.

[0103] In some embodiments, an FGFR1 ECD fusion molecule comprises a signal peptide. In some embodiments, an FGFR1 ECD fusion molecule lacks a signal peptide. In some embodiments, the FGFR1 ECD portion of an FGFR1 ECD fusion molecule comprises a sequence selected from SEQ ID NOs: 1 to 4. In some embodiments, the FGFR1 ECD portion of an FGFR1 ECD fusion molecule consists of a sequence selected from SEQ ID NOs: 1 to 4. When an FGFR1 ECD portion of an FGFR1 ECD fusion molecule "consists of" a sequence selected from SEQ ID NOs: 1 to 4, the FGFR1 ECD portion of an FGFR1 ECD fusion molecule may or may not contain various post-translational modifications, such as glycosylation and sialylation. In other words, when an FGFR1 ECD portion of an FGFR1 ECD fusion molecule consists of a

particular amino acid sequence, it does not contain additional amino acids from FGFR1 in the contiguous amino acid sequence, but may contain modifications to amino acid side chains, the N-terminal amino group, and/or the C-terminal carboxy group. Further, because the FGFR1 ECD is linked to a fusion molecule, there may be additional amino acids a the N- and/or C-terminus of the FGFR1 ECD, but those amino acids are not from the FGFR1 sequence, but may be from, for example, a linker sequence, or a fusion partner sequence.

[0104] In some embodiments, the fusion partner portion of an FGFR1 ECD fusion molecule is selected from Fc, albumin, and polyethylene glycol. Nonlimiting exemplary fusion partners are discussed herein.

[0105] The inventors have found that administration of an FGFR1 ECD and/or an FGFR1 ECD fusion molecule and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, sorafenib, etoposide, topotecan, a vascular epithelial growth factor (VEGF) agonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab is useful for treating cancer. In some embodiments, an FGFR1 ECD and/or an FGFR1 ECD fusion molecule is administered with docetaxel.

Fusion Partners and Conjugates

[0106] As discussed herein, an FGFR1 ECD may be combined with at least one fusion partner, resulting in an FGFR1 ECD fusion molecule. These fusion partners may facilitate purification, and the FGFR1 ECD fusion molecules may show an increased half-life *in vivo*. Suitable fusion partners of an FGFR1 ECD include, for example, polymers, such as water soluble polymers, the constant domain of immunoglobulins; all or part of human serum albumin (HSA); fetuin A; fetuin B; a leucine zipper domain; a tetranectin trimerization domain; mannose binding protein (also known as mannose binding lectin), for example, mannose binding protein 1; and an Fc region, as described herein and further described in U.S. Patent No. 6,686,179. Nonlimiting exemplary FGFR1 ECD fusion molecules are described, e.g., in U.S. Patent No. 7,678,890.

[0107] An FGFR1 ECD fusion molecule may be prepared by attaching polyaminoacids or branch point amino acids to the FGFR1 ECD. For example, the polyaminoacid may be a carrier protein that serves to increase the circulation half life of the FGFR1 ECD (in addition to the advantages achieved via a fusion molecule). For the therapeutic purpose of the present invention, such polyaminoacids should ideally be those that have or do not create neutralizing antigenic responses, or other adverse responses. Such polyaminoacids may be chosen from serum album (such as HSA), an additional antibody or portion thereof, for example the Fc region, fetuin A, fetuin B, leucine zipper nuclear factor erythroid derivative-2 (NFE2), neuroretinal leucine zipper,

tetranectin, or other polyaminoacids, for example, lysines. As described herein, the location of attachment of the polyaminoacid may be at the N terminus or C terminus, or other places in between, and also may be connected by a chemical linker moiety to the selected molecule.

Polymers

[0108] Polymers, for example, water soluble polymers, may be useful as fusion partners to reduce precipitation of the FGFR1 ECD fusion molecule in an aqueous environment, such as typically found in a physiological environment. Polymers employed in the invention will be pharmaceutically acceptable for the preparation of a therapeutic product or composition.

[0109] Suitable, clinically acceptable, water soluble polymers include, but are not limited to, polyethylene glycol (PEG), polyethylene glycol propionaldehyde, copolymers of ethylene glycol/propylene glycol, monomethoxy-polyethylene glycol, carboxymethylcellulose, dextran, polyvinyl alcohol (PVA), polyvinyl pyrrolidone, poly-1,3-dioxolane, poly-1,3,6-trioxane, ethylene/maleic anhydride copolymer, poly (β-amino acids) (either homopolymers or random copolymers), poly(n-vinyl pyrrolidone) polyethylene glycol, polypropylene glycol homopolymers (PPG) and other polyakylene oxides, polypropylene oxide/ethylene oxide copolymers, polyoxyethylated polyols (POG) (e.g., glycerol) and other polyoxyethylated polyols, polyoxyethylated sorbitol, or polyoxyethylated glucose, colonic acids or other carbohydrate polymers, Ficoll, or dextran and mixtures thereof.

[0110] As used herein, polyethylene glycol (PEG) is meant to encompass any of the forms that have been used to derivatize other proteins, such as mono-(C_1-C_{10}) alkoxy- or aryloxy-polyethylene glycol. Polyethylene glycol propionaldehyde may have advantages in manufacturing due to its stability in water.

[0111] Polymers used herein, for example water soluble polymers, may be of any molecular weight and may be branched or unbranched. In some embodiments, the polymers have an average molecular weight of between about 2 kDa to about 100 kDa (the term "about" indicating that in preparations of a polymer, some molecules will weigh more, some less, than the stated molecular weight). The average molecular weight of each polymer may be between about 5 kDa and about 50 kDa, or between about 12 kDa and about 25 kDa. Generally, the higher the molecular weight or the more branches, the higher the polymer:protein ratio. Other sizes may also be used, depending on the desired therapeutic profile; for example, the duration of sustained release; the effects, if any, on biological activity; the ease in handling; the degree or lack of antigenicity; and other known effects of a polymer on an FGFR1 ECD.

[0112] Polymers employed in the present invention are typically attached to an FGFR1 ECD with consideration of effects on functional or antigenic domains of the polypeptide. In general,

chemical derivatization may be performed under any suitable condition used to react a protein with an activated polymer molecule. Activating groups which can be used to link the polymer to the active moieties include sulfone, maleimide, sulfhydryl, thiol, triflate, tresylate, azidirine, oxirane, and 5-pyridyl.

[0113] Polymers of the invention are typically attached to a heterologous polypeptide at the alpha (α) or epsilon (ε) amino groups of amino acids or a reactive thiol group, but it is also contemplated that a polymer group could be attached to any reactive group of the protein that is sufficiently reactive to become attached to a polymer group under suitable reaction conditions. Thus, a polymer may be covalently bound to an FGFR1 ECD via a reactive group, such as a free amino or carboxyl group. The amino acid residues having a free amino group may include lysine residues and the N-terminal amino acid residue. Those having a free carboxyl group may include aspartic acid residues, glutamic acid residues, and the C-terminal amino acid residue. Those having a reactive thiol group include cysteine residues.

[0114] Methods for preparing fusion molecules conjugated with polymers, such as water soluble polymers, will each generally involve (a) reacting an FGFR1 ECD with a polymer under conditions whereby the polypeptide becomes attached to one or more polymers and (b) obtaining the reaction product. Reaction conditions for each conjugation may be selected from any of those known in the art or those subsequently developed, but should be selected to avoid or limit exposure to reaction conditions such as temperatures, solvents, and pH levels that would inactivate the protein to be modified. In general, the optimal reaction conditions for the reactions will be determined case-by-case based on known parameters and the desired result. For example, the larger the ratio of polymer:polypeptide conjugate, the greater the percentage of conjugated product. The optimum ratio (in terms of efficiency of reaction in that there is no excess unreacted polypeptide or polymer) may be determined by factors such as the desired degree of derivatization (e.g., mono-, di-, tri-, etc.), the molecular weight of the polymer selected, whether the polymer is branched or unbranched and the reaction conditions used. The ratio of polymer (for example, PEG) to a polypeptide will generally range from 1:1 to 100:1. One or more purified conjugates may be prepared from each mixture by standard purification techniques, including among others, dialysis, salting-out, ultrafiltration, ion-exchange chromatography, gel filtration chromatography, and electrophoresis.

[0115] One may specifically desire an N-terminal chemically modified FGFR1 ECD. One may select a polymer by molecular weight, branching, etc., the proportion of polymers to FGFR1 ECD molecules in the reaction mix, the type of reaction to be performed, and the method of obtaining the selected N-terminal chemically modified FGFR1 ECD. The method of obtaining

the N-terminal chemically modified FGFR1 ECD preparation (separating this moiety from other monoderivatized moieties if necessary) may be by purification of the N-terminal chemically modified FGFR1 ECD material from a population of chemically modified protein molecules.

[0116] Selective N-terminal chemical modification may be accomplished by reductive alkylation which exploits differential reactivity of different types of primary amino groups (lysine versus the N-terminal) available for derivatization in a particular protein. Under the appropriate reaction conditions, substantially selective derivatization of the protein at the N terminus with a carbonyl group-containing polymer is achieved. For example, one may selectively attach a polymer to the N terminus of the protein by performing the reaction at a pH that allows one to take advantage of the pKa differences between the ε-amino group of the lysine residues and that of the α-amino group of the N-terminal residue of the protein. By such selective derivatization, attachment of a polymer to a protein is controlled: the conjugation with the polymer takes place predominantly at the N terminus of the protein and no significant modification of other reactive groups, such as the lysine side chain amino groups, occurs. Using reductive alkylation, the polymer may be of the type described above and should have a single reactive aldehyde for coupling to the protein. Polyethylene glycol propionaldehyde, containing a single reactive aldehyde, may also be used.

[0117] In one embodiment, the present invention contemplates the chemically derivatized FGFR1 ECD to include mono- or poly- (e.g., 2-4) PEG moieties. Pegylation may be carried out by any of the pegylation reactions available. Methods for preparing a pegylated protein product will generally include (a) reacting a polypeptide with polyethylene glycol (such as a reactive ester or aldehyde derivative of PEG) under conditions whereby the protein becomes attached to one or more PEG groups; and (b) obtaining the reaction product(s). In general, the optimal reaction conditions will be determined case by case based on known parameters and the desired result.

[0118] There are a number of PEG attachment methods known in the art. *See*, for example, EP 0 401 384; Malik et al., *Exp. Hematol.*, 20:1028-1035 (1992); Francis, *Focus on Growth Factors*, 3(2):4-10 (1992); EP 0 154 316; EP 0 401 384; WO 92/16221; WO 95/34326; and the other publications cited herein that relate to pegylation.

[0119] Pegylation may be carried out, e.g., via an acylation reaction or an alkylation reaction with a reactive polyethylene glycol molecule. Thus, protein products according to the present invention include pegylated proteins wherein the PEG group(s) is (are) attached via acyl or alkyl groups. Such products may be mono-pegylated or poly-pegylated (for example, those containing 2-6 or 2-5 PEG groups). The PEG groups are generally attached to the protein at the α- or ε-

amino groups of amino acids, but it is also contemplated that the PEG groups could be attached to any amino group attached to the protein that is sufficiently reactive to become attached to a PEG group under suitable reaction conditions.

[0120] Pegylation by acylation generally involves reacting an active ester derivative of polyethylene glycol (PEG) with an FGFR1 ECD. For acylation reactions, the polymer(s) selected typically have a single reactive ester group. Any known or subsequently discovered reactive PEG molecule may be used to carry out the pegylation reaction. An example of a suitable activated PEG ester is PEG esterified to N-hydroxysuccinimide (NHS). As used herein, acylation is contemplated to include, without limitation, the following types of linkages between the therapeutic protein and a polymer such as PEG: amide, carbamate, urethane, and the like, see for example, Chamow, *Bioconjugate Chem.*, 5:133-140 (1994). Reaction conditions may be selected from any of those currently known or those subsequently developed, but should avoid conditions such as temperature, solvent, and pH that would inactivate the polypeptide to be modified.

[0121] Pegylation by acylation will generally result in a poly-pegylated protein. The connecting linkage may be an amide. The resulting product may be substantially only (e.g., > 95%) mono-, di-, or tri-pegylated. However, some species with higher degrees of pegylation may be formed in amounts depending on the specific reaction conditions used. If desired, more purified pegylated species may be separated from the mixture (particularly unreacted species) by standard purification techniques, including among others, dialysis, salting-out, ultrafiltration, ion-exchange chromatography, gel filtration chromatography, and electrophoresis.

[0122] Pegylation by alkylation generally involves reacting a terminal aldehyde derivative of PEG with a polypeptide in the presence of a reducing agent. For the reductive alkylation reaction, the polymer(s) selected should have a single reactive aldehyde group. An exemplary reactive PEG aldehyde is polyethylene glycol propionaldehyde, which is water stable, or mono C_1-C_{10} alkoxy or aryloxy derivatives thereof, see for example, U.S. Pat. No. 5,252,714.

Markers

[0123] Moreover, FGFR1 ECDs of the present invention may be fused to marker sequences, such as a peptide that facilitates purification of the fused polypeptide. The marker amino acid sequence may be a hexa-histidine peptide such as the tag provided in a pQE vector (Qiagen, Mississauga, Ontario, Canada), among others, many of which are commercially available. As described in Gentz et al., *Proc. Natl. Acad. Sci.* 86:821-824 (1989), for instance, hexa-histidine provides for convenient purification of the fusion protein. Another peptide tag useful for purification, the hemagglutinin (HA) tag, corresponds to an epitope derived from the influenza

HA protein. (Wilson et al., *Cell* 37:767 (1984)). Any of these above fusions may be engineered using the FGFR1 ECDs described herein.

Oligomerization Domain Fusion Partners

[0124] In various embodiments, oligomerization offers some functional advantages to a fusion protein, including, but not limited to, multivalency, increased binding strength, and the combined function of different domains. Accordingly, in some embodiments, a fusion partner comprises an oligomerization domain, for example, a dimerization domain. Exemplary oligomerization domains include, but are not limited to, coiled-coil domains, including alpha-helical coiled-coil domains; collagen domains; collagen-like domains; and certain immunoglobulin domains. Exemplary coiled-coil polypeptide fusion partners include, but are not limited to, the tetranectin coiled-coil domain; the coiled-coil domain of cartilage oligomeric matrix protein; angiopoietin coiled-coil domains; and leucine zipper domains. Exemplary collagen or collagen-like oligomerization domains include, but are not limited to, those found in collagens, mannose binding lectin, lung surfactant proteins A and D, adiponectin, ficolin, conglutinin, macrophage scavenger receptor, and emilin.

Antibody Fc Immunoglobulin Domain Fusion Partners

[0125] Many Fc domains that may be used as fusion partners are known in the art. In some embodiments, a fusion partner is an Fc immunoglobulin domain. An Fc fusion partner may be a wild-type Fc found in a naturally occurring antibody, a variant thereof, or a fragment thereof. Non-limiting exemplary Fc fusion partners include Fcs comprising a hinge and the CH2 and CH3 constant domains of a human IgG, for example, human IgG1, IgG2, IgG3, or IgG4. Additional exemplary Fc fusion partners include, but are not limited to, human IgA and IgM. In some embodiments, an Fc fusion partner comprises a C237S mutation, for example, in an IgG1 (see, for example, SEQ ID NO: 8). In some embodiments, an Fc fusion partner comprises a hinge, CH2, and CH3 domains of human IgG2 with a P331S mutation, as described in U.S. Patent No. 6,900,292. Certain exemplary Fc domain fusion partners are shown in SEQ ID NOs: 8 to 10.

Albumin Fusion Partners and Albumin-binding Molecule Fusion Partners

[0126] In some embodiments, a fusion partner is an albumin. Exemplary albumins include, but are not limited to, human serum album (HSA) and fragments of HSA that are capable of increasing the serum half-life or bioavailability of the polypeptide to which they are fused. In some embodiments, a fusion partner is an albumin-binding molecule, such as, for example, a peptide that binds albumin or a molecule that conjugates with a lipid or other molecule that binds albumin. In some embodiments, a fusion molecule comprising HSA is prepared as described, e.g., in U.S. Patent No. 6,686,179.

Exemplary Attachment of Fusion Partners

[0127] The fusion partner may be attached, either covalently or non-covalently, to the N terminus or the C terminus of the FGFR1 ECD. The attachment may also occur at a location within the FGFR1 ECD other than the N terminus or the C terminus, for example, through an amino acid side chain (such as, for example, the side chain of cysteine, lysine, serine, or threonine).

[0128] In either covalent or non-covalent attachment embodiments, a linker may be included between the fusion partner and the FGFR1 ECD. Such linkers may be comprised of at least one amino acid or chemical moiety. Exemplary methods of covalently attaching a fusion partner to an FGFR1 ECD include, but are not limited to, translation of the fusion partner and the FGFR1 ECD as a single amino acid sequence and chemical attachment of the fusion partner to the FGFR1 ECD. When the fusion partner and an FGFR1 ECD are translated as single amino acid sequence, additional amino acids may be included between the fusion partner and the FGFR1 ECD as a linker. In some embodiments, the linker is selected based on the polynucleotide sequence that encodes it, to facilitate cloning the fusion partner and/or FGFR1 ECD into a single expression construct (for example, a polynucleotide containing a particular restriction site may be placed between the polynucleotide encoding the fusion partner and the polynucleotide encoding the FGFR1 ECD, wherein the polynucleotide containing the restriction site encodes a short amino acid linker sequence). When the fusion partner and the FGFR1 ECD are covalently coupled by chemical means, linkers of various sizes may typically be included during the coupling reaction.

[0129] Exemplary methods of non-covalently attaching a fusion partner to an FGFR1 ECD include, but are not limited to, attachment through a binding pair. Exemplary binding pairs include, but are not limited to, biotin and avidin or streptavidin, an antibody and its antigen, etc.

Co-Translational and Post-Translational Modifications

[0130] The invention encompasses administration of FGFR1 ECDs and FGFR1 ECD fusion molecules that are differentially modified during or after translation, for example by glycosylation, acetylation, phosphorylation, amidation, derivatization by known protecting/blocking groups, proteolytic cleavage, or linkage to an antibody molecule or other cellular ligand. Any of numerous chemical modifications may be carried out by known techniques, including, but not limited to, specific chemical cleavage by cyanogen bromide, trypsin, chymotrypsin, papain, V8 protease; $NABH_4$; acetylation; formylation; oxidation; reduction; and/or metabolic synthesis in the presence of tunicamycin.

[0131] Additional post-translational modifications encompassed by the invention include, for example, for example, N-linked or O-linked carbohydrate chains, processing of N-terminal or C-terminal ends), attachment of chemical moieties to the amino acid backbone, chemical modifications of N-linked or O-linked carbohydrate chains, and addition or deletion of an N-terminal methionine residue as a result of prokaryotic host cell expression. A nonlimiting discussion of various post-translational modifications of FGFR1 ECDs and FGFR1 ECD fusion molecules can be found, e.g., in U.S. Patent No. 7,678,890.

FGFR1 ECD and FGFR1 ECD Fusion Molecule Expression and Production Vectors

[0132] Vectors comprising polynucleotides that encode FGFR1 ECDs are provided. Vectors comprising polynucleotides that encode FGFR1 ECD fusion molecules are also provided. Such vectors include, but are not limited to, DNA vectors, phage vectors, viral vectors, retroviral vectors, etc.

[0133] In some embodiments, a vector is selected that is optimized for expression of polypeptides in CHO or CHO-derived cells. Exemplary such vectors are described, e.g., in Running Deer et al., *Biotechnol. Prog.* 20:880-889 (2004).

[0134] In some embodiments, a vector is chosen for *in vivo* expression of FGFR1 ECDs and/or FGFR1 ECD fusion molecules in animals, including humans. In some such embodiments, expression of the polypeptide is under the control of a promoter that functions in a tissue-specific manner. For example, liver-specific promoters are described, e.g., in PCT Publication No. WO 2006/076288. A nonlimiting discussion of various expression vectors can be found, e.g., in U.S. Patent No. 7,678,890.

Host Cells

[0135] In various embodiments, FGFR1 ECDs or FGFR1 ECD fusion molecules may be expressed in prokaryotic cells, such as bacterial cells; or in eukaryotic cells, such as fungal cells, plant cells, insect cells, and mammalian cells. Such expression may be carried out, for example, according to procedures known in the art. Exemplary eukaryotic cells that may be used to express polypeptides include, but are not limited to, COS cells, including COS 7 cells; 293 cells, including 293-6E cells; CHO cells, including CHO-S and DG44 cells; and NSO cells. In some embodiments, a particular eukaryotic host cell is selected based on its ability to make certain desired post-translational modifications to the FGFR1 ECDs or FGFR1 ECD fusion molecules. For example, in some embodiments, CHO cells produce FGFR1 ECDs and/or FGFR1 ECD fusion molecules that have a higher level of sialylation than the same polypeptide produced in 293 cells.

[0136] Introduction of a nucleic acid into a desired host cell may be accomplished by any method known in the art, including but not limited to, calcium phosphate transfection, DEAE-dextran mediated transfection, cationic lipid-mediated transfection, electroporation, transduction, infection, etc. Nonlimiting exemplary methods are described, e.g., in Sambrook et al., *Molecular Cloning, A Laboratory Manual,* 3rd ed. Cold Spring Harbor Laboratory Press (2001). Nucleic acids may be transiently or stably transfected in the desired host cells, according to methods known in the art. A nonlimiting discussion of host cells and methods of polypeptides in host cells can be found, e.g., in U.S. Patent No. 7,678,890.

[0137] In some embodiments, a polypeptide may be produced *in vivo* in an animal that has been engineered or transfected with a nucleic acid molecule encoding the polypeptide, according to methods known in the art.

Purification of FGFR1 ECD Polypeptides

[0138] FGFR1 ECDs or FGFR1 ECD fusion molecules may be purified by various methods known in the art. Such methods include, but are not limited to, the use of affinity matrices or hydrophobic interaction chromatography. Suitable affinity ligands include any ligands of the FGFR1 ECD or of the fusion partner. Suitable affinity ligands in the case of an antibody that binds FGFR1 include, but are not limited to, FGFR1 itself and fragments thereof. Further, a Protein A, Protein G, Protein A/G, or an antibody affinity column may be used to bind to an Fc fusion partner to purify an FGFR1 ECD fusion molecule. Antibodies to FGFR1 ECD may also be used to purify FGFR1 ECD or FGFR1 ECD fusion molecules. Hydrophobic interactive chromatography, for example, a butyl or phenyl column, may also suitable for purifying some polypeptides. Many methods of purifying polypeptides are known in the art. A nonlimiting discussion of various methods of purifying polypeptides can be found, e.g., in U.S. Patent No. 7,678,890.

EXAMPLES

[0139] The examples discussed below are intended to be purely exemplary of the invention and should not be considered to limit the invention in any way. The examples are not intended to represent that the experiments below are all or the only experiments performed. Efforts have been made to ensure accuracy with respect to numbers used (for example, amounts, temperature, etc.) but some experimental errors and deviations should be accounted for. Unless indicated otherwise, parts are parts by weight, molecular weight is weight average molecular weight, temperature is in degrees Centigrade, and pressure is at or near atmospheric.

Example 1: Administration of FGFR1-ECD.339-Fc and Docetaxel in the H1703 Non-Small Cell Lung Cancer (NSCLC) Xenograft Model

[0140] Six week old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. Human non-small cell lung cancer (NSCLC) cell line H1703 was used as the tumor model and was purchased from ATCC (Manassas, VA; Cat. No. CRL-5889). The cells were cultured for three passages in RPMI + 10% FBS + 1% L-glutamine at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free phosphate buffered saline (PBS) containing 50% Matrigel at 2.5 x10^7 cells per milliliter. The cells were implanted subcutaneously over the right flank of the mice at 2.5x10^6 cells/100 µl/mouse. One day after tumor implantation, mice were randomized according to body weight at 10 mice per group.

[0141] FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice a week for four weeks. Docetaxel was purchased from Toronto Research Chemicals (North York, Ontario, Canada; cat. No. D494420) and formulated in H_2O containing 5% Tween 80 and 5% glucose. Docetaxel was administered i.p. at 25 mg/kg (equivalent to about 75 mg/m^2 in a human) once every three weeks for two doses. In combination groups, FGFR1-ECD.339-Fc and docetaxel were either given concurrently or sequentially with FGFR1-ECD.339-Fc given one day before docetaxel or vice versa. Human albumin was purchased from Grifols USA (Los Angeles, CA; Cat. No. NDC 61953-0002-1), formulated in PBS at 3 mg/mL and was used as negative control at 300 µg/100 µL/mouse (15 mg/kg). The dosing schedule for each set of mice is shown in Table 2.

Table 2: Dosing Schedule

Group	n	Route	Treatment	Schedule
1	10	i.p.	Albumin	2x/wk x 6 wks
2	10	i.p.	FGFR1-ECD.339-Fc	2x/wk x 6wks
3	10	i.p.	Docetaxel	1x/3wk x 2 doses
4	10	i.p. i.p.	FGFR1-ECD.339-Fc Docetaxel	2x/wk x 6wks 1x/3wk x 2 doses
5	10	i.p. i.p.	FGFR1-ECD.339-Fc Docetaxel (1 day after)	2x/wk x 6wks 1x/3wk x 2 doses
6	10	i.p. i.p.	FGFR1-ECD.339-Fc Docetaxel (1 day before)	2x/wk x 6wks 1x/3wk x 2 doses

[0142] The tumor volume and body weight of the mice were monitored twice a week throughout the study. The tumor volume was measured by external caliper to determine the greatest longitudinal diameter (length) and the greatest transverse diameter (width). The tumor volume was then calculated using the following formula:

$$Tumor\ volume\ (mm^3) = (length \times width^2)/2$$

[0143] On day 38, when the average tumor volume in the Albumin group reached 850 mm^3, the mice were euthanized by isoflurane inhalation and cervical dislocation.

[0144] The mean tumor volume throughout the study for each set of mice is shown in Figure 1. In that experiment, sequential administration of FGFR1-ECD.339-Fc and docetaxel inhibited tumor growth more than either drug alone. Furthermore, in that experiment, concurrent administration of FGFR1-ECD.339-Fc and docetaxel was more effective than sequential administration at inhibiting tumor growth. No weight loss was observed over the course of the study. (Data not shown.)

[0145] The tumor volume of each group of mice on day 38 was analyzed by one-way ANOVA followed by Tukey's test. The results of that analysis are shown in Table 3.

Table 3. Tumor volume analysis on day 38

	Mean Tumor volume mm^3(±SD)	Tumor growth inhibition (%)	p Value compare to control (Tukey's test)
Albumin	835 (±151)	-	-
FGFR1-ECD.339-Fc	557 (±151)	33	<0.01
Docetaxel	209 (±303)	74	<0.001
FGFR1-ECD.339-Fc/Docetaxel concurrent	27 (±55)	96	<0.001
FGFR1-ECD.339-Fc/Docetaxel Sequential	99 (±117)	88	<0.001
Docetaxel/FGFR1-ECD.339-Fc Sequential	72 (±109)	91	<0.001

[0146] Administration of FGFR1-ECD.339-Fc alone resulted in 33% ($p<0.01$) tumor growth inhibition, and administration of docetaxel alone resulted in 74% ($p<0.001$) tumor growth inhibition. Sequential administration with FGFR1-ECD.339-Fc first resulted in 88% ($p<0.001$) tumor growth inhibition, and sequential administration with docetaxel first resulted in 91% ($p<0.001$) tumor growth inhibition. Finally, concurrent dosing of FGFR1-ECD.339-Fc and docetaxel resulted in 96% ($p<0.001$) tumor growth inhibition.

[0147] Fractional tumor volume analysis was used to assess the degree of enhanced (additive or synergistic) or decreased (antagonistic) tumor growth inhibition in the sequential and concurrent combinations of FGFR1-ECD.339-Fc and docetaxel. The results of that analysis are shown in Table 4.

Table 4. Analysis of fractional tumor volume[a] on day 38

	FGFR1-ECD.339-Fc	Docetaxel	Expected[b]	Observed	Expected/Observed[c]
Concurrent	0.68	0.25	0.17	0.03	5.67
FGFR1-ECD.339-Fc/ Docetaxel sequential	0.68	0.25	0.17	0.11	1.55
Docetaxel/ FGFR1-ECD.339-Fc sequential	0.68	0.25	0.17	0.09	1.89

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0148] Those results demonstrate that concurrent administration of FGFR1-ECD.339-Fc and docetaxel results in synergistic inhibition of tumor growth, while sequential administration of FGFR1-ECD.339-Fc and docetaxel results in additive inhibition.

Example 2: Administration of FGFR1-ECD.339-Fc and Pemetrexed in the H520 Non-Small Cell Lung Cancer (NSCLC) Xenograft Model

[0149] Six to eight week old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. Squamous cell lung cancer cell line NCI-H520 was used as the tumor model and was purchased from ATCC (Manassas, VA; Cat. No. HTB-182). The cells were cultured for three to four passages in RPMI + 10% FBS + 1% L-glutamine at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free PBS containing 50% Matrigel at 3.5 x10^7 cells/ml. The cells were implanted subcutaneously over the right flank of the mice at 3.5x10^6 cells/100µl/mouse. One day after tumor implantation, mice were randomized according to body weight at 10 mice per group. Dosing for all groups began one day post tumor implantation.

[0150] FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice a week for six weeks. Pemetrexed disodium was purchased from Fisher Scientific (Pittsburgh, PA;

Cat. No. NC9564691) and formulated in Saline USP at 12.5 mg/mL, 25 mg/mL, and 50 mg/mL. Pemetrexed was administered i.p. at three different dosage levels: 62.6 mg/kg (1.25 mg/100 µl/mouse); 125 mg/kg (2.5 mg/100 µl/mouse); and 250 mg/kg (5 mg/100 µl/mouse) daily for five days in week one, and daily for five days in week 2. In combination groups, FGFR1-ECD.339-Fc and pemetrexed were administered on the same schedule as when given as single agents, and were administered concurrently on days 1, 4, 8, and 11. Human albumin was purchased from Grifols USA (Los Angeles, CA; Cat. No. NDC 61953-0002-1), formulated in PBS at 3 mg/mL and was used as negative control at 300 µg/100 µL/mouse (15 mg/kg). The dosing schedule for each group of mice is shown in Table 5.

Table 5: Dosing Schedule

Group	n	Route	Treatment	Dose	Schedule
1	10	i.p.	Albumin	15mg/kg	2x/wk x 6 wks
2	10	i.p.	FGFR1-ECD.339-Fc	15mg/kg	2x/wk x 6wks
3	10	i.p.	Pemetrexed	62.5mg/kg	QD x 5 x 2 cycles
4	10	i.p.	Pemetrexed	125mg/kg	QD x 5 x 2 cycles
5	10	i.p.	Pemetrexed	250 mg/kg	QD x 5 x 2 cycles
6	10	i.p. i.p.	FGFR1-ECD.339-Fc Pemetrexed	15mg/kg 62.5mg/kg	2x/wk x 6wks QD x 5 x 2 cycles
7	10	i.p. i.p.	FGFR1-ECD.339-Fc Pemetrexed	15mg/kg 125 mg/kg	2x/wk x 6wks QD x 5 x 2 cycles
8	10	i.p. i.p.	FGFR1-ECD.339-Fc Pemetrexed	15 mg/kg 250 mg/kg	2x/wk x 6wks QD x 5 x 2 cycles

[0151] The tumor volume and body weight of the mice were monitored twice a week throughout study. The tumor volume was measured and calculated using the method and formula described in Example 1.

[0152] Animals were euthanized when any of the following signs were observed before the end of the study: body weight loss of ≥15% of initial body weight; tumor ulceration of ≥30% of tumor surface area; mice were moribund; or the individual tumor volume was ≥2000 mm^3. The mice were euthanized by isoflurane inhalation and cervical dislocation.

[0153] The mean tumor volume throughout the study for low pemetrexed dosage groups, medium pemetrexed dosage groups, and high pemetrexed dosage groups are shown in Figures 2A, 3A, and 4A, respectively. Figures 2B, 3B, and 4B show the body weight of the mice in each group over the course of the study. It appears that 250 mg/kg pemetrexed is approaching the

maximum tolerated dose in the mice, based on the loss of body weight following administration of that dose. *See* Figure 4B.

[0154] Administration of either FGFR1-ECD.339-Fc or pemetrexed at the low or medium dose alone resulted in tumor inhibition over the course of the study. The highest dose of pemetrexed alone did not appear to inhibit tumor growth. Concurrent dosing of FGFR1-ECD.339-Fc and pemetrexed resulted in greater inhibition of tumor growth, although the tumor inhibition observed with the combination of FGFR1-ECD.339-Fc and the highest dose of pemetrexed was not statistically significant.

[0155] The body weight graphs show that the mice tolerated the low and medium doses of pemetrexed well. At the high dose of pemetrexed, the mice initially lost significant body weight. The dosing was therefore stopped after the first 5-day dosing. Thus, in the high dose group, the animals only received the first five doses and missed the second five doses.

[0156] The tumor volume of each group of mice on day 49 was analyzed by one-way ANOVA followed by Tukey's test. The results of that analysis are shown in Table 6.

Table 6: Tumor volume analysis on day 49

	Mean Tumor volume mm^3(±SD)	Tumor growth inhibition (%)	p Value compare to control (Tukey's test)
Albumin	917.3 (±313.9)	-	-
FGFR1-ECD.339-Fc	630.4 (±461.5)	31	>0.05
Pemetrexed 62.5 mg/kg	544.7 (±341.5)	40	>0.05
FGFR1-ECD.339-Fc/ Pemetrexed 62.5 mg/kg	292.5 (±198.5)	68	<0.01
Pemetrexed 125 mg/kg	689.5 (±328.7)	24	>0.05
FGFR1-ECD.339-Fc/ Pemetrexed 125 mg/kg	389.2 (±271.3)	57	<0.05
Pemetrexed 250 mg/kg	926.6 (±339.9)	1	>0.05
FGFR1-ECD.339-Fc/ Pemetrexed 250 mg/kg	489.3 (±231.0)	46	>0.05

[0157] Administration of FGFR1-ECD.339-Fc alone resulted in 31% ($p>0.05$) tumor growth inhibition, and administration of pemetrexed alone at 62.5, 125 or 250 mg/kg resulted in 40, 24 or 1 % ($p>0.05$) tumor growth inhibition respectively. Concurrent dosing of FGFR1-ECD.339-Fc (15 mg/kg) and pemetrexed at 62.5, 125, or 250 mg/kg resulted in 68% ($p< 0.01$), 57% ($p<0.05$) or 46% ($p>0.05$) tumor growth inhibition respectively.

[0158] Fractional tumor volume analysis was used to assess the degree of enhanced (additive or synergistic) or decreased (antagonistic) tumor growth inhibition following administration of FGFR1-ECD.339-Fc and pemetrexed. The results of that analysis are shown in Table 7.

Table 7. Analysis of fractional tumor volume[a] on day 49

	FGFR1-ECD.339-Fc	Pemetrexed	Expected[b]	Observed	Expected/ Observed[c]
Pemetrexed 62.5	0.68	0.59	0.40	0.31	1.29
Pemetrexed 125	0.68	0.75	0.51	0.42	1.21
Pemetrexed 250	0.68	1.00	0.68	0.53	1.28

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0159] Those results demonstrate that administration of FGFR1-ECD.339-Fc and pemetrexed results in additive inhibition of tumor growth.

Example 3: Administration of FGFR1-ECD.339-Fc in Combination with Various Chemotherapeutics in the A549 Non-Small Cell Lung Cancer (NSCLC) Xenograft Model

[0160] Six weeks old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. A549 cells purchased from ATCC (Manassas, VA; Cat. No. CCL-185) were cultured for three passages in RPMI + 10% FBS + 1% L-glutamine at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free phosphate buffered saline (PBS) containing 50% Matrigel at 5 x10^7 cells per milliliter. The cells were implanted subcutaneously over the right flank of the mice at 5x10^6 cells/100 µl/mouse. One day after tumor implantation, mice were randomized according to body weight at 10 mice per group.

[0161] The tumor volume and body weight of the mice were monitored twice a week throughout each study. The tumor volume was measured and calculated using the method and formula described in Example 1.

[0162] The tumor volume of each group of mice at the end of each study was analyzed by one-way ANOVA followed by Tukey's test. Fractional tumor volume analysis was then used to assess the degree of enhanced (additive or synergistic) or decreased (antagonistic) tumor growth inhibition achieved following administration of FGFR1-ECD.339-Fc with one or more additional chemotherapeutic molecules.

[0163] Certain study details, and the results for each combination, are discussed below.

A. FGFR1-ECD.339-Fc and Cisplatin

[0164] FGFR1-ECD.339-Fc was formulated in 0.9% Sodium Chloride Injection USP (Henry Schein, Inc., Melville, NY; Cat. No. 1533826) at 4 mg/ml and administered intraperitoneally (i.p.) at 20 mg/kg (400 μg/100 μl/mouse) twice per week for six weeks. Cisplatin was purchased from Sigma-Aldrich (St. Louis, MO; Cat. No. P4394), formulated in 0.9% saline, and administered i.p. at 3.5 mg/kg (17 μg/100 μl per mouse) once per week for six weeks. Saline was used as negative control and was administered i.p. at 100 μl per mouse twice a week for six weeks.

[0165] On day 42, when the average tumor volume in the vehicle group reached 1300 mm^3, the mice were euthanized by isoflurane inhalation and cervical dislocation.

[0166] The mean tumor volume throughout the study for each set of mice is shown in Figure 5. In that experiment, administration of FGFR1-ECD.339-Fc and cisplatin inhibited tumor growth more than either drug alone. Further, the mice did not lose weight over the course of that study. (Data not shown.)

[0167] The tumor volume of each group of mice on day 42 was analyzed by one-way ANOVA followed by Tukey's test. The results of that analysis are shown in Table 8.

Table 8. Tumor volume analysis on day 42

	Mean Tumor volume mm^3 (±SD)	Tumor growth inhibition (%)	p Value compare to control (Tukey's test)
Saline vehicle	1339 (±411)	-	-
FGFR1-ECD.339-Fc	807 (±431)	39	<0.01
Cisplatin	682 (±195)	49	<0.001
FGFR1-ECD.339-Fc + Cisplatin	382 (±210)	71	<0.001

[0168] In order to determine whether combination of FGFR1-ECD.339-Fc and cisplatin resulted in enhanced (additive or synergistic) or decreased (antagonistic) antitumor activity, fractional tumor volume was analyzed as described in Example 1. The results of that analysis are shown in Table 9.

Table 9. Analysis of fractional tumor volume[a] on day 42 relative to control

	FGFR1-ECD.339-Fc	Cisplatin	Expected [b]	Observed	Expected/Observed [c]
FGFR1-ECD.339-Fc + cisplatin	0.60	0.5	0.30	0.28	1.07

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0169] Those results show that the combination of FGFR1-ECD.339-Fc and cisplatin resulted in additive inhibition of tumor growth in that experiment.

B. FGFR1-ECD.339-Fc and Paclitaxel

[0170] The combination of FGFR1-ECD.339-Fc and paclitaxel was tested in the A549 human non-small cell lung cancer xenograft model, described above. FGFR1-ECD.339-Fc was formulated in 0.9% Saline for Injection USP at 3 mg/ml. Paclitaxel was purchased from Bedford Laboratories (Bedford, OH; Cat. No. 1075029) and was formulated in 0.9% saline for injection containing 5% dextrose at 3.6 mg/ml for a dose of 18 mg/kg. FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 15 mg/kg twice per week for 5 weeks. Paclitaxel was administered i.p. at 18 mg/kg on days 8, 12, and 15.

[0171] When the average tumor volume in vehicle control group reached ~500 mm^3, the mice were euthanized by isoflurane inhalation and cervical dislocation.

[0172] The mean tumor volume throughout the study for each set of mice is shown in Figure 6. In that experiment, the combination of FGFR1-ECD.339-Fc and paclitaxel inhibited tumor growth more than either drug alone. Further, the mice did not lose weight over the course of that study. (Data not shown.)

[0173] In order to determine whether the combination of FGFR1-ECD.339-Fc and paclitaxel resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on day 31 and day 38 was analyzed as described in Example 1. The results of that analysis are shown in Table 10.

Table 10. Analysis of fractional tumor volume[a] on day 31 and day 38

Day	FGFR1-ECD.339-Fc	Paclitaxel	Expected[b]	Observed	Expected/Observed[c]
31	0.84	0.57	0.48	0.26	1.81
38	0.89	0.50	0.45	0.39	1.13

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0174] Those results show that administration of FGFR1-ECD.339-Fc and paclitaxel resulted in additive inhibition of tumor growth.

C. FGFR1-ECD.339-Fc and 5-FU

[0175] The combination of FGFR1-ECD.339-Fc and 5-fluorouracil (5-FU) was tested in the A549 human non-small cell lung cancer xenograft model, described above. FGFR1-ECD.339-Fc was formulated in 0.9% Saline for Injection USP at 3 mg/ml. 5-FU was purchased from Sigma-Aldrich (St. Louis, MO; Cat. No. F6627) and was initially dissolved in dimethyl sulfoxide (DMSO, Sigma-Aldrich, St. Louis, MO; Cat. No. D8418-50) at the concentration of 50 mg/ml as a stock solution. The stock solution was further diluted in 0.9% Sodium Chloride Injection USP to 6.6 mg/ml (for 33 mg/kg dosing). FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 15 mg/kg twice per week for four weeks. 5-FU was administered i.p. at 33 mg/kg twice a week for three weeks.

[0176] Mice were euthanized on day 31 by isoflurane inhalation and cervical dislocation.

[0177] The mean tumor volume throughout the study for each set of mice is shown in Figure 7. In that experiment, the combination of FGFR1-ECD.339-Fc and 5-FU inhibited tumor growth more than either drug alone. Further, the mice did not lose weight over the course of that study. (Data not shown.)

[0178] In order to determine whether the combination of FGFR1-ECD.339-Fc and 5-FU resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on day 31 was analyzed as described in Example 1. The results of that analysis are shown in Table 11.

Table 11. Analysis of fractional tumor volume[a] on day 31

Day	FGFR1-ECD.339-Fc	5-FU	Expected[b]	Observed	Expected/Observed[c]
31	0.84	1.04	0.89	0.38	2.33

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0179] Those results show that administration of FGFR1-ECD.339-Fc and 5-FU resulted in synergistic inhibition of tumor growth in that experiment. The inventors note that similar experiments using 20 mg/kg or 50 mg/kg 5-FU did not result in synergy. (Data not shown.)

D. FGFR1-ECD.339-Fc and Docetaxel

[0180] The combination of FGFR1-ECD.339-Fc and docetaxel was tested in the A549 human non-small cell lung cancer xenograft model, described above. FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice a week for four weeks. Docetaxel was administered i.p. at 3 mg/kg or 10 mg/kg twice per week for four weeks.

[0181] Mice in the albumin control group were euthanized on day 32 by isoflurane inhalation and cervical dislocation when the average tumor volume in the group reached 1000 mm^3.

[0182] The mean tumor volume throughout the study for each set of mice is shown in Figures 8A (3 mg/kg docetaxel) and 8B (10 mg/kg docetaxel). In that experiment, the combination of FGFR1-ECD.339-Fc and docetaxel inhibited tumor growth more than either drug alone, at either dosage of docetaxel. Further, the mice did not lose weight over the course of that study, at either dosage of docetaxel. (Data not shown.)

[0183] In order to determine whether the combination of FGFR1-ECD.339-Fc and docetaxel resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on day 32 was analyzed as described in Example 1. The results of that analysis are shown in Table 12.

Table 12. Analysis of fractional tumor volume[a] on day 32

Day	FGFR1-ECD.339-Fc	Docetaxel	Expected[b]	Observed	Expected/ Observed[c]
32 (3 mg/kg docetaxel)	0.54	0.79	0.43	0.44	0.95
32 (10 mg/kg docetaxel)	0.54	0.58	0.31	0.42	0.73

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0184] Those results show that administration of FGFR1-ECD.339-Fc and docetaxel resulted in additive inhibition of tumor growth in that experiment.

E. FGFR1-ECD.339-Fc and Vincristine

[0185] The combination of FGFR1-ECD.339-Fc and vincristine was tested in the A549 human non-small cell lung cancer xenograft model, described above. FGFR1-ECD.339-Fc was

formulated in 0.9% Saline for Injection USP at 1.5 mg/ml for administration at 15 mg/kg (300 μg/200 μl per mouse), or 2 mg/ml for administration at 20 mg/kg (400 μg/200 μl per mouse). Vincristine was obtained from Fluka-Sigma (St. Louis, MO 63103, Catalog #V8879) and was formulated in 0.9% Saline for Injection USP at 0.1 mg/ml or 0.15 mg/mL for administration at 1 mg/kg (0.02 μg/100 μl per mouse) or 1.5 mg/kg (0.03 μg/200 μl per mouse), respectively.

[0186] In the first experiment, FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 15 mg/kg twice per week starting on day 1 for six weeks, and vincristine was administered i.p. at 1 mg/kg on days 8, 15, and 22. In the second experiment, FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 20 mg/kg twice per week starting on day 19 for seven weeks, and vincristine was administered i.p. at 1.5 mg/kg on days 27, 34, and 41.

[0187] Mice from the first experiment were euthanized 46 days post tumor implantation. In the second study, mice in the albumin control group and mice in the FGFR1-ECD.339-Fc group were euthanized 70 days post tumor implantation, while mice in the vincristine-treated groups were euthanized 77 days post tumor implantation. All of the mice were euthanized by isoflurane inhalation and cervical dislocation.

[0188] The mean tumor volume throughout the study for each set of mice is shown in Figures 9A (1 mg/kg vincristine; dosing begun at day 1) and 9B (1.5 mg/kg vincristine; dosing begun at day 19). In that experiment, the combination of FGFR1-ECD.339-Fc and vincristine inhibited tumor growth more than either drug alone, at either dosage of vincristine, and at either dosing schedule. Further, at the lower dose of vincristine, the mice did not lose weight. (Data not shown.) At the higher dose of vincristine, the mice lost weight, indicating that the higher dose is closer to the maximum tolerated dose. See Figure 9C.

[0189] In order to determine whether the combination of FGFR1-ECD.339-Fc and vincristine resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on days 39 and 46 for the first experiment, and on days 70 for the second experiment, was analyzed as described in Example 1. The results of that analysis are shown in Table 13.

Table 13. Analysis of fractional tumor volume[a]

Dose of FGFR1-ECD.339-Fc	Dose of Vincristine	Day	FGFR1-ECD.339-Fc	Vincristine	Exp.[b]	Obs.	Expected/ Observed[c]
15 mg/kg (start day 1)	1 mg/kg	39	0.50	0.53	0.27	0.23	1.16
15 mg/kg (start day 1)	1 mg/kg	46	0.40	0.55	0.22	0.24	0.91
20 mg/kg (start day 19)	1.5 mg/kg	70	0.71	0.41	0.29	0.14	2.07

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0190] Those results show that administration of FGFR1-ECD.339-Fc and vincristine resulted in additive inhibition of tumor growth at the lower dose of vincristine, and synergistic inhibition of tumor growth at the higher dose of vincristine.

F. FGFR1-ECD.339-Fc, Carboplatin, and Paclitaxel

[0191] The combination of FGFR1-ECD.339-Fc, carboplatin, and paclitaxel was tested in the A549 human non-small cell lung cancer xenograft model, described above. FGFR1-ECD.339-Fc was formulated in 0.9% Saline for Injection USP at 3 mg/ml (for administration at 15 mg/kg). Carboplatin was obtained from Sigma-Aldrich (St. Luis, MO 63103, Catalog # C2538) and was formulated in 0.9% Saline for Injection USP at 2.5 mg/mL for administration at 25 mg/kg (500 μg/200μL per mouse). Paclitaxel was obtained from LC Laboratories (Woburn, MA 01801; Catalog # P-9600) and was formulated in a solution of 50.3% Cremophor® and 49.7% dehydrated alcohol at 20 mg/mL as stock solution. The stock solution was further diluted in 5% dextrose in 0.9% Saline for Injection USP at 3 mg/mL for administration at 30 mg/kg (600 μg/200 μL per mouse).

[0192] FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 15 mg/kg twice per week starting on day 7 for three weeks. Carboplatin was administered i.p. at 25 mg/kg twice per week starting on day 7 for three weeks. Paclitaxel was administered i.p. at 30 mg/kg twice per week starting on day 8 for three weeks.

[0193] Mice were euthanized on day 34 in single agent groups and on day 41 in combination groups. Mice were euthanized by isoflurane inhalation and cervical dislocation.

[0194] The mean tumor volume throughout the study for each set of mice is shown in Figure 10. In that experiment, the combination of FGFR1-ECD.339-Fc, carboplatin, and paclitaxel inhibited tumor growth more than any of the drugs alone, and also more than the combination of

carboplatin and paclitaxel. No weight loss was observed during the course of that study. (Data not shown.)

[0195] In order to determine whether the combination of FGFR1-ECD.339-Fc, carboplatin, and paclitaxel resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on day 28 was analyzed as described in Example 1. The results of that analysis are shown in Table 14.

Table 14. Analysis of fractional tumor volume[a]

Day	FGFR1-ECD.339-Fc	Paclitaxel + carboplatin	Expected[b]	Observed	Expected/ Observed[c]
28	0.58	0.27	0.16	0.14	1.15

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0196] Those results show that administration of FGFR1-ECD.339-Fc, carboplatin, and paclitaxel resulted in additive inhibition of tumor growth in that experiment.

Example 4: Administration of FGFR1-ECD.339-Fc in Combination with Various Chemotherapeutics in the Colo205 Colon Cancer Xenograft Model

[0197] Colo205 cells were purchased from ATCC (Manassas, VA; Cat. No. CCL-222) and were cultured for 3 passages in RPMI1640 media, 10% FBS, and 1% L-Glutamine at 37°C in a humidified atmosphere with 5% CO_2. Cells were resuspended in a solution of 50%/v PBS and 50%/v Matrigel at a concentration of 25 million cells/ml. Resuspended cells were kept on ice until implantation. Six weeks old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. On day 0, 2.5 million cells/100 µl were implanted over the right flank of the each mouse using a 27G1/2 needle. One day after tumor implantation, the mice were randomized according to the body weight.

[0198] The tumor volume and body weight of the mice were monitored twice a week throughout each study. The tumor volume was measured and calculated using the method and formula described in Example 1.

[0199] The tumor volume of each group of mice at the end of each study was analyzed by one-way ANOVA followed by Tukey's test. Fractional tumor volume analysis was then used to assess the degree of enhanced (additive or synergistic) or decreased (antagonistic) tumor growth inhibition achieved following administration of FGFR1-ECD.339-Fc with one or more additional chemotherapeutic molecules.

[0200] Certain study details, and the results for each combination, are discussed below.

A. FGFR1-ECD.339-Fc, 5-FU, Leucovorin, and Bevacizumab

[0201] FGFR1-ECD.339-Fc was formulated in 0.9% Sodium Chloride Injection USP (Henry Schein, Inc, Melville, NY; Cat. No. 1533826) at 2 mg/ml and stored in screw cap microcentrifuge tubes at -80°C. The negative control reagent, human albumin, was purchased from Grifols USA (Los Angeles, CA; Cat. No. NDC 61953-0002-1) and was formulated in PBS at 3 mg/ml. 5-FU was purchased from Sigma-Aldrich (St. Louis, MO; Cat. No. F6627) and was initially dissolved in dimethyl sulfoxide (DMSO, Sigma-Aldrich, St. Louis, MO; Cat. No. D8418-50) at the concentration of 50 mg/ml as a stock solution. The stock solution was further diluted in 0.9% Sodium Chloride Injection USP to 2 mg/ml (for 10 mg/kg dosing), to 4 mg/ml (for 20 mg/kg dosing), and to 6 mg/ml (for 30 mg/kg dosing). Leucovorin (LV) was also purchased from Sigma-Aldrich (Cat. No. F8259) and was formulated in 0.9% Sodium Chloride Injection USP at 2 mg/ml (for 10 mg/kg dosing), to 4 mg/ml (for 20 mg/kg dosing), and to 6 mg/ml (for 30 mg/kg dosing). Bevacizumab was purchased from Genentech, Inc (South San Francisco, CA; Cat. No. 15734) and was diluted in 0.9% Sodium Chloride Injection USP to 0.2 mg/ml (for 1 mg/kg dosing).

[0202] In the first experiment, FGFR1-ECD.339-Fc was combined with three different concentrations of 5-FU/leucovorin. In the second experiment, FGFR1-ECD.339-Fc was combined with either bevacizumab or 5-FU/leucovorin, or both. The grouping and dosing schedule for the experiments are shown in Table 15. The double line separates the groups from the two experiments.

Table 15. Dosing Schedule (Dosing started one day post tumor implantation)

N	Treatment	Drug 1 (Dose, route, Schedule)	Drug 2 (Dose, route, Schedule)	Drug 3 (Dose, route, Schedule)
10	Albumin+ Vehicle	Albumin (10 mg/kg, i.p., 3x/wk x 4 wks)	Saline (100 µl, q.d. x 5 days)	-
10	FGFR1-ECD.339-Fc	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	-	-
10	5-Fu/LV	5-FU (10 mg/kg, i.p., q.d. x 5 days)	LV (10 mg/kg, i.p., q.d. x 5 days)	
	FGFR1-ECD.339-Fc + 5-Fu/LV (10 mg/kg)	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	5-FU (10 mg/kg, i.p., q.d. x 5 days)	LV (10 mg/kg, i.p., q.d. x 5 days)
10	5-Fu/LV	5-FU (20 mg/kg, i.p., q.d. x 5 days)	LV (20 mg/kg, i.p., q.d. x 5 days)	
	FGFR1-ECD.339-Fc + 5-Fu/LV (20 mg/kg)	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	5-FU (20 mg/kg, i.p., q.d. x 5 days)	LV (20 mg/kg, i.p., q.d. x 5 days)
10	5-Fu/LV	5-FU (30 mg/kg, i.p., q.d. x 5 days)	LV (30 mg/kg, i.p., q.d. x 5 days)	
	FGFR1-ECD.339-Fc + 5-Fu/LV (30 mg/kg)	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	5-FU (30 mg/kg, i.p., q.d. x 5 days)	LV (30 mg/kg, i.p., q.d. x 5 days)
10	Bevacizumab	Bev (1 mg/kg, i.p., 2x/wk x 4 wks)		-
10	Bevacizumab + 5-Fu/LV	Bev (1 mg/kg, i.p., 2x/wk x 4 wks)	5-Fu/LV (10 mg/kg each, i.p., q.d. x 5 days)	-
10	FGFR1-ECD.339-Fc	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	-	-
10	FGFR1-ECD.339-Fc + Bevacizumab	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	Bev (1 mg/kg, i.p., 2x/wk x 4 wks)	-
10	FGFR1-ECD.339-Fc + Bevacizumab + 5-Fu/LV	FGFR1-ECD.339-Fc (15 mg/kg, i.p., 3x/wk x 4 wks)	Bev (1 mg/kg, i.p., 2x/wk x 4 wks)	5-Fu/LV (10 mg/kg each, i.p., q.d. x 5 days)

[0203] When the average tumor volume in a group was near 600 mm^3, the mice in that group were euthanized by isoflurane inhalation and cervical dislocation. The mean tumor volume throughout the study for each set of mice is shown in Figure 11. At 20 mg/kg 5-FU/leucovorin and 30 mg/kg 5-FU/leucovorin, the mice lost about 3 grams and about 4 grams of body weight, respectively (about 14% and 19%, respectively). (Data not shown.) No weight loss in the mice was observed in any of the remaining groups. (Data not shown.)

[0204] The order of effectiveness of the various treatments was evaluated two ways: 1) the average tumor volume in each group on a single time point (day); and 2) time for the average tumor volume in each group to reach 500 mm^3 (*see* the dotted line in Figure 11E).

[0205] The results of that experiment according to both methods showed that the antitumor effect of various treatment groups was in the following order: FGFR1-ECD.339-Fc, bevacizumab, and 5-Fu/leucovorin > FGFR1-ECD.339-Fc and bevacizumab > bevacizumab and 5-Fu/leucovorin = bevacizumab > FGFR1-ECD.339-Fc > vehicle.

[0206] The average tumor volume of each group of mice in the second experiment on day 24 was analyzed by one-way ANOVA followed by Tukey's test. The results of that analysis are shown in Table 16.

Table 16. Tumor volume analysis on day 24

	Mean Tumor volume mm^3(±SD)	Tumor growth inhibition (%)	p Value compare to control (Tukey's test)
Albumin+vehicle	693 (±159)	-	-
FGFR1-ECD.339-Fc	509 (±144)	26	<0.05
5-FU/LV	511 (±196)	26	>0.05
Bevacizumab	405 (±56)	41	<0.001
Bevacizumab + 5-Fu/LV	399 (±131)	42	<0.001
FGFR1-ECD.339-Fc + Bevacizumab	322 (±116)	53	<0.001
FGFR1-ECD.339-Fc + Bevacizumab + 5-Fu/LV	269 (±83)	61	<0.001

[0207] In order to determine whether administration of FGFR1-ECD.339-Fc and 5-FU/leucovorin at various concentrations; FGFR1-ECD.339-Fc and bevacizumab; or FGFR1-ECD.339-Fc, bevacizumab, and 5-Fu/leucovorin resulted in additive, synergistic, or antagonistic activity, fractional tumor volume was analyzed as described in Example 1. The results of that analysis are shown in Table 17.

Table 17. Analysis of fractional tumor volume[a]

Day 16	FGFR1-ECD.339-Fc	5-FU / LV (10 mg/kg)	Expected [b]	Observed	Expected / Observed [c]
	0.76	0.86	0.67	0.62	1.08
Day 16	FGFR1-ECD.339-Fc	5-FU / LV (20 mg/kg)	Expected [b]	Observed	Expected / Observed [c]
	0.76	0.56	0.42	0.42	1.00
Day 16	FGFR1-ECD.339-Fc	5-FU / LV (30 mg/kg)	Expected [b]	Observed	Expected / Observed [c]
	0.76	0.36	0.27	0.28	0.96
Day 24	FGFR1-ECD.339-Fc	Bevacizumab	Expected [b]	Observed	Expected / Observed [c]
	0.73	0.58	0.42	0.46	0.91
Day 24	FGFR1-ECD.339-Fc	Bevacizumab / 5-Fu/LV	Expected [b]	Observed	Expected / Observed [c]
	0.73	0.57	0.42	0.38	1.10

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0208] Those results show that administration of FGFR1-ECD.339-Fc and 5-FU/leucovorin at various concentrations; FGFR1-ECD.339-Fc and bevacizumab; or FGFR1-ECD.339-Fc, bevacizumab, and 5-Fu/leucovorin, resulted in additive inhibition of tumor growth.

B. FGFR1-ECD.339-Fc, 5-FU, Leucovorin, and Oxaliplatin

[0209] The combination of FGFR1-ECD.339-Fc, 5-FU, leucovorin, and oxaliplatin was tested in the Colo205 human colon cancer xenograft model, described above. FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml (for administration at 15 mg/kg). 5-FU was purchased from Sigma-Aldrich (St. Louis, MO; Cat. No. F6627) and was initially dissolved in dimethyl sulfoxide (DMSO, Sigma-Aldrich, St. Louis, MO; Cat. No. D8418-50) at the concentration of 50 mg/ml as a stock solution. The stock solution was further diluted in 0.9% Sodium Chloride Injection USP to 2 mg/ml (for 10 mg/kg dosing). Leucovorin was also purchased from Sigma-Aldrich (Cat. No. F8259) and was formulated in 0.9% Sodium Chloride Injection USP at 2 mg/ml (for 10 mg/kg dosing). Oxaliplatin was obtained from LC laboratories (Woburn, MA 01801; Catalog # O-7111) and was formulated in 5% Dextrose Injection (Baxter, Deerfield, IL 60015; Catalog # 2B0082) at 1 mg/mL, 2 mg/mL, and 3 mg/ml for administration at 5 mg/kg (100 µg/100 µL per mouse), 10 mg/kg (200 µg/100 µL per mouse), and 15 mg/kg (300 µg/100 µl per mouse).

[0210] FGFR1-ECD.339-Fc was administered intraperitoneally (i.p.) at 15 mg/kg twice per week starting on day 1 for four weeks. 5-FU and leucovorin were each administered i.p. at 10

mg/kg daily for five days. Oxaliplatin was administered i.p. at 5 mg/kg, 10 mg/kg, or 15 mg/kg in one dose on day 1.

[0211] Mice were euthanized on day 28 by isoflurane inhalation and cervical dislocation.

[0212] The mean tumor volume throughout the study for each set of mice is shown in Figure 12. In that experiment, the combination of FGFR1-ECD.339-Fc, 5-FU, leucovorin, and oxaliplatin inhibited tumor growth more than FGFR1-ECD.339-Fc alone or the combination 5-FU, leucovorin, and oxaliplatin. Minimal weight loss in the mice was observed at 5 mg/kg oxaliplatin (0.78 grams, or 4% body weight); moderate weight loss was observed at 10 mg/kg (2.6 grams, or 13% body weight); and more severe weight loss was observed at 15 mg/kg oxaliplatin twice per week (3.7 grams, or 19% body weight). (Data not shown.)

[0213] In order to determine whether the combination of FGFR1-ECD.339-Fc, 5-FU, leucovorin, and oxaliplatin resulted in additive, synergistic, or antagonistic activity, fractional tumor volume on day 17 was analyzed as described in Example 1. The results of that analysis are shown in Table 18.

Table 18. Analysis of fractional tumor volume[a] on day 17

Oxaliplatin dose	FGFR1-ECD.339-Fc	Oxaliplatin/ 5-FU/LV	Expected[b]	Observed	Expected/ Observed[c]
5 mg/kg	0.77	0.78	0.60	0.47	1.27
10 mg/kg	0.77	0.63	0.48	0.5	0.96
15 mg/kg twice per week	0.77	0.46	0.35	0.36	0.97

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0214] Those results show that administration of FGFR1-ECD.339-Fc, 5-FU, leucovorin, and oxaliplatin resulted in additive inhibition of tumor growth at each dosage of oxaliplatin tested in that experiment.

Example 5: Administration of FGFR1-ECD.339-Fc, Doxorubicin, and Paclitaxel in the JIMT-1 Breast Cancer Xenograft Model

[0215] Six week old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. Human breast cancer cell line JIMT-1 was used as the tumor model and was purchased from Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DMSZ, Braunschweig, Germany; Cat. No. ACC 589). The cells were cultured for ten passages in DMEM + 10% FBS, 1% L-

glutamine, and 1% penicillin/streptomycin at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free phosphate buffered saline (PBS) containing 50% Matrigel at 5 x10^7 cells per milliliter. The cells were implanted subcutaneously over the right flank of the mice at 5x10^6 cells/100 µl/mouse. One day after tumor implantation, mice were randomized according to body weight at 10 mice per group.

[0216] FGFR1-ECD.339-Fc was formulated in 0.9% Saline for Injection USP at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice per week for five weeks beginning on day 7. Doxorubicin was obtained from Sigma-Aldrich (St. Luis, MO; Catalog # 44583) and was formulated in 0.9% Saline for Injection USP at 0.05 mg/mL for administration at 0.5 mg/kg (10 µg/200 µL per mouse) once per week for five weeks, beginning on day 7. Paclitaxel was obtained from Bedford Laboratories (Bedford, OH; Cat. No. 1075029) and was formulated in a solution of 50.3% Cremophor® and 49.7% dehydrated alcohol. The stock solution was diluted in 5% dextrose/0.9% Saline for Injection USP to a final concentration of 3 mg/mL paclitaxel in 16.8% Cremophor®, 16.6% dehydrated alcohol, 3.3% dextrose, 0.6% Saline for Injection USP. Paclitaxel was administered at 30 mg/kg (60 µg/200 µL per mouse) twice per week for five weeks beginning on day 7.

[0217] The tumor volume and body weight of the mice were monitored twice a week throughout the study. The tumor volume was measured and calculated using the method and formula described in Example 1.

[0218] Mice were euthanized on day 42 by isoflurane inhalation and cervical dislocation.

[0219] The mean tumor volume throughout the study for each set of mice is shown in Figure 13. In that experiment, the combination of FGFR1-ECD.339-Fc, doxorubicin, and paclitaxel inhibited tumor growth more than FGFR1-ECD.339-Fc alone or the combination of doxorubicin and paclitaxel without FGFR1-ECD.339-Fc. No weight loss was observed over the course of the study. (Data not shown.)

[0220] Fractional tumor volume analysis was used to assess the degree of enhanced (additive or synergistic) or decreased (antagonistic) tumor growth inhibition by the combination of FGFR1-ECD.339-Fc, doxorubicin, and paclitaxel. The results of that analysis are shown in Table 19.

Table 19. Analysis of fractional tumor volume[a] on day 21

	FGFR1-ECD.339-Fc	Doxorubicin and paclitaxel	Expected[b]	Observed	Expected/Observed[c]
Day 21	0.93	0.59	0.55	0.50	1.10

[a] Fractional tumor volume (FTV) = (Mean tumor volume (TV) treated)/(Mean TV control)
[b] Expected = (FTV drug 1) x (FTV drug 2)
[c] Ratio of expected over observed, >2=synergistic; ~1=additive; <0.5=antagonistic.

[0221] Those results demonstrate that the combination of FGFR1-ECD.339-Fc, doxorubicin, and paclitaxel resulted in additive inhibition of tumor growth in that experiment.

Example 6: Treatment with FGFR1-ECD.339-Fc and KDR ECD-Fc in mice having H520 lung xenograft tumor cells showed tumor inhibition

[0222] SCID CB17 mice at 8 weeks of age were administered either vehicle, kinase insert domain receptor (KDR) cDNA (Five Prime Therapeutics, South San Francisco, CA) (which expresses a protein that acts as a VEGF antagonist and VEGF trap), FGFR1 cDNA (Five Prime Therapeutics, South San Francisco, CA), or a combination of KDR and FGFR1, by hydrodynamic tail vein transfection (TVT), substantially as described in Chen et al., *Human Gene Therapy* 16(1): 126-131 (2005), and then inoculated 4 days later with $5x10^6$ H520 lung xenograft tumor cells s.c. on the flank, with the cells in a 1:1 mixture of Matrigel in 100µl total volume. KDR and FGFR1 cDNA constructs each contain their respective extracellular domain fused to an IgG1 Fc domain. Tumor volume measurements were made at approximately 10 day intervals. On day 29, the tumor volume was reduced in groups treated with single agents relative to vehicle (Mann Whitney test $P<0.05$). On day 29, the tumor volume was reduced in the combination group relative to groups treated with single agents (Mann Whitney test $P<0.001$).

Example 7: Administration of FGFR1-ECD.339-Fc and Cisplatin / Etoposide in the DMS 53 Small Cell Lung Cancer (SCLC) Xenograft Model

[0223] Six week old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. Human small cell lung cancer (SCLC) cell line DMS 53 was used as the tumor model and was purchased from ATCC (Manassas, VA; Cat. No. CRL-2062). The cells were cultured for three passages in Waymouth's MB 752/1 medium + 10% FBS + 2mM L-glutamine at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free phosphate buffered saline (PBS) containing 50% Matrigel at 5 $x10^7$ cells per milliliter. The cells were implanted subcutaneously over the right flank of the mice at $5x10^6$ cells/100 µl/mouse. After tumors reached a size of 100-

125 mm^3, mice were sorted and randomized so each group (n=10) has the approximately the same average tumor volume, and treatment initiated according to Table 20 below.

[0224] FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice a week for four weeks. Cisplatin was purchased from Amatheon, Inc., Miami, FL (Cat No. 5539-0112-50) pre-formulated at concentration of 1mg/ml. 0.45 ml of cisplating stock solution (1mg/ml) was added to 1.05 ml of 5% dextrose solution, for a 1.5 ml working solution with a concentration of 0.3 mg/ml. Each mouse received 100 µl of working solution (0.3 mg/ml) to provide a dose of 3mg/kg every 7 or 21 days depending on group. Etoposide was purchased from Amatheon, Inc (Cat. No. 5539-0291-01) pre-formulated at concentration of 20mg/ml. 0.140 ml of stock solution (20mg/ml) was added to 3.36 ml of 5% dextrose solution, for a 3.5 ml working solution with a concentration of 0.8 mg/ml. Each mouse received 50 µl of working solution (0.8 mg/ml) to provide a dose of 4mg/kg for 3 days in a row. Etoposide dosing was repeated every 7 or 21 days depending on group. In combination groups, FGFR1-ECD.339-Fc and cisplatin / etoposide was administered concurrently. Human albumin was purchased from Grifols USA (Los Angeles, CA; Cat. No. NDC 61953-0002-1), diluted to a working stock (3 mg/ml) with 0.9% sodium chloride, and was used as negative control at 300 µg/100 µl/mouse (15 mg/kg). The dosing schedule for each set of mice is shown in Table 20.

Table 20

Group	Drugs	Cisplatin (mg/kg, schedule)	Etoposide (mg/kg, schedule)	FGFR1-ECD.339-Fc (mg/kg, schedule)	Route
1	Albumin 15mg/kg	0	0	0	IP
2	FGFR1-ECD.339-Fc	0	0	15 , 2x/week	IP
3	Cisplatin/ Etoposide	3, once every 21 days	4, qd x 3 every 21 days	0	IP
4	Cisplatin/ Etoposide/ FGFR1-ECD.339-Fc	3, once every 21 days	4, qd x 3 every 21 days	15 , 2x/week	IP
5	Cisplatin/ Etoposide	3, once every 7 days	4, qd x 3 every 7 days	0	IP
6	Cisplatin/ Etoposide/ FGFR1-ECD.339-Fc	3, once every 7 days	4, qd x 3 every 7 days	15 , 2x/week	IP

Example 8: Administration of FGFR1-ECD.339-Fc and Topotecan in the DMS 53 Small Cell Lung Cancer (SCLC) Xenograft Model

[0225] Six week old female SCID mice were purchased from Charles River Laboratories (Wilmington, MA) and were acclimated for 1 week before the start of the study. Human small cell lung cancer (SCLC) cell line DMS 53 was used as the tumor model and was purchased from ATCC (Manassas, VA; Cat. No. CRL-2062). The cells were cultured for three passages in Waymouth's MB 752/1 medium + 10% FBS + 2mM L-glutamine at 37°C in a humidified atmosphere with 5% CO_2. When the cultured cells reached 85-90% confluence, cells were harvested and resuspended in cold Ca^{2+} and Mg^{2+} free phosphate buffered saline (PBS) containing 50% Matrigel at 5 x10^7 cells per milliliter. The cells were implanted subcutaneously over the right flank of the mice at 5x10^6 cells/100 µl/mouse. After tumors reached a size of 100-125 mm^3, mice were sorted and randomized so each group (n=10) has the approximately the same average tumor volume, and treatment initiated according to Table 21 below.

[0226] FGFR1-ECD.339-Fc was formulated in PBS at 3 mg/ml and administered intraperitoneally (i.p.) at 15 mg/kg (300 µg/100 µl/mouse) twice a week for four weeks. Topotecan powder was purchased from Sigma-Aldrich, Inc. (Cat No. T2705-50MG) and a 5 mg/ml stock solution made in a 5% dextrose solution. Dilutions are also made with 5% dextrose solution. 0.6 ml of stock solution (5 mg/ml) was added to 5.4 ml of 5% dextrose solution, for a 6 ml working solution with a concentration of 0.5 mg/ml. Each mouse received 100 µl of working solution (0.5 mg/ml) to give a dose of 2.5 mg/kg. Topotecan dosing was repeated every 7 or 21 days depending on group. In combination groups, FGFR1-ECD.339-Fc and topotecan was administered concurrently. Human albumin was purchased from Grifols USA (Los Angeles, CA; Cat. No. NDC 61953-0002-1), diluted to a working stock (3 mg/ml) with 0.9% sodium chloride, and was used as negative control at 300 µg/100 µl/mouse (15 mg/kg). The dosing schedule for each set of mice is shown in Table 21.

Table 21

Group	Drugs	Topotecan (mg/kg, schedule)	FGFR1-ECD.339 -Fc (mg/kg, schedule)	Route
1	Albumin 15mg/kg	0	0	IP
2	FGFR1-ECD.339-Fc	0	15 , 2x/week	IP
3	Topotecan	2.5, qd x 5 every 21 days	0	IP
4	Topotecan/ FGFR1-ECD.339-Fc	2.5, qd x 5 every 21 days	15 , 2x/week	IP
5	Topotecan	2.5, qd x 5 every 7 days	0	IP
6	Topotecan/ FGFR1-ECD.339-Fc	2.5, qd x 5 every 7 days	15 , 2x/week	IP

TABLE OF SEQUENCES

[0227] Table 22 lists certain sequences discussed herein. FGFR1 sequences are shown without the signal peptide, unless otherwise indicated.

Table 22: Sequences and Descriptions

SEQ ID NO	Description	Sequence
1	Full-length human FGFR1 ECD (with signal peptide); SP-hFGFR1-ECD.353	MWSWKCLLFW AVLVTATLCT ARPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL EERPAVMTSP LYLE
2	Full-length human FGFR1 ECD (without signal peptide); hFGFR1-ECD.353	RPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL EERPAVMTSP LYLE
3	SP-hFGFR1-ECD.339	MWSWKCLLFW AVLVTATLCT ARPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL
4	hFGFR1-ECD.339	RPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL

5	SP-hFGFR1-ECD.339-Fc	MWSWKCLLFW AVLVTATLCT ARPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL EPKSSDKTHT CPPCPAPELL GGPSVFLFPP KPKDTLMISR TPEVTCVVVD VSHEDPEVKF NWYVDGVEVH NAKTKPREEQ YNSTYRVVSV LTVLHQDWLN GKEYKCKVSN KALPAPIEKT ISKAKGQPRE PQVYTLPPSR DELTKNQVSL TCLVKGFYPS DIAVEWESNG QPENNYKTTP PVLDSDGSFF LYSKLTVDKS RWQQGNVFSC SVMHEALHNH YTQKSLSLSP GK
6	hFGFR1-ECD.339-Fc	RPSPTLPEQ AQPWGAPVEV ESFLVHPGDL LQLRCRLRDD VQSINWLRDG VQLAESNRTR ITGEEVEVQD SVPADSGLYA CVTSSPSGSD TTYFSVNVSD ALPSSEDDDD DDDSSSEEKE TDNTKPNPVA PYWTSPEKME KKLHAVPAAK TVKFKCPSSG TPNPTLRWLK NGKEFKPDHR IGGYKVRYAT WSIIMDSVVP SDKGNYTCIV ENEYGSINHT YQLDVVERSP HRPILQAGLP ANKTVALGSN VEFMCKVYSD PQPHIQWLKH IEVNGSKIGP DNLPYVQILK TAGVNTTDKE MEVLHLRNVS FEDAGEYTCL AGNSIGLSHH SAWLTVLEAL EPKSSDKTHT CPPCPAPELL GGPSVFLFPP KPKDTLMISR TPEVTCVVVD VSHEDPEVKF NWYVDGVEVH NAKTKPREEQ YNSTYRVVSV LTVLHQDWLN GKEYKCKVSN KALPAPIEKT ISKAKGQPRE PQVYTLPPSR DELTKNQVSL TCLVKGFYPS DIAVEWESNG QPENNYKTTP PVLDSDGSFF LYSKLTVDKS RWQQGNVFSC SVMHEALHNH YTQKSLSLSP GK
7	hFGFR1 signal peptide	MWSWKCLLFWAVLVTATLCTA
8	Fc C237S	EPKSSDKTHT CPPCPAPELL GGPSVFLFPP KPKDTLMISR TPEVTCVVVD VSHEDPEVKF NWYVDGVEVH NAKTKPREEQ YNSTYRVVSV LTVLHQDWLN GKEYKCKVSN KALPAPIEKT ISKAKGQPRE PQVYTLPPSR DELTKNQVSL TCLVKGFYPS DIAVEWESNG QPENNYKTTP PVLDSDGSFF LYSKLTVDKS RWQQGNVFSC SVMHEALHNH YTQKSLSLSP GK
9	Exemplary Fc #1	ERKCCVECPP CPAPPVAGPS VFLFPPKPKD TLMISRTPEV TCVVVDVSHE DPEVQFNWYV DGVEVHNAKT KPREEQFNST FRVVSVLTVV HQDWLNGKEY KCKVSNKGLP APIEKTISKT KGQPREPQVY TLPPSREEMT KNQVSLTCLV KGFYPSDIAV EWESNGQPEN NYKTTPPMLD SDGSFFLYSK LTVDKSRWQQ GNVFSCSVMH EALHNHYTQK SLSLSPGK
10	Exemplary Fc #2	ESKYGPPCPS CPAPEFLGGP SVFLFPPKPK DTLMISRTPE VTCVVVDVSQ EDPEVQFNWY VDGVEVHNAK TKPREEQFNS TYRVVSVLTV LHQDWLNGKE YKCKVSNKGL PSSIEKTISK AKGQPREPQV YTLPPSQEEM TKNQVSLTCL VKGFYPSDIA VEWESNGQPE NNYKTTPPVL DSDGSFFLYS RLTVDKSRWQ EGNVFSCSVM HEALHNHYTQ KSLSLSLGK

CLAIMS

1. A method of treating cancer comprising administering to a subject a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab.

2. The method of claim 1, wherein the FGFR1 ECD further comprises a fusion partner.

3. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is docetaxel.

4. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is paclitaxel.

5. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is cisplatin.

6. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is pemetrexed.

7. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is vincristine.

8. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is 5-FU.

9. The method of claim 1 or 2, wherein the at least one additional therapeutic agent is topotecan.

10. The method of any one of claims 1-9, wherein the method comprises administering to the subject at least two additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab.

11. The method of claim 10, wherein one of the at least two additional therapeutic agents is paclitaxel, oxaliplatin, 5-FU, or bevacizumab.

12. The method of claim 10, wherein the at least two additional therapeutic agents are paclitaxel and carboplatin.

13. The method of claim 10, wherein the at least two additional therapeutic agents are oxaliplatin and 5-FU.

14. The method of claim 10, wherein the at least two additional therapeutic agents are

doxorubicin and paclitaxel

15. The method of claim 10, wherein the at least two additional therapeutic agents are 5-FU and leucovorin.

16. The method of claim 10, wherein the at least two additional therapeutic agents are bevacizumab and 5-FU.

17. The method of claim 10, wherein the at least two additional therapeutic agents are cisplatin and etoposide.

18. The method of any one of claims 1- 17, wherein the FGFR1 ECD comprises an amino acid sequence selected from SEQ ID NOs: 1 to 4.

19. The method of any one of claims 2-18, wherein the FGFR1 ECD further comprises a fusion partner and the fusion partner is an Fc.

20. The method of claim 19, wherein the FGFR1 ECD and Fc comprise a sequence selected from SEQ ID NO: 5 and SEQ ID NO: 6.

21. A dosage pack comprising at least one component selected from: (i) a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD), (ii) a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) fusion molecule, and (iii) at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, etoposide, topotecan, a VEGF antagonist, a VEGF trap, an anti-VEGF antibody, and pemetrexed, wherein the dosage pack further comprises instructions for administering an FGFR1 ECD and/or FGFR1 ECD fusion molecule and the at least one additional therapeutic to a patient.

22. A combination of a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) and at least one additional therapeutic agent selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, and bevacizumab, for use in treatment of cancer.

23. A combination of a fibroblast growth factor receptor 1 (FGFR1) extracellular domain (ECD) and at least two additional therapeutic agents selected from docetaxel, paclitaxel, vincristine, carboplatin, cisplatin, oxaliplatin, doxorubicin, 5-fluorouracil (5-FU), leucovorin, pemetrexed, etoposide, topotecan, a VEGF antagonist, a VEGF trap, an anti-VEGF antibody, and bevacizumab, for use in treatment of cancer.

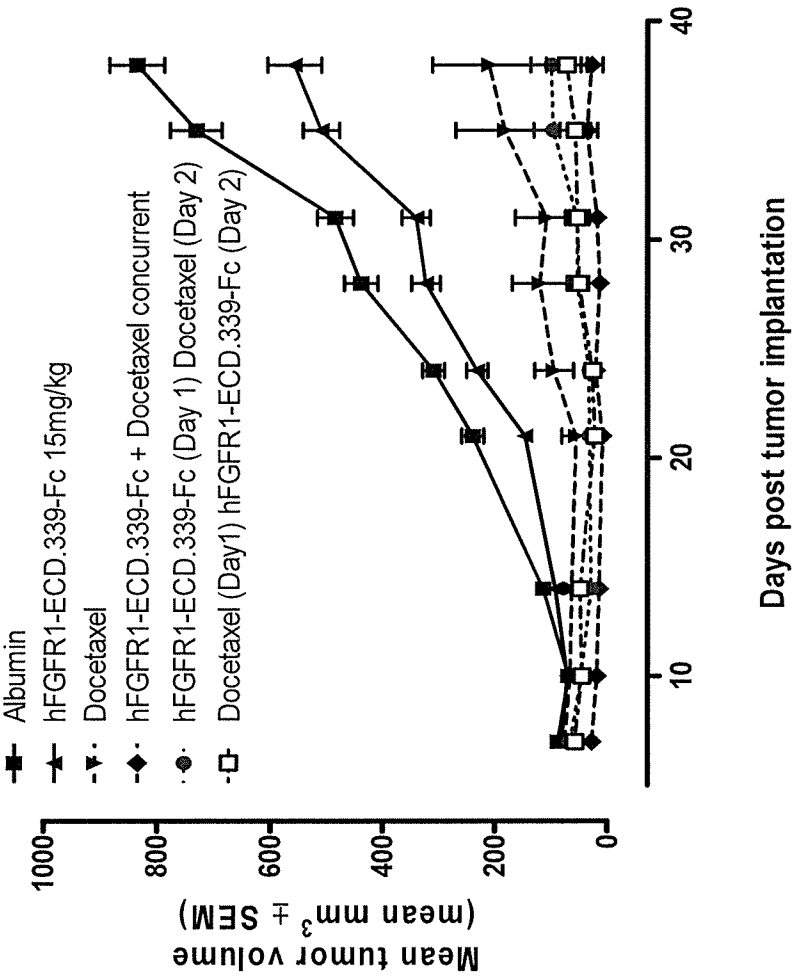

Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Docetaxel
hFGFR1-ECD.339-Fc + Docetaxel concurrent
hFGFR1-ECD.339-Fc (Day 1) Docetaxel (Day 2)
Docetaxel (Day1) hFGFR1-ECD.339-Fc (Day 2)
Mean tumor volume
(mean mm3 ± SEM)
1000
800
600
400
200
0
10
20
30
40
Days post tumor implantation

FIGURE 1

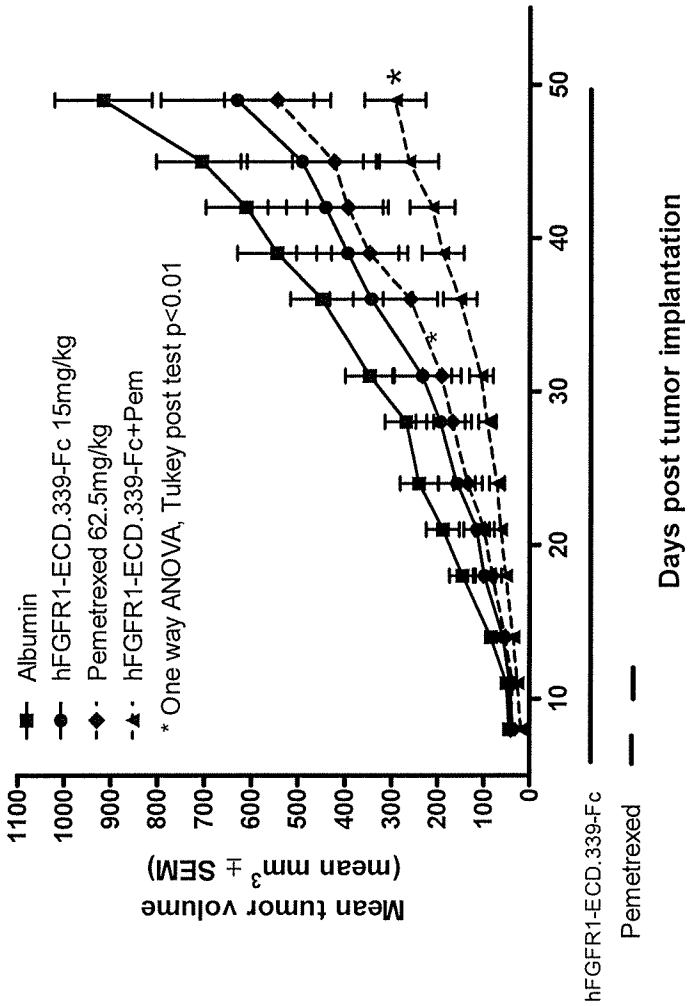

Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 62.5mg/kg
hFGFR1-ECD.339-Fc+Pem
* One way ANOVA, Tukey post test p<0.01
Mean tumor volume
(mean mm3 ± SEM)
1100
1000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
*
*
hFGFR1-ECD.339-Fc
Pemetrexed
Days post tumor implantation

FIGURE 2A

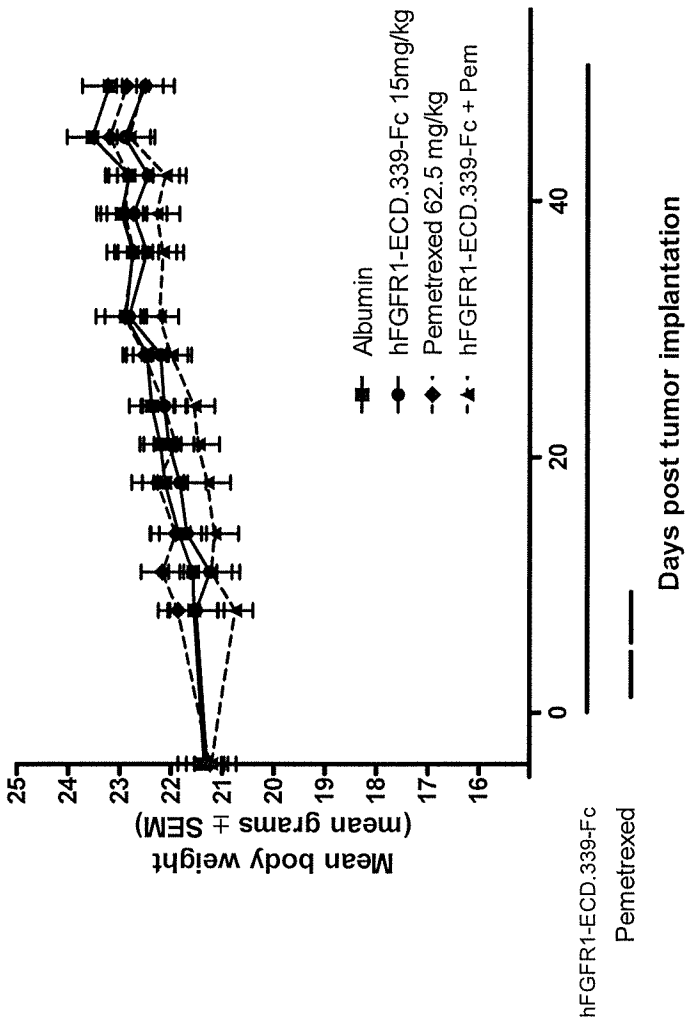

Mean body weight
(mean grams ± SEM)
25
24
23
22
21
20
19
18
17
16
0
20
40
Days post tumor implantation
Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 62.5 mg/kg
hFGFR1-ECD.339-Fc + Pem
hFGFR1-ECD.339-Fc
Pemetrexed

FIGURE 2B

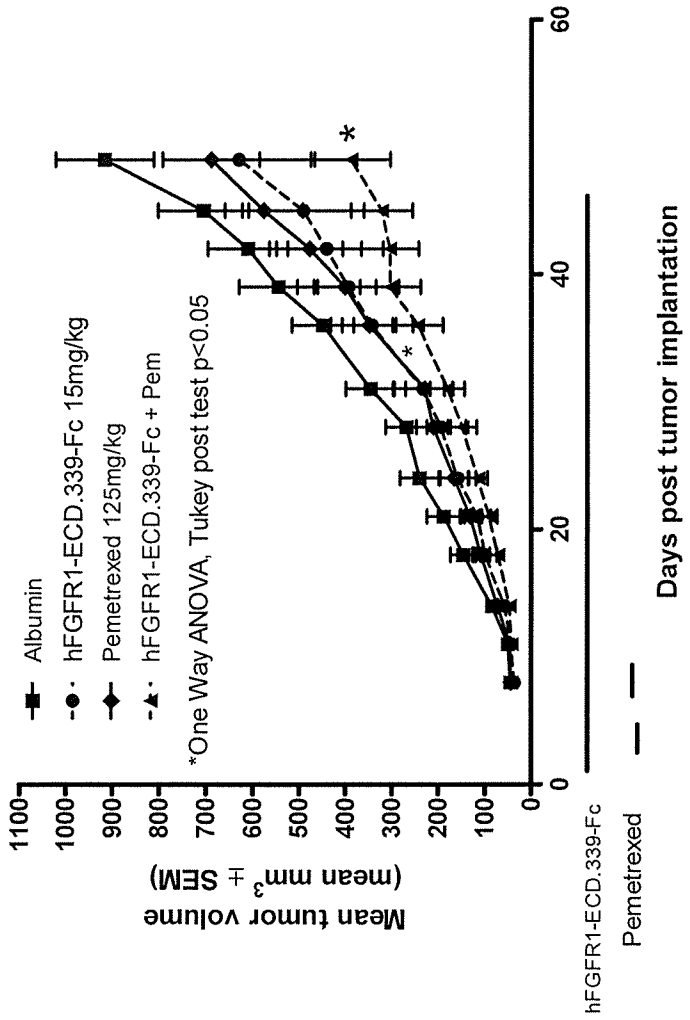

Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 125mg/kg
hFGFR1-ECD.339-Fc + Pem
*One Way ANOVA, Tukey post test p<0.05
Mean tumor volume
(mean mm3 ± SEM)
1100
1000
900
800
700
600
500
400
300
200
100
0
0
20
40
60
*
*
hFGFR1-ECD.339-Fc
Pemetrexed
Days post tumor implantation

FIGURE 3A

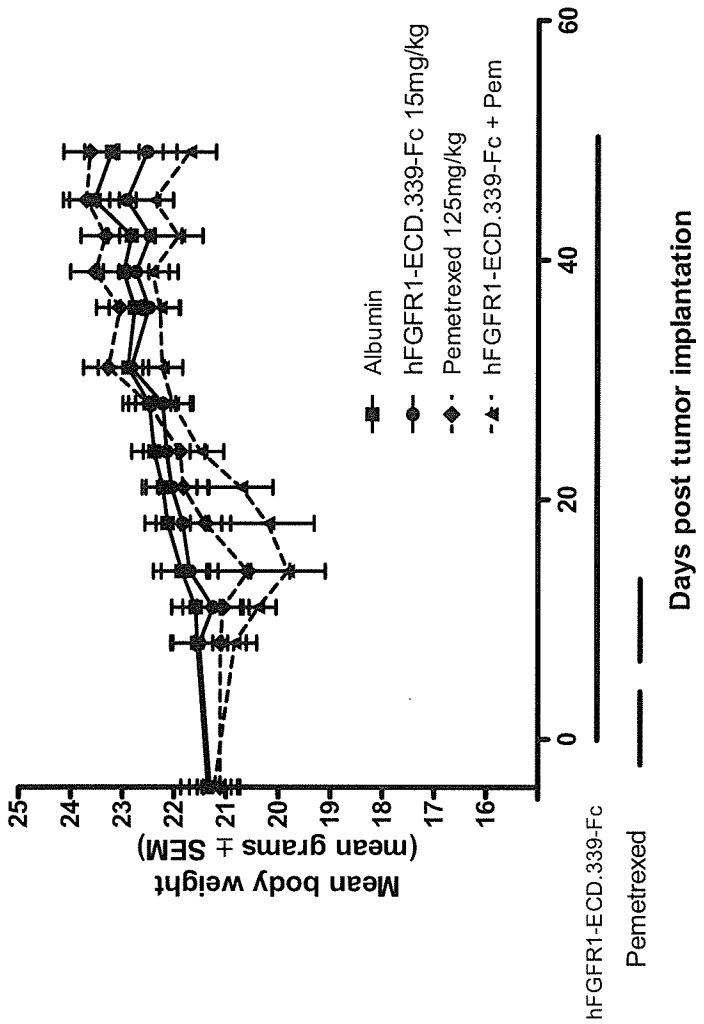

Mean body weight
(mean grams ± SEM)
25
24
23
22
21
20
19
18
17
16
0
20
40
60
Days post tumor implantation
Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 125mg/kg
hFGFR1-ECD.339-Fc + Pem
hFGFR1-ECD.339-Fc
Pemetrexed

FIGURE 3B

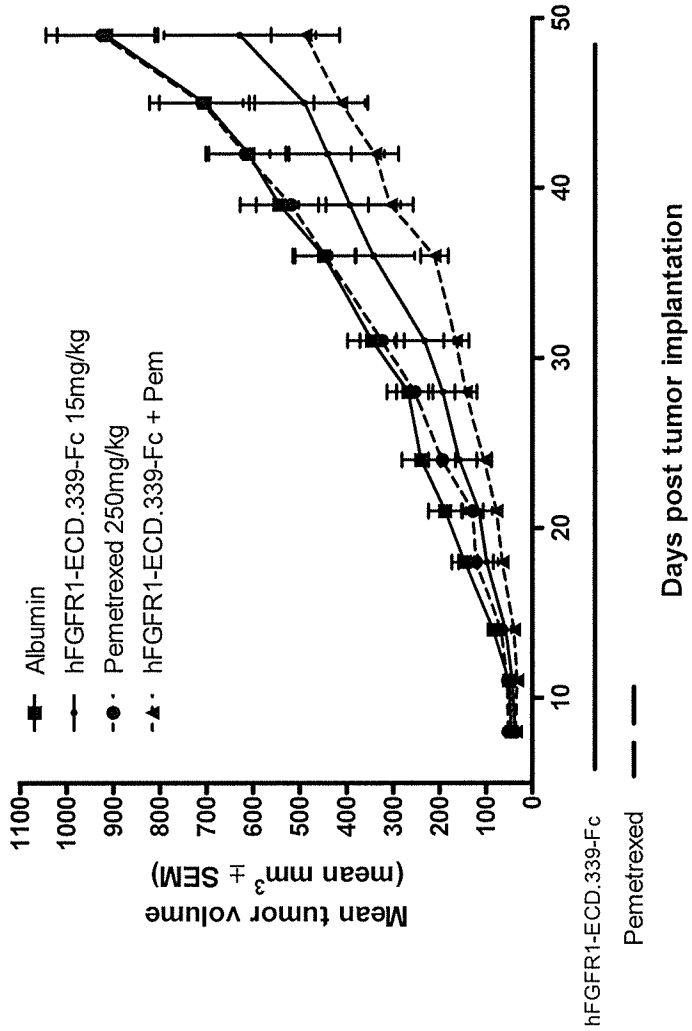

Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 250mg/kg
hFGFR1-ECD.339-Fc + Pem
Mean tumor volume
(mean mm3 ± SEM)
1100
1000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
Days post tumor implantation
hFGFR1-ECD.339-Fc
Pemetrexed

FIGURE 4A

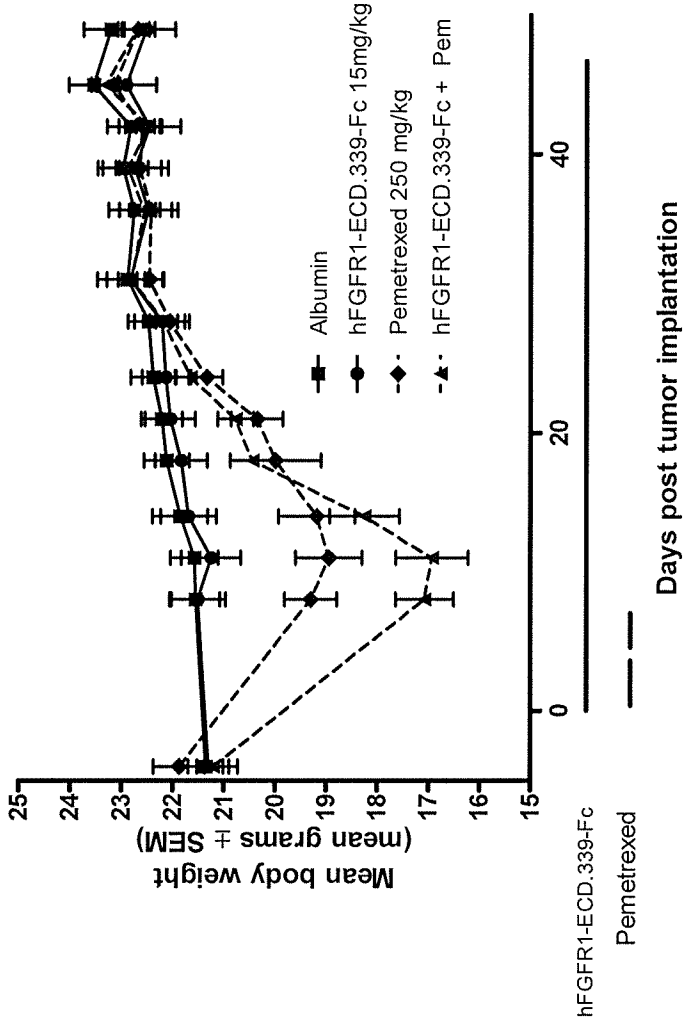

Mean body weight
(mean grams ± SEM)
25
24
23
22
21
20
19
18
17
16
15
0
20
40
Days post tumor implantation
Albumin
hFGFR1-ECD.339-Fc 15mg/kg
Pemetrexed 250 mg/kg
hFGFR1-ECD.339-Fc + Pem
hFGFR1-ECD.339-Fc
Pemetrexed

FIGURE 4B

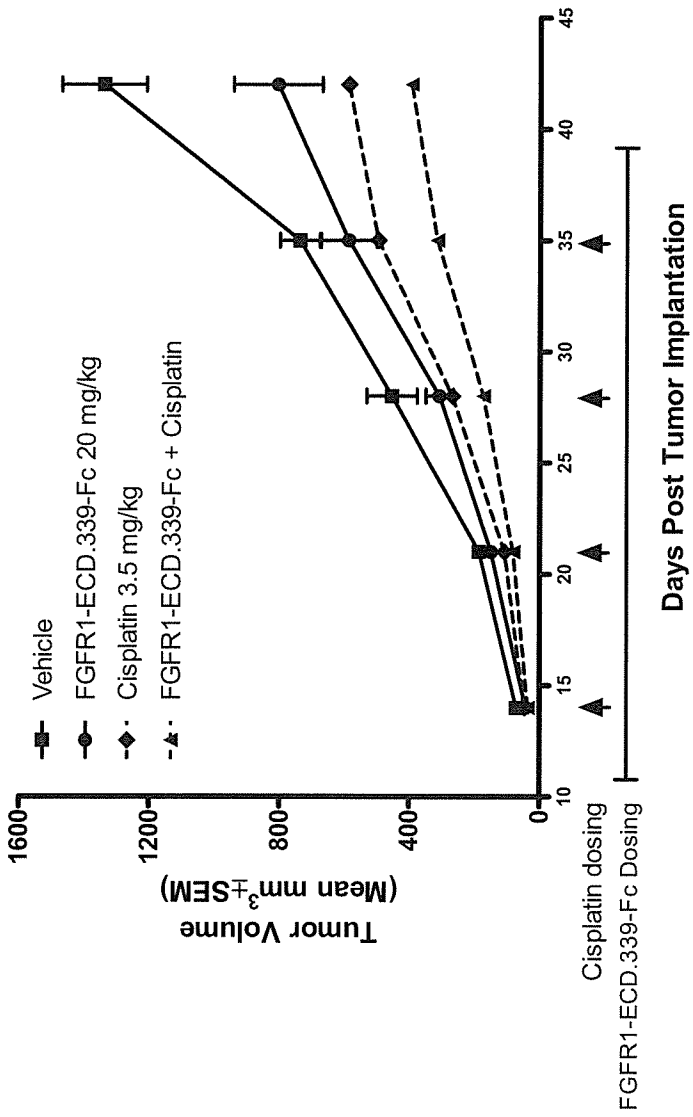

Vehicle
FGFR1-ECD.339-Fc 20 mg/kg
Cisplatin 3.5 mg/kg
FGFR1-ECD.339-Fc + Cisplatin
Tumor Volume
(Mean mm³±SEM)
1600
1200
800
400
0
10
15
20
25
30
35
40
45
Days Post Tumor Implantation
Cisplatin dosing
FGFR1-ECD.339-Fc Dosing

FIGURE 5

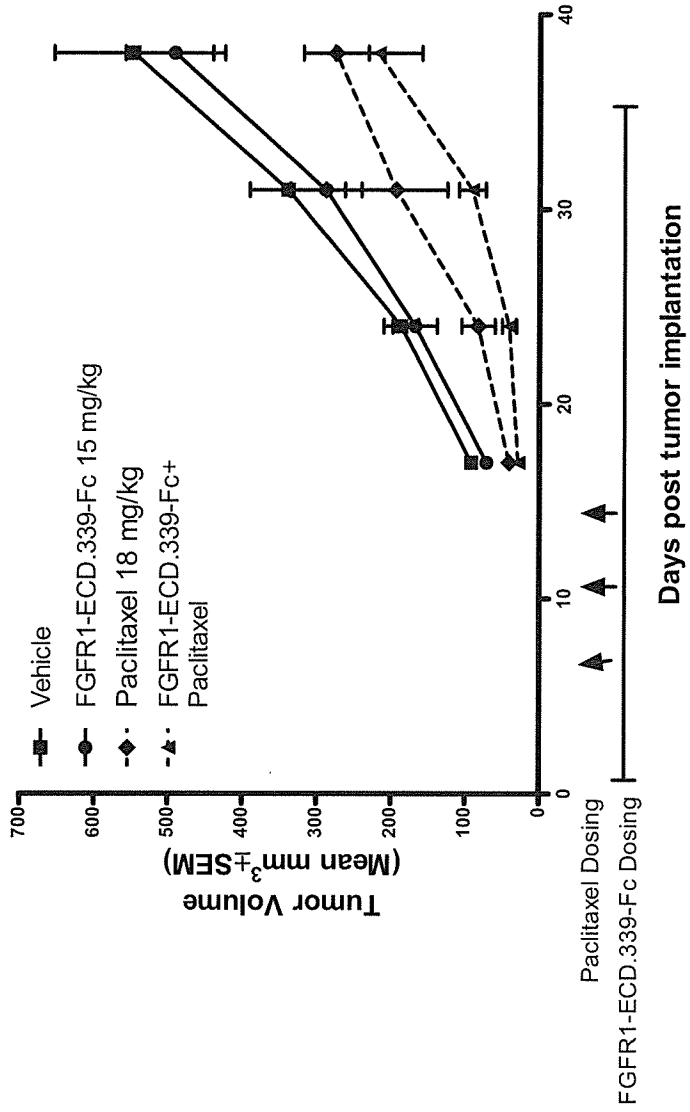

Tumor Volume
(Mean mm3±SEM)
700
600
500
400
300
200
100
0
0
10
20
30
40
Days post tumor implantation
Vehicle
FGFR1-ECD.339-Fc 15 mg/kg
Paclitaxel 18 mg/kg
FGFR1-ECD.339-Fc+
Paclitaxel
Paclitaxel Dosing
FGFR1-ECD.339-Fc Dosing

FIGURE 6

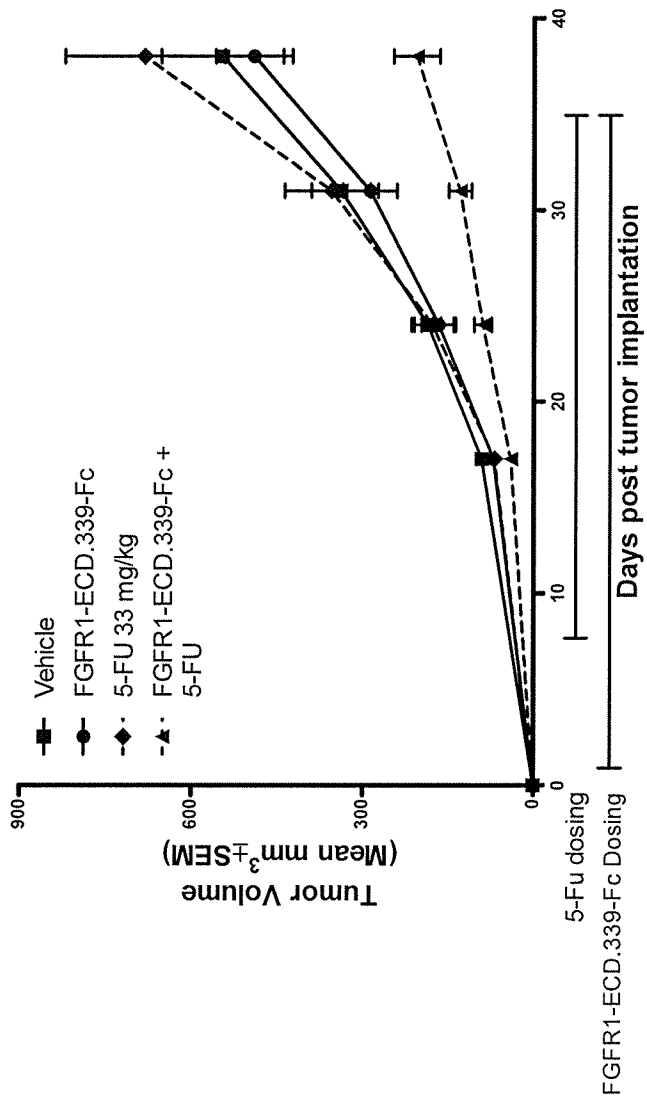

Vehicle
FGFR1-ECD.339-Fc
5-FU 33 mg/kg
FGFR1-ECD.339-Fc + 5-FU
Tumor Volume (Mean mm3±SEM)
900
600
300
0
0
10
20
30
40
Days post tumor implantation
5-Fu dosing
FGFR1-ECD.339-Fc Dosing

FIGURE 7

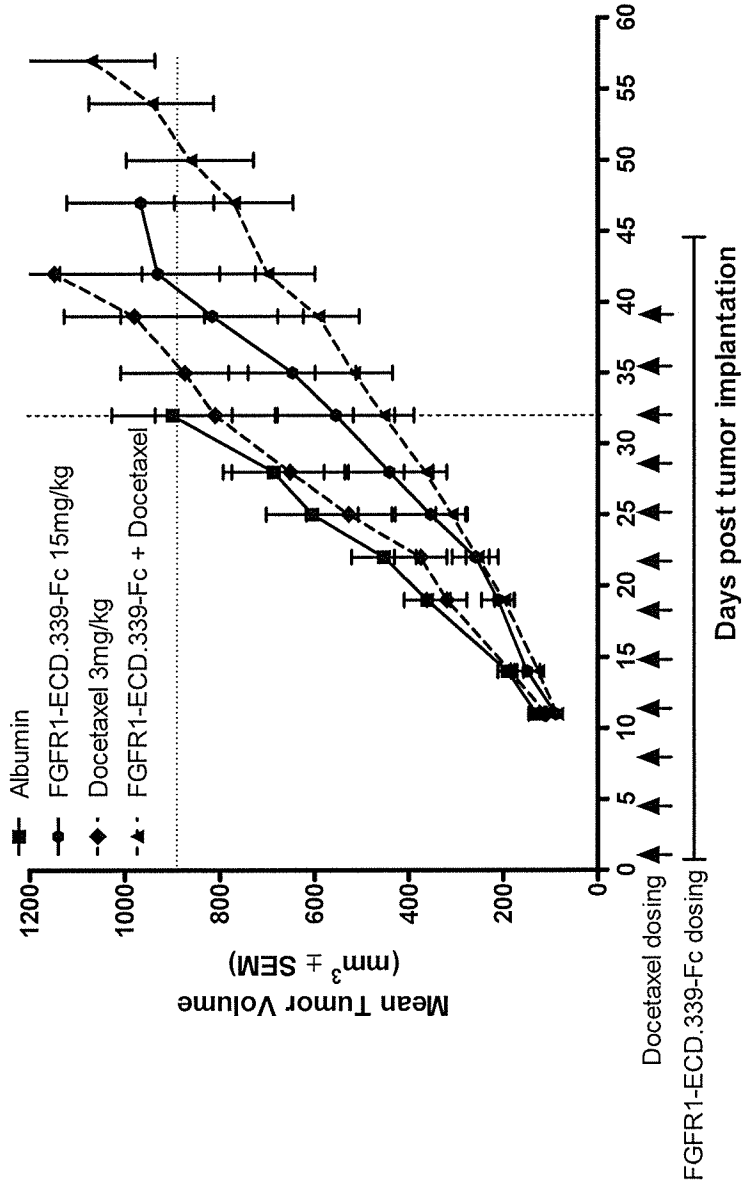

Albumin
FGFR1-ECD.339-Fc 15mg/kg
Docetaxel 3mg/kg
FGFR1-ECD.339-Fc + Docetaxel
Mean Tumor Volume
(mm3 ± SEM)
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
45
50
55
60
Docetaxel dosing
FGFR1-ECD.339-Fc dosing
Days post tumor implantation

FIGURE 8A

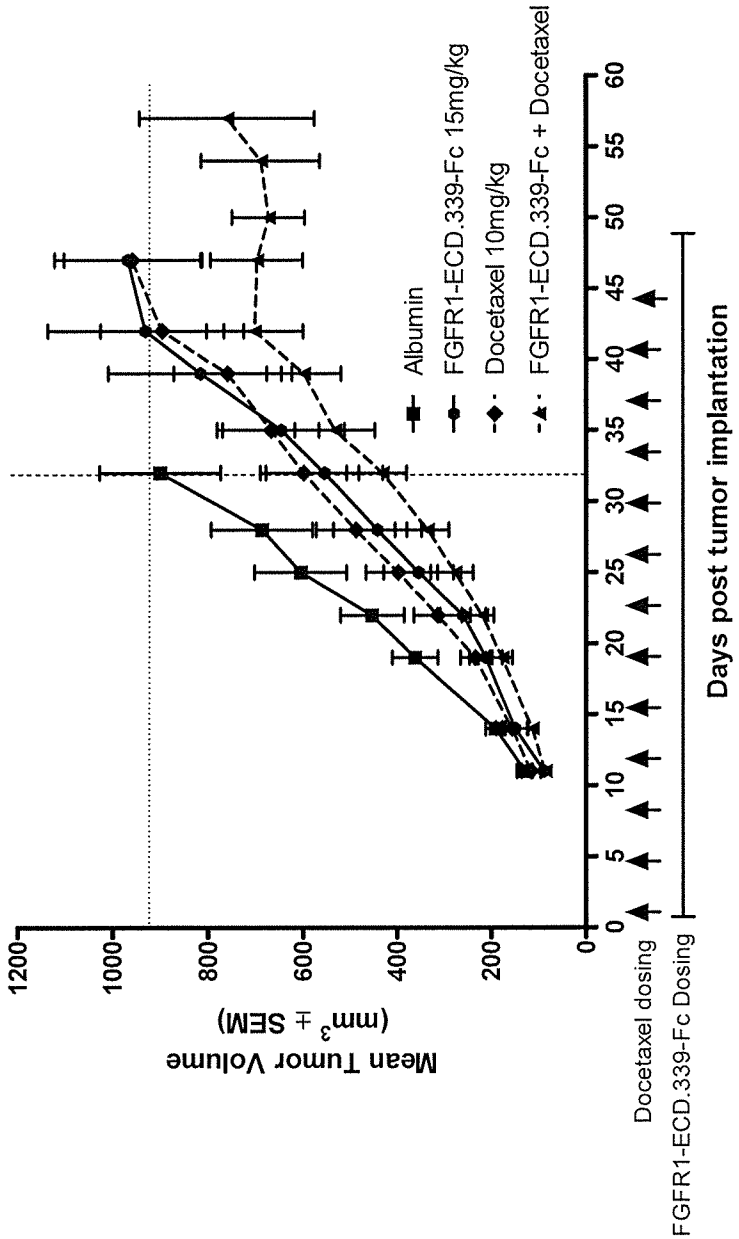

Mean Tumor Volume
(mm3 ± SEM)
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
45
50
55
60
Days post tumor implantation
Docetaxel dosing
FGFR1-ECD.339-Fc Dosing
Albumin
FGFR1-ECD.339-Fc 15mg/kg
Docetaxel 10mg/kg
FGFR1-ECD.339-Fc + Docetaxel

FIGURE 8B

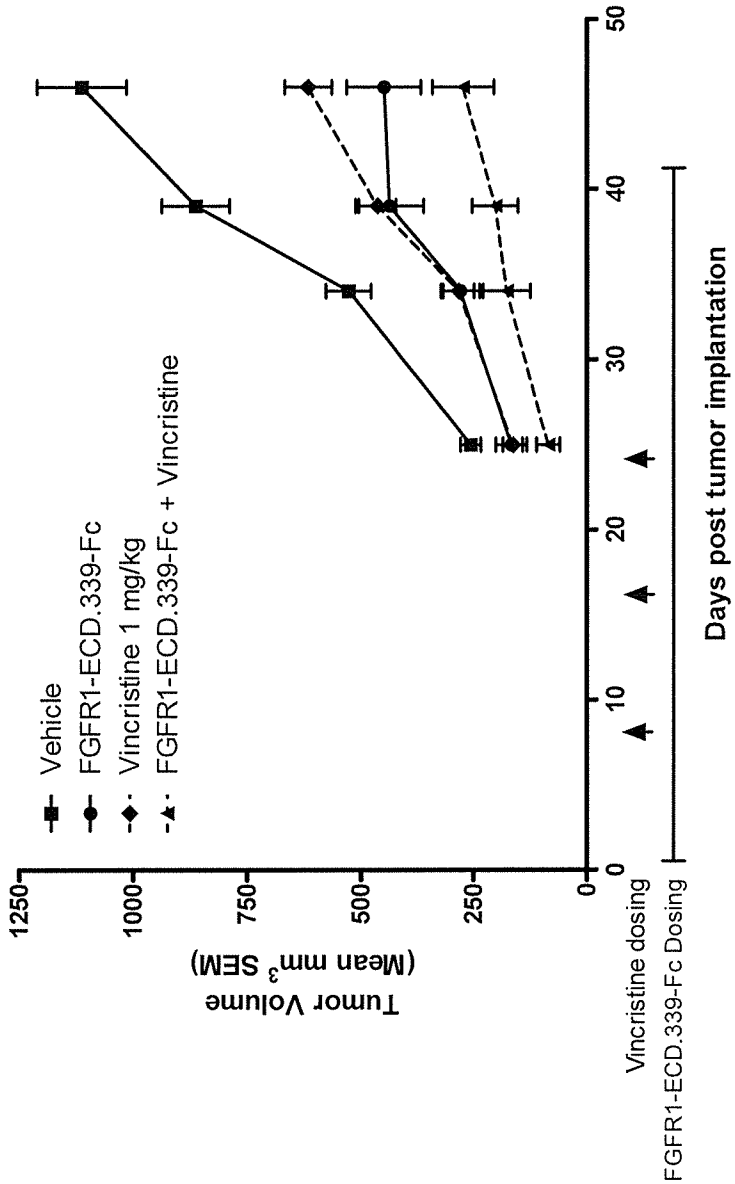

Tumor Volume
(Mean mm3 SEM)
1250
1000
750
500
250
0
0
10
20
30
40
50
Days post tumor implantation
Vincristine dosing
FGFR1-ECD.339-Fc Dosing
Vehicle
FGFR1-ECD.339-Fc
Vincristine 1 mg/kg
FGFR1-ECD.339-Fc + Vincristine

FIGURE 9A

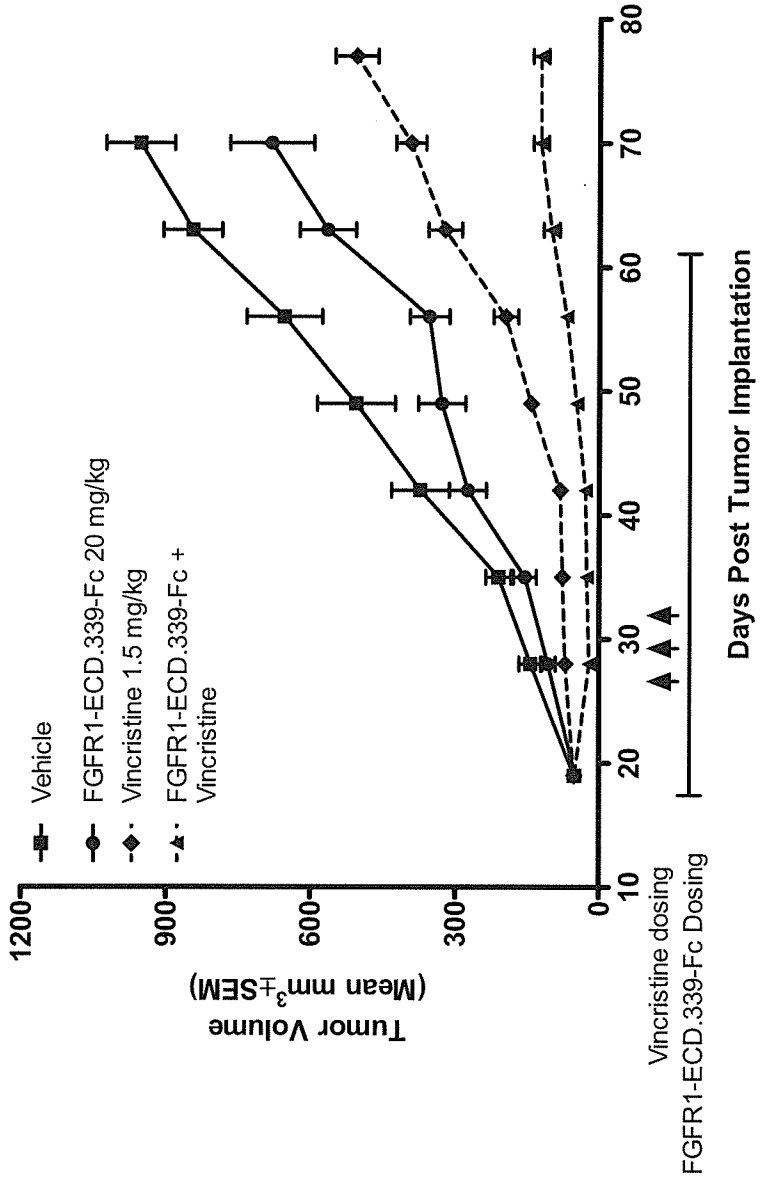

Vehicle
FGFR1-ECD.339-Fc 20 mg/kg
Vincristine 1.5 mg/kg
FGFR1-ECD.339-Fc + Vincristine
Tumor Volume (Mean mm³±SEM)
1200
900
600
300
0
10
20
30
40
50
60
70
80
Days Post Tumor Implantation
Vincristine dosing
FGFR1-ECD.339-Fc Dosing

FIGURE 9B

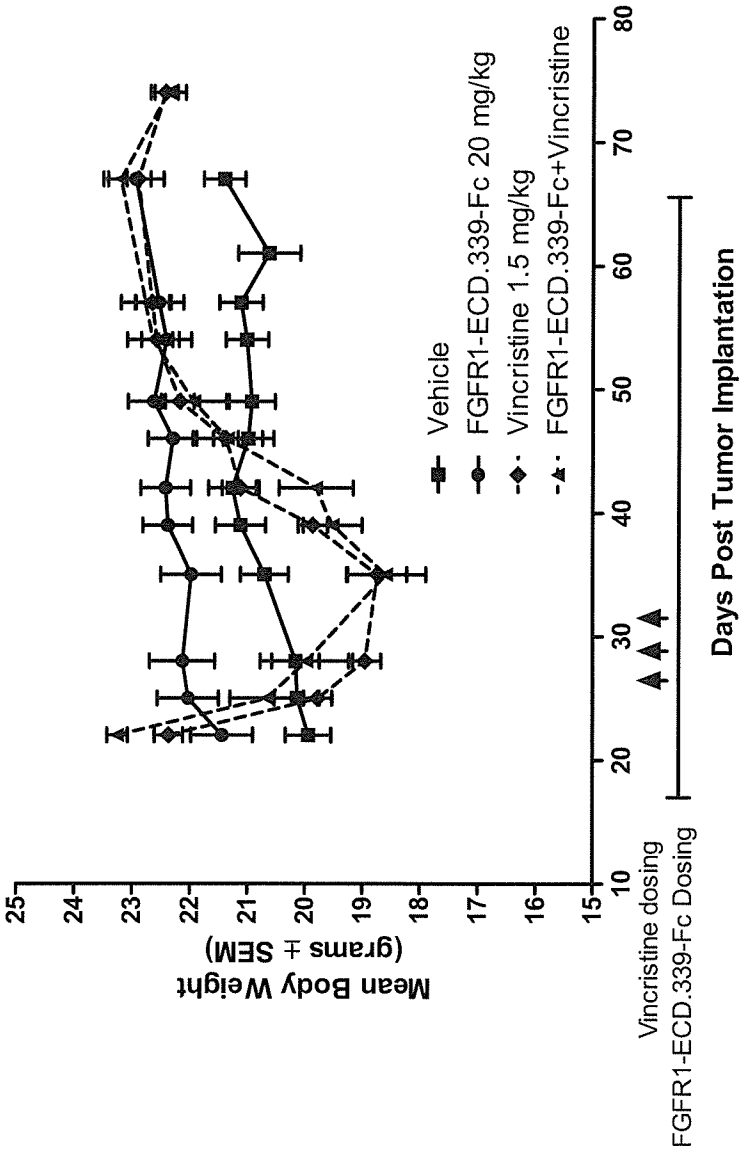

Mean Body Weight
(grams ± SEM)
25
24
23
22
21
20
19
18
17
16
15
10
20
30
40
50
60
70
80
Days Post Tumor Implantation
Vincristine dosing
FGFR1-ECD.339-Fc Dosing
Vehicle
FGFR1-ECD.339-Fc 20 mg/kg
Vincristine 1.5 mg/kg
FGFR1-ECD.339-Fc+Vincristine

FIGURE 9C

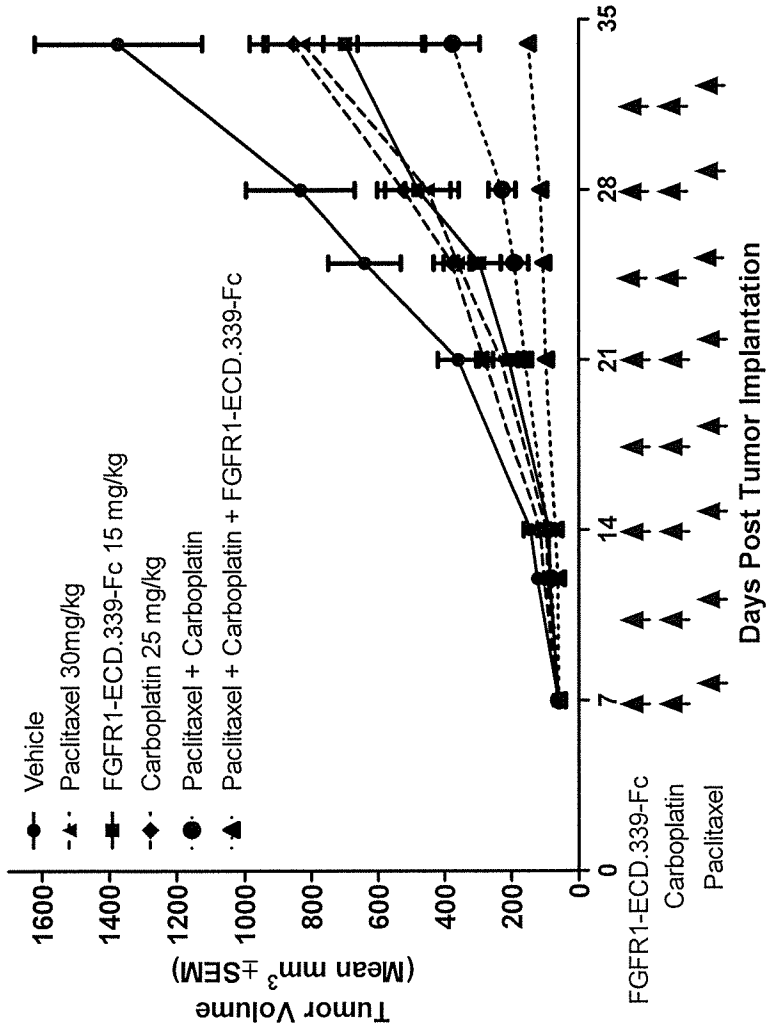

Vehicle
Paclitaxel 30mg/kg
FGFR1-ECD.339-Fc 15 mg/kg
Carboplatin 25 mg/kg
Paclitaxel + Carboplatin
Paclitaxel + Carboplatin + FGFR1-ECD.339-Fc
Tumor Volume
(Mean mm³ ±SEM)
1600
1400
1200
1000
800
600
400
200
0
7
14
21
28
35
Days Post Tumor Implantation
FGFR1-ECD.339-Fc
Carboplatin
Paclitaxel

FIGURE 10

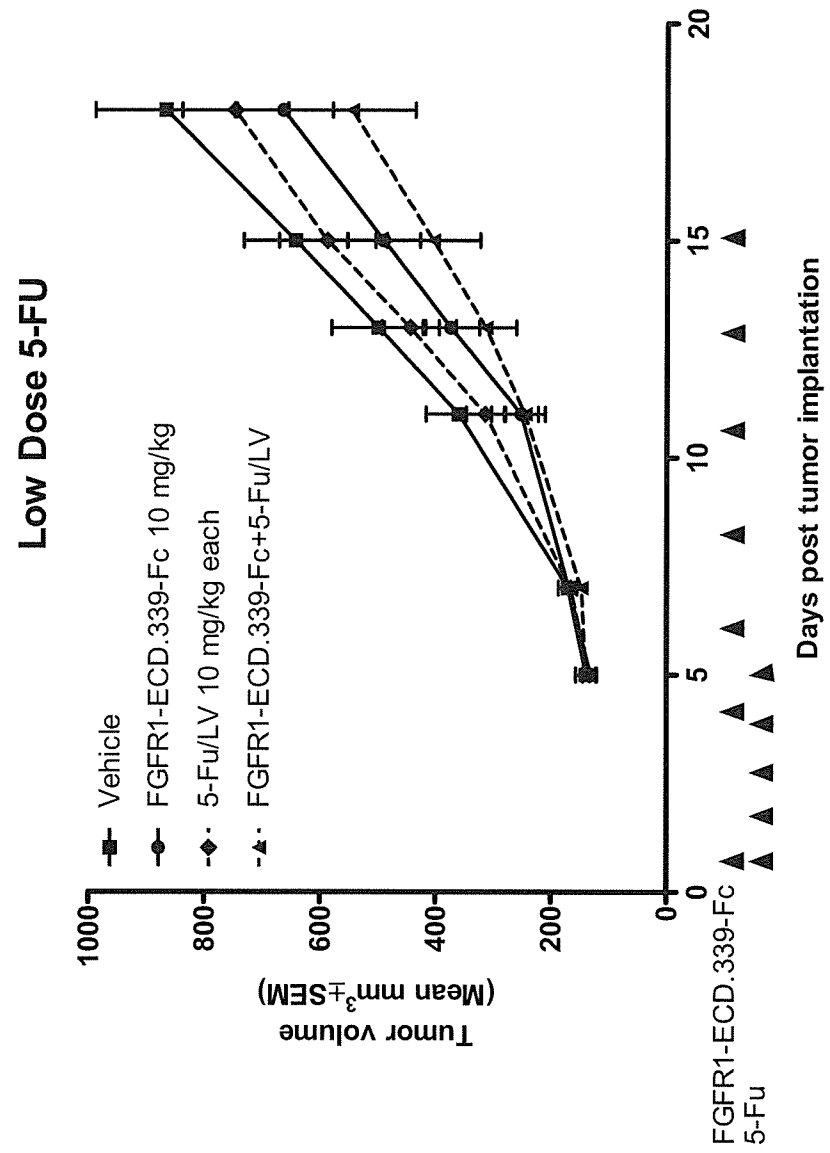

Low Dose 5-FU
Vehicle
FGFR1-ECD.339-Fc 10 mg/kg
5-Fu/LV 10 mg/kg each
FGFR1-ECD.339-Fc+5-Fu/LV
Tumor volume
(Mean mm3±SEM)
1000
800
600
400
200
0
0
5
10
15
20
Days post tumor implantation
FGFR1-ECD.339-Fc
5-Fu

FIGURE 11A

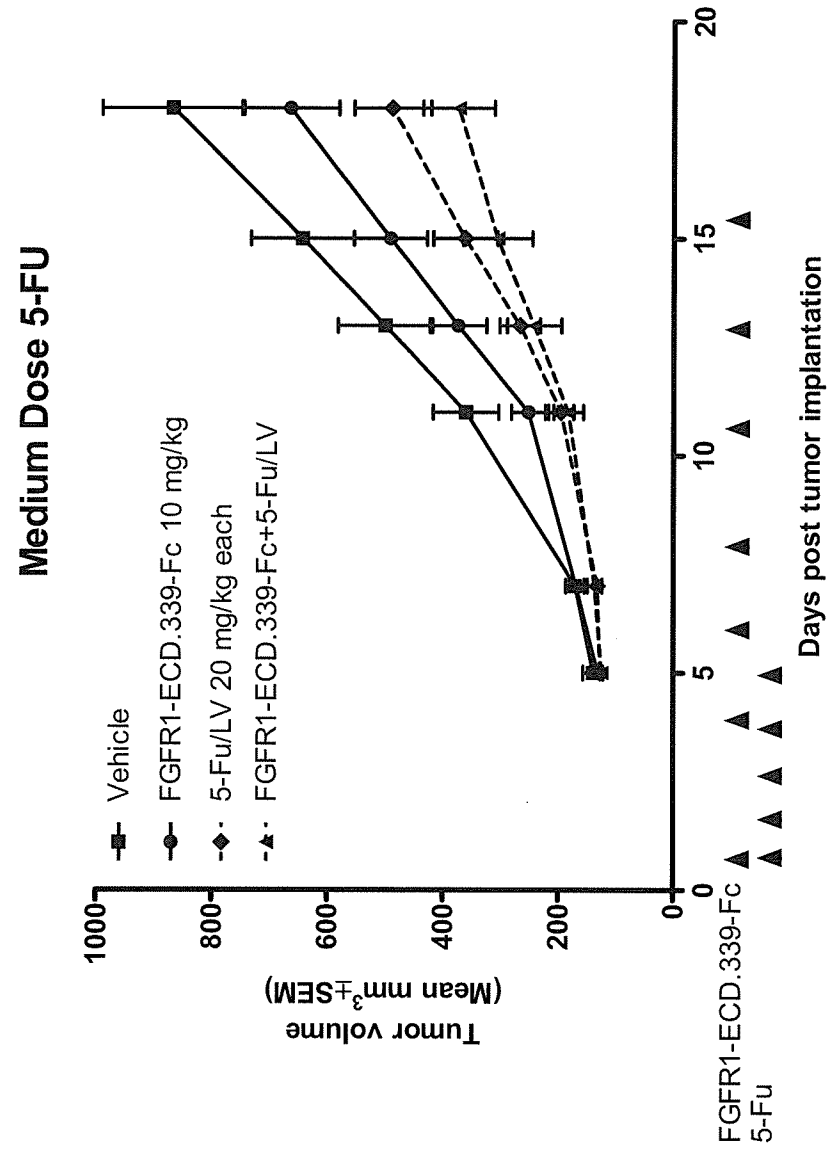

Medium Dose 5-FU
Vehicle
FGFR1-ECD.339-Fc 10 mg/kg
5-Fu/LV 20 mg/kg each
FGFR1-ECD.339-Fc+5-Fu/LV
Tumor volume
(Mean mm3±SEM)
1000
800
600
400
200
0
0
5
10
15
20
Days post tumor implantation
FGFR1-ECD.339-Fc
5-Fu

FIGURE 11B

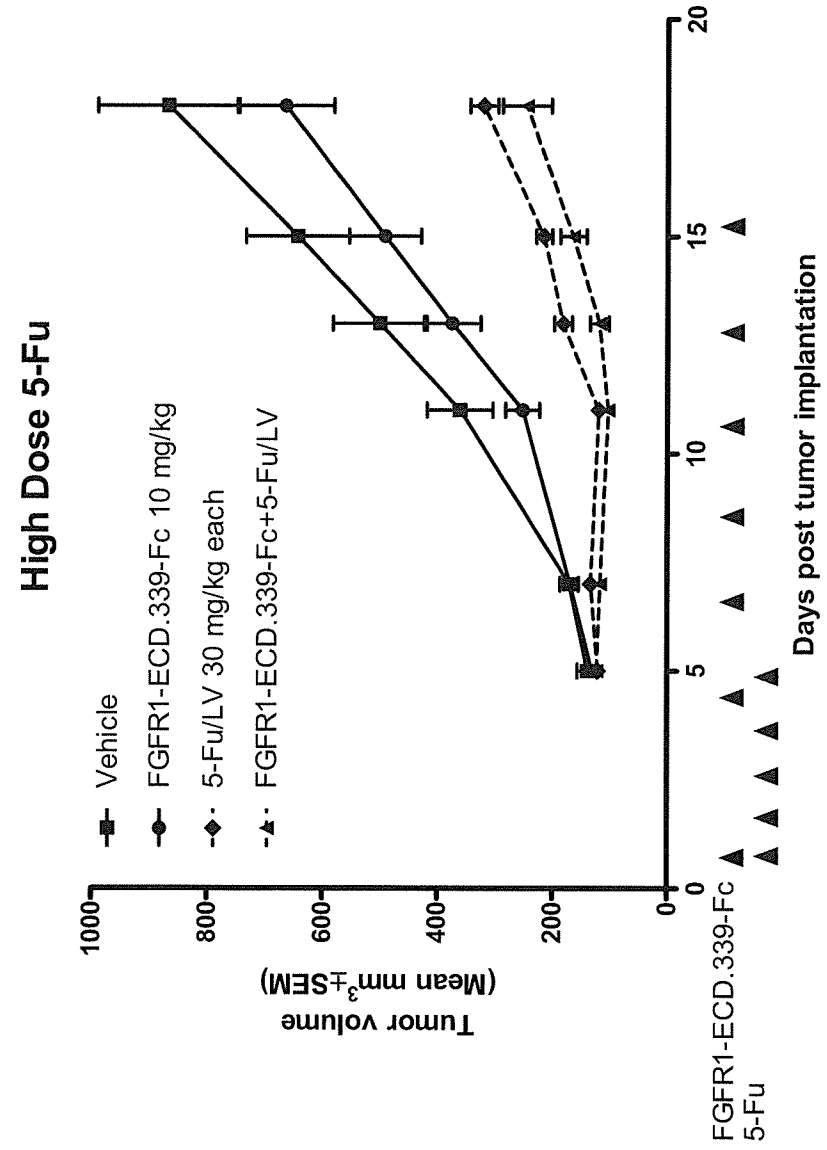

High Dose 5-Fu
Vehicle
FGFR1-ECD.339-Fc 10 mg/kg
5-Fu/LV 30 mg/kg each
FGFR1-ECD.339-Fc+5-Fu/LV
Tumor volume
(Mean mm3±SEM)
1000
800
600
400
200
0
0
5
10
15
20
Days post tumor implantation
FGFR1-ECD.339-Fc
5-Fu

FIGURE 11C

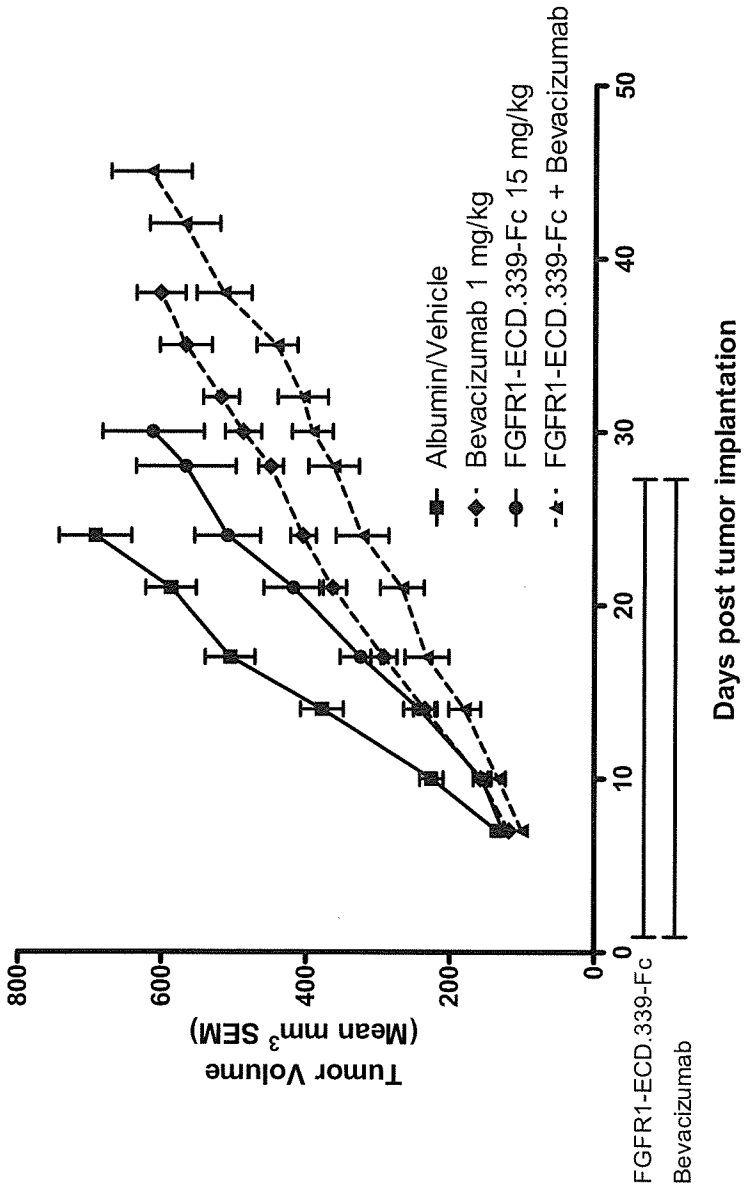

Tumor Volume
(Mean mm3 SEM)
800
600
400
200
0
0
10
20
30
40
50
Days post tumor implantation
Albumin/Vehicle
Bevacizumab 1 mg/kg
FGFR1-ECD.339-Fc 15 mg/kg
FGFR1-ECD.339-Fc + Bevacizumab
FGFR1-ECD.339-Fc
Bevacizumab

FIGURE 11D

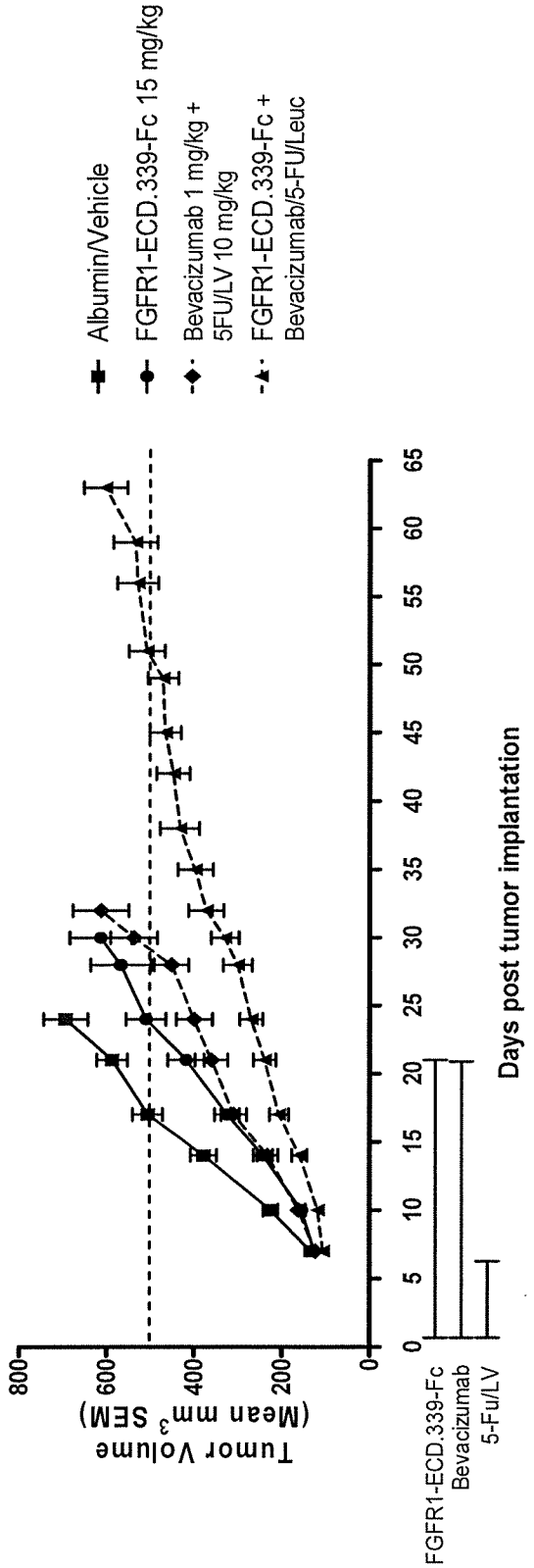
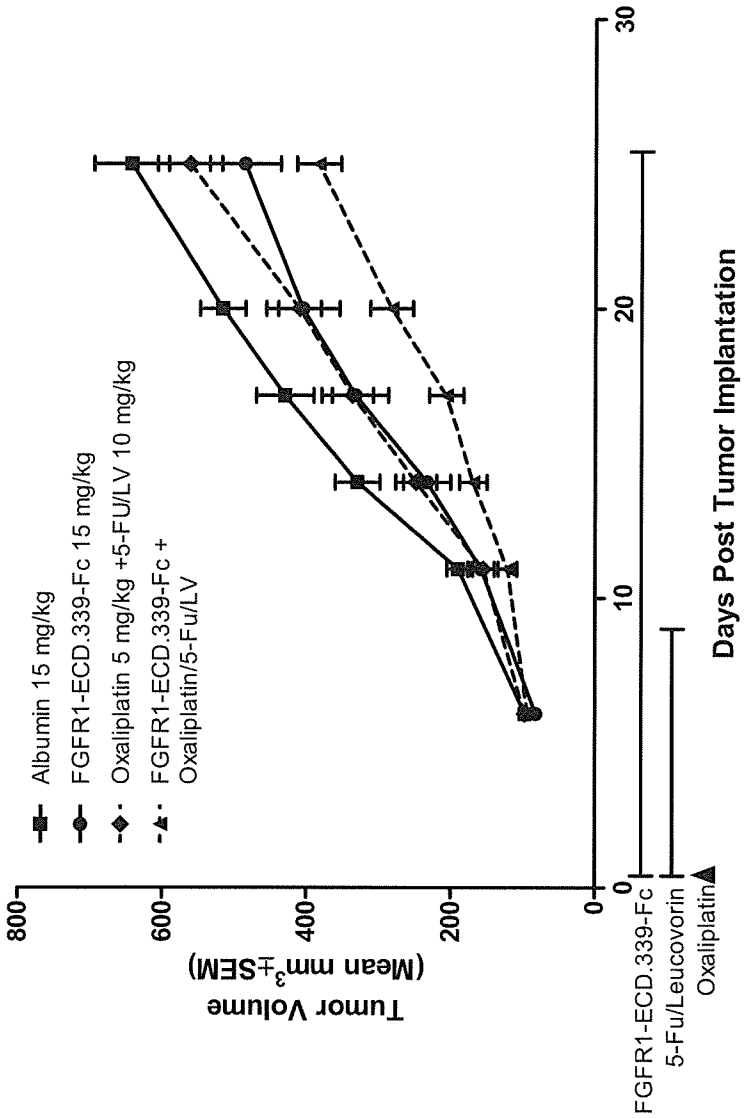

Albumin/Vehicle
FGFR1-ECD.339-Fc 15 mg/kg
Bevacizumab 1 mg/kg + 5FU/LV 10 mg/kg
FGFR1-ECD.339-Fc + Bevacizumab/5-FU/Leuc
Tumor Volume (Mean mm3 SEM)
800
600
400
200
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Days post tumor implantation
FGFR1-ECD.339-Fc
Bevacizumab
5-Fu/LV

FIGURE 11E


Albumin 15 mg/kg
FGFR1-ECD.339-Fc 15 mg/kg
Oxaliplatin 5 mg/kg +5-FU/LV 10 mg/kg
FGFR1-ECD.339-Fc + Oxaliplatin/5-Fu/LV
Tumor Volume (Mean mm3±SEM)
800
600
400
200
0
0
10
20
30
Days Post Tumor Implantation
FGFR1-ECD.339-Fc
5-Fu/Leucovorin
Oxaliplatin

FIGRUE 12A

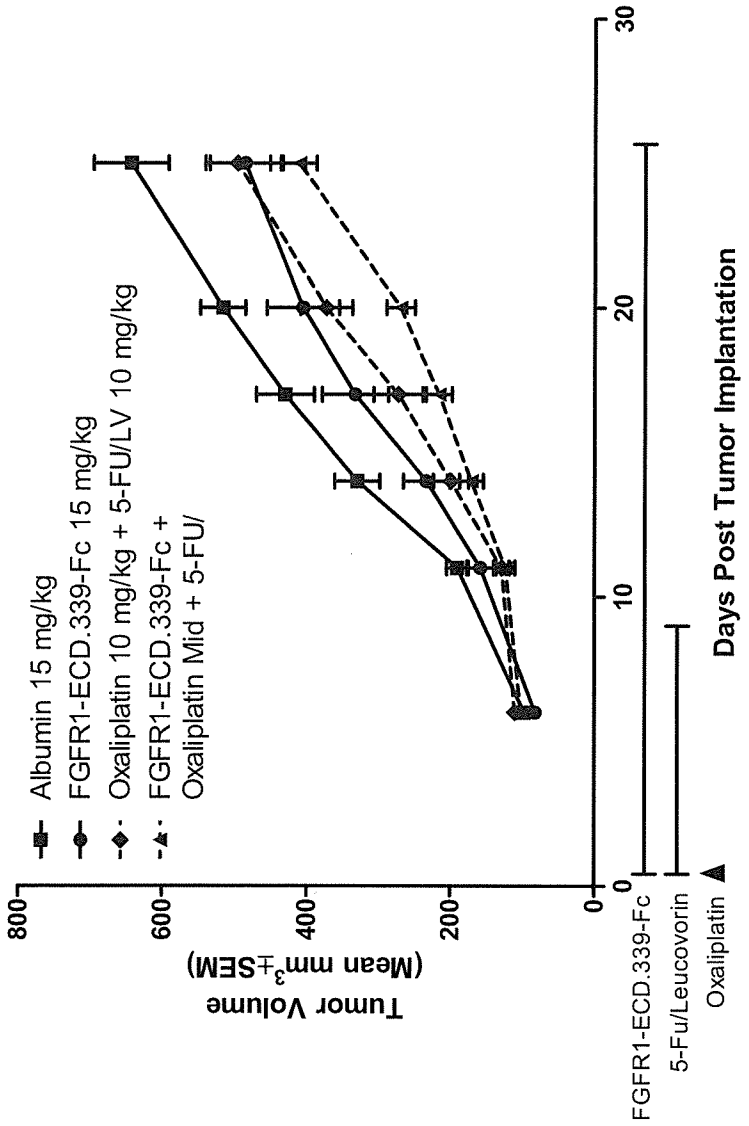

Albumin 15 mg/kg
FGFR1-ECD.339-Fc 15 mg/kg
Oxaliplatin 10 mg/kg + 5-FU/LV 10 mg/kg
FGFR1-ECD.339-Fc +
Oxaliplatin Mid + 5-FU/
Tumor Volume
(Mean mm3±SEM)
800
600
400
200
0
0
10
20
30
Days Post Tumor Implantation
FGFR1-ECD.339-Fc
5-Fu/Leucovorin
Oxaliplatin

FIGURE 12B

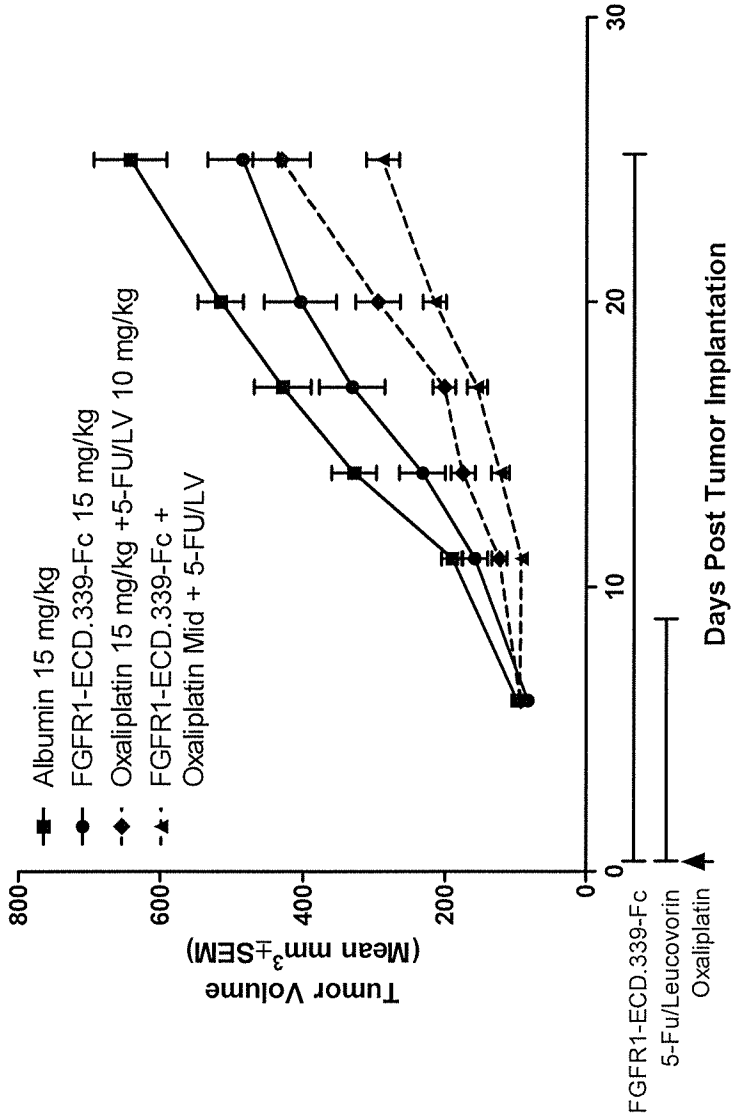

Albumin 15 mg/kg
FGFR1-ECD.339-Fc 15 mg/kg
Oxaliplatin 15 mg/kg +5-FU/LV 10 mg/kg
FGFR1-ECD.339-Fc +
Oxaliplatin Mid + 5-FU/LV
Tumor Volume
(Mean mm3±SEM)
800
600
400
200
0
0
10
20
30
Days Post Tumor Implantation
FGFR1-ECD.339-Fc
5-Fu/Leucovorin
Oxaliplatin

FIGURE 12C

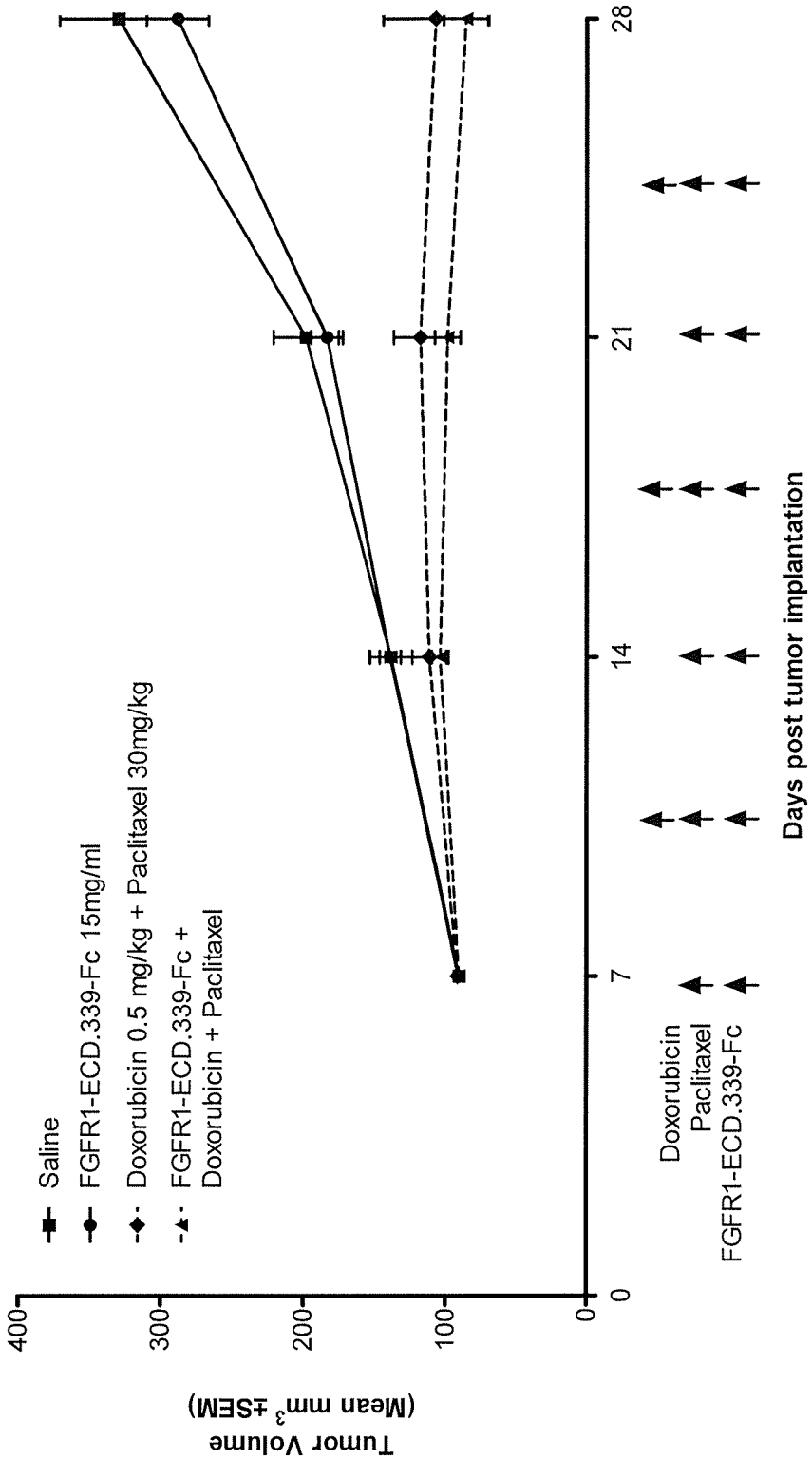

Tumor Volume
(Mean mm³ ±SEM)
400
300
200
100
0
0
7
14
21
28
Days post tumor implantation
Saline
FGFR1-ECD.339-Fc 15mg/ml
Doxorubicin 0.5 mg/kg + Paclitaxel 30mg/kg
FGFR1-ECD.339-Fc +
Doxorubicin + Paclitaxel
Doxorubicin
Paclitaxel
FGFR1-ECD.339-Fc

FIGURE 13

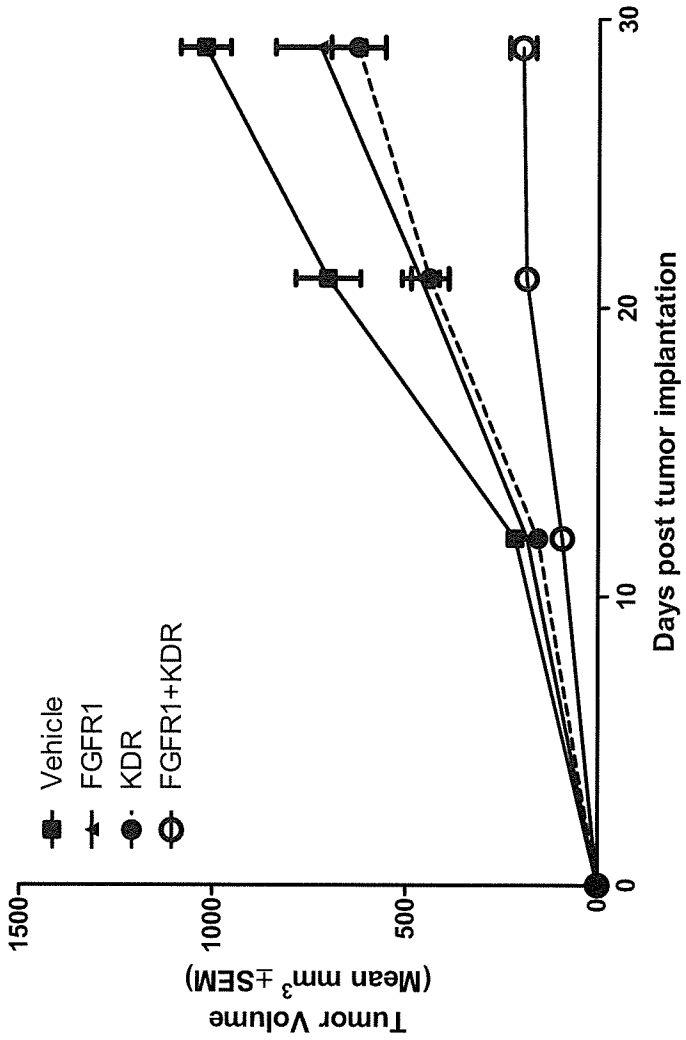

Tumor Volume
(Mean mm3 ±SEM)
1500
1000
500
0
0
10
20
30
Days post tumor implantation
Vehicle
FGFR1
KDR
FGFR1+KDR

FIGURE 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/060666

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K31/337 A61K31/475 A61K31/519 A61K38/18 A61K45/06
A61P35/00 A61K39/395 A61K31/4745 A61K31/513 A61K31/555
A61K31/704 A61K31/7048 A61K33/24 A61K38/17 C07K19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K C07K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, EMBASE, WPI Data, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/065543 A2 (CENTELION [FR]; NESBIT MARK [FR]; CAMERON BEATRICE [FR]; BLANCHE FRANC) 5 June 2008 (2008-06-05)	1-3,19, 22
Y	page 4, lines 9-32 page 21, line 35 - page 22, line 35	10,18, 20,21,23

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 January 2012	12/04/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bliem, Barbara

3

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	LONG LI ET AL: "Antitumor efficacy of FP-1039, a soluble FGF receptor 1:Fc conjugate, as a single agent or in combination with anticancer drugs.", PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR CANCER RESEARCH ANNUAL MEETING, vol. 50, April 2009 (2009-04), page 674, XP008147481, & 100TH ANNUAL MEETING OF THE AMERICAN-ASSOCIATION-FOR-CANCER-RESEARCH; DENVER, CA, USA; APRIL 18 -22, 2009 ISSN: 0197-016X abstract -----	1-3,10, 18-23
Y	LONG L ET AL: "Preclinical Antitumor Efficacy of FP-1039, A Soluble FGF Receptor 1:Fc Conjugate, as a Single Agent or in Combination with Anticancer Drugs", AACR 100TH ANNUAL MEETING 2009,, no. 2789, 17 April 2009 (2009-04-17), page 1, XP007920079, poster -----	1-3,10, 18-23
Y	Cancer chemotherapy: In: Rang HP et al: "Rang and Dale's Pharmacology", 2008, Churchill Linvingston Elsevier, XP002667232, pages 718-735, the whole document -----	1-3,10, 18-23
A	ZHENG ET AL: "Enhanced efficacy in anti-tumour activity by combined therapy of recombinant FGFR-1 related angiogenesis and low-dose cytotoxic agent", EUROPEAN JOURNAL OF CANCER, PERGAMON PRESS, OXFORD, GB, vol. 43, no. 14, 14 September 2007 (2007-09-14), pages 2134-2139, XP022243363, ISSN: 0959-8049, DOI: 10.1016/J.EJCA.2007.07.014 abstract -----	1-3,10, 18-23

3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/060666

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

3(completely); 1, 2, 10, 18-23(partially)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 3(completely); 1, 2, 10, 18-23(partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is docetaxel for the treatment of cancer.

   ---

2. claims: 4(completely); 1, 2, 10-12, 14, 18-23(partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is paclitaxel for the treatment of cancer.

   ---

3. claims: 7(completely); 1, 2, 10, 18-23(partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is vincristine for the treatment of cancer.

   ---

4. claims: 1, 2, 10, 12, 18-23(all partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is carboplatin for the treatment of cancer.

   ---

5. claims: 5(completely); 1, 2, 10, 17-23(partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is cisplatin for the treatment of cancer.

   ---

6. claims: 1, 2, 10, 11, 13, 18-23(all partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is oxaliplatin for the treatment of cancer.

   ---

7. claims: 1, 2, 10, 14, 18-23(all partially)

   Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic

agent wherein said additional therapeutic agent is doxorubicin for the treatment of cancer.

---

8. claims: 8(completely); 1, 2, 10, 11, 13, 15, 16, 18-23(partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is 5-fluorouracil for the treatment of cancer.

---

9. claims: 1, 2, 10, 15, 18-23(all partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is leucovorin for the treatment of cancer.

---

10. claims: 6(completely); 1, 2, 10, 18-23(partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is pemetrexed for the treatment of cancer.

---

11. claims: 1, 2, 10, 17-23(all partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is etoposide for the treatment of cancer.

---

12. claims: 9(completely); 1, 2, 10, 18-23(partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is topotecan for the treatment of cancer.

---

13. claims: 1, 2, 10, 11, 16, 18-23(all partially)

Composition comprising a fibroblast growth factor receptor 1 extracellular domain and at least one additional therapeutic agent wherein said additional therapeutic agent is a VEGF antagonist, a VEGF trap, or an anti-VEGF antibody, including bevacizumab, for the treatment of cancer.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/060666

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008065543 A2	05-06-2008	AR 063975 A1	04-03-2009
		AT 509106 T	15-05-2011
		AU 2007326985 A1	05-06-2008
		CA 2668932 A1	05-06-2008
		CL 34112007 A1	04-07-2008
		CO 6190564 A2	19-08-2010
		CR 10777 A	23-07-2009
		DK 2092069 T3	29-08-2011
		EA 200970515 A1	30-12-2009
		EC SP099361 A	30-06-2009
		EP 2092069 A2	26-08-2009
		HR 20110503 T1	31-08-2011
		JP 2010510801 A	08-04-2010
		KR 20090102769 A	30-09-2009
		MA 31143 B1	01-02-2010
		PE 12502008 A1	07-10-2008
		PT 2092069 E	29-07-2011
		RS 51911 B	29-02-2012
		SI 2092069 T1	30-09-2011
		SV 2009003272 A	05-02-2010
		TW 200839012 A	01-10-2008
		US 2010061979 A1	11-03-2010
		WO 2008065543 A2	05-06-2008