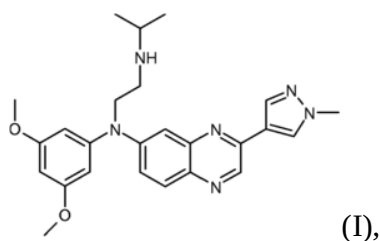


What is claimed is:

1. A method of identifying a cancer patient that is responsive to treatment with a fibroblast growth factor receptor (FGFR) inhibitor, wherein the patient has been diagnosed with adrenal cancer, bladder cancer and/or glioblastoma, wherein the FGFR inhibitor comprises a compound having the structure of Formula (I),



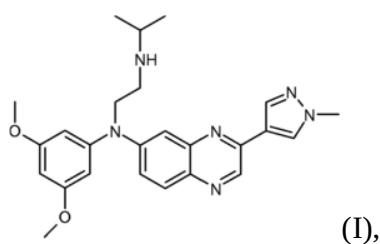
a N-oxide thereof, a pharmaceutically acceptable salt thereof, or a solvate thereof, and wherein the method comprises:

evaluating a biological sample from the patient for one or more FGFR mutants from a FGFR mutant gene panel, wherein the one or more FGFR mutants from the FGFR mutant gene panel comprise a FGFR fusion gene comprising FGFR3:TACC3 v1 (FGFR3 exon 18-TACC3 exon 11 fusion), FGFR3:TACC3 v3 (FGFR3 exon 18-TACC3 exon 10 fusion), FGFR3:TACC3 Intron (FGFR3 exon 18-TACC3 exon 4 fusion), or a combination thereof, and wherein said evaluating comprises

amplifying cDNA with a pair of primers that amplify the one or more FGFR mutants; and

determining whether the one or more FGFR mutants are present in the sample, wherein the presence of FGFR3:TACC3 v1, FGFR3:TACC3 v3, FGFR3:TACC3 Intron, or a combination thereof indicates that the patient is responsive to treatment with the FGFR inhibitor.

2. A method of identifying a cancer patient that is responsive to treatment with a fibroblast growth factor receptor (FGFR) inhibitor, wherein the patient has been diagnosed with adrenal cancer, bladder cancer and/or glioblastoma, wherein the FGFR inhibitor comprises a compound having the structure of Formula (I),



a N-oxide thereof, a pharmaceutically acceptable salt thereof, or a solvate thereof, and wherein the method comprises:

evaluating a biological sample from the patient for the presence of one or more FGFR mutants from a FGFR mutant gene panel, wherein the one or more FGFR mutants from the FGFR mutant gene panel comprise a FGFR fusion gene comprising FGFR3:TACC3 v1 (FGFR3 exon 18-TACC3 exon 11 fusion), FGFR3:TACC3 v3 (FGFR3 exon 18-TACC3 exon 10 fusion), FGFR3:TACC3 Intron (FGFR3 exon 18-TACC3 exon 4 fusion), or a combination thereof, and wherein the presence of FGFR3:TACC3 v1, FGFR3:TACC3 v3, FGFR3:TACC3 Intron, or a combination thereof indicates that the patient is responsive to treatment with the FGFR inhibitor.

3. The method of claim 1 or 2, wherein the FGFR inhibitor comprises the compound having the structure of Formula (I).
4. The method of any one of claims 1-3, wherein the cancer is bladder cancer.
5. The method of any one of claims 1-4, wherein the one or more FGFR mutant s from the FGFR mutant gene panel further comprise FGFR3:BAIAP2L1 (FGFR3 exon 18-TACC3 exon 2 fusion), FGFR2:BICC1 (FGFR3 exon 19-TACC3 exon 3 fusion), FGFR2:AFF3 (FGFR3 exon 19-TACC3 exon 8 fusion), FGFR2:CASP7 (FGFR3 exon 19-TACC3 exon 4 fusion), FGFR2:CCDC6 (FGFR3 exon 19-TACC3 exon 2 fusion), or FGFR2:OFD1 (FGFR3 exon 19-TACC3 exon 3 fusion), or any combination thereof.
6. The method of any one of claims 1-4, wherein the one or more FGFR mutants from the FGFR mutant gene panel further comprise a FGFR single nucleotide polymorphism comprising R248C, S249C, G370C, or Y373C, or any combination thereof.
7. The method of any one of claims 1-3, wherein the cancer is bladder cancer and the one or more FGFR mutants from the FGFR mutant gene panel further comprise

FGFR3:BAIAP2L1 (FGFR3 exon 18-TACC3 exon 2 fusion), FGFR2:BICC1 (FGFR3 exon 19-TACC3 exon 3 fusion), FGFR2:AFF3 (FGFR3 exon 19-TACC3 exon 8 fusion), FGFR2:CASP7 (FGFR3 exon 19-TACC3 exon 4 fusion), FGFR3 R248C, FGFR3 S249C, FGFR3 G370C, or FGFR3 Y373C, or any combination thereof.

8. The method of any one of claims 1-3, wherein the cancer is metastatic bladder cancer and the one or more FGFR mutants from the FGFR mutant gene panel further comprise FGFR3:BAIAP2L1 (FGFR3 exon 18-TACC3 exon 2 fusion), FGFR2:BICC1 (FGFR3 exon 19-TACC3 exon 3 fusion), FGFR2:AFF3 (FGFR3 exon 19-TACC3 exon 8 fusion), FGFR2:CASP7 (FGFR3 exon 19-TACC3 exon 4 fusion), FGFR3 R248C, FGFR3 S249C, FGFR3 G370C, or FGFR3 Y373C, or any combination thereof.
9. The method of any one of claims 3-8, wherein the evaluating comprises amplifying a cDNA with a pair of primers that amplify the one or more FGFR mutants.
10. The method of claim 9, wherein the cDNA is a pre-amplified cDNA.
11. The method of any one of the previous claims, wherein the one or more FGFR mutants and pair of primers are:
 - FGFR3:TACC3 v1 (FGFR3 exon 18-TACC3 exon 11 fusion) and primers having the sequences of SEQ ID NO:5 and SEQ ID NO:6;
 - FGFR3:TACC3 v3 (FGFR3 exon 18-TACC3 exon 10 fusion) and primers having the sequences of SEQ ID NO:7 and SEQ ID NO:8;
 - FGFR3:TACC3 Intron (FGFR3 exon 18-TACC3 exon 4 fusion) and primers having the sequences of SEQ ID NO:9 and SEQ ID NO: 10, or a combination thereof, and optionally:
 - FGFR3 :BAIAP2L1 (FGFR3 exon 18-TACC3 exon 2 fusion) and primers having the sequences of SEQ ID NO: 11 and SEQ ID NO:12;
 - FGFR2:BICC1 (FGFR3 exon 19-TACC3 exon 3 fusion) and primers having the sequences of SEQ ID NO: 13 and SEQ ID NO:14;
 - FGFR2:AFF3 (FGFR3 exon 19-TACC3 exon 8 fusion) and primers having the sequences of SEQ ID NO: 15 and SEQ ID NO:16;

FGFR2:CASP7 (FGFR3 exon 19-TACC3 exon 4 fusion) and primers having the sequences of SEQ ID NO: 17 and SEQ ID NO:18;

FGFR2:CCDC6 (FGFR3 exon 19-TACC3 exon 2 fusion) and primers having the sequences of SEQ ID NO: 19 and SEQ ID NO:20;

FGFR2:OFD1 (FGFR3 exon 19-TACC3 exon 3 fusion) and primers having the sequences of SEQ ID NO:21 and SEQ ID NO:22;

R248C and primers having the sequences of SEQ ID NO:23 and SEQ ID NO:24 or SEQ ID NO:31 and SEQ ID NO:32;

S249C and primers having the sequences of SEQ ID NO:25 and SEQ ID NO:26 or SEQ ID NO:33 and SEQ ID NO:34;

G370C and primers having the sequences of SEQ ID NO:27 and SEQ ID NO:28 or SEQ ID NO:35 and SEQ ID NO:36;

Y373C and primers having the sequences of SEQ ID NO:29 and SEQ ID NO:30 or SEQ ID NO:37 and SEQ ID NO:38;

or any combination thereof.

12. The method of any one of the previous claims, wherein the evaluating comprises: isolating a RNA from the biological sample and synthesizing cDNA from the isolated RNA.
13. The method of claim 12, further comprising pre-amplifying the cDNA prior to the amplifying step.
14. The method of any one of claims 1 or 3-13, wherein the cDNA is preamplified.
15. The method of any one of claims 1 or 3-13, wherein the amplifying step comprises performing a real-time PCR.
16. The method of claim 15, wherein the real-time PCR is performed with one or more probes comprising SEQ ID NO:43, SEQ ID NO:44, SEQ ID NO:46, and optionally in combination with one or more probes comprising SEQ ID NO:45, SEQ ID NO:47, SEQ ID NO:48, SEQ ID NO:49, SEQ ID NO:50, SEQ ID NO:51, SEQ ID NO:52, SEQ ID NO:53, SEQ ID NO:54, and/or SEQ ID NO:55.

17. The method of claim 15 or 16, wherein the real-time PCR is performed with one or more 3' blocking oligonucleotides comprising SEQ ID NO:39, SEQ ID NO:41, and SEQ ID NO:42.
18. The method of any one of claims 1 or 3-13, wherein said determining step comprises sequencing the amplified cDNA.
19. ~~A kit for performing the method of claim 1 or 2, comprising:~~
~~one or more pairs of primers having the sequences of SEQ ID NO:5 and SEQ ID NO:6, SEQ ID NO:7 and SEQ ID NO:8, SEQ ID NO:9 and SEQ ID NO: 10, or a combination thereof and optionally in combination with one or more pairs of primers having the sequences of:~~
~~SEQ ID NO: 11 and SEQ ID NO:12, SEQ ID NO:13 and SEQ ID NO:14, SEQ ID NO:15 and SEQ ID NO:16, SEQ ID NO: 17 and SEQ ID NO: 18, SEQ ID NO: 19 and SEQ ID NO:20, SEQ ID NO:21 and SEQ ID NO:22, SEQ ID NO:23 and SEQ ID NO:24, SEQ ID NO:25 and SEQ ID NO:26, SEQ ID NO:27 and SEQ ID NO:28, SEQ ID NO:29 and SEQ ID NO:30, SEQ ID NO:31 and SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34, SEQ ID NO:35 and SEQ ID NO:36, SEQ ID NO:37 and SEQ ID NO:38, or any combination thereof; and~~
~~instructions for performing an assay to detect the one or more FGFR mutants.~~
20. ~~The kit of claim 19, further comprising one or more probes, one or more 3' blocking oligonucleotides, or both.~~
21. ~~The kit of claim 20, wherein~~
~~a. the pair of primers have the sequences SEQ ID NO:5 and SEQ ID NO:6 and the or each probe has the sequence of SEQ ID NO:43;~~
~~b. the pair of primers have the sequences SEQ ID NO:7 and SEQ ID NO:8 and the or each probe has the sequence of SEQ ID NO:44; or~~
~~c. the pair of primers have the sequences SEQ ID NO:9 and SEQ ID NO: 10 and the or each probe has the sequence of SEQ ID NO:46, or a combination thereof, and optionally in combination with:~~
~~d. the pair of primers have the sequences SEQ ID NO: 11 and SEQ ID NO: 12 and the or each probe has the sequence of SEQ ID NO:47;~~

- e. ~~the pair of primers have the sequences SEQ ID NO: 13 and SEQ ID NO: 14 and the or each probe has the sequence of SEQ ID NO:45;~~
- f. ~~the pair of primers have the sequences SEQ ID NO: 15 and SEQ ID NO: 16 and the or each probe has the sequence of SEQ ID NO:48;~~
- g. ~~the pair of primers have the sequences SEQ ID NO: 17 and SEQ ID NO: 18 and the or each probe has the sequence of SEQ ID NO:49;~~
- h. ~~the pair of primers have the sequences SEQ ID NO: 19 and SEQ ID NO:20 and the or each probe has the sequence of SEQ ID NO:50;~~
- i. ~~the pair of primers have the sequences SEQ ID NO:21 and SEQ ID NO:22 and the or each probe has the sequence of SEQ ID NO:51;~~
- j. ~~the pair of primers have the sequences SEQ ID NO:23 and SEQ ID NO:24 and the or each probe has the sequence of SEQ ID NO:52;~~
- k. ~~the pair of primers have the sequences SEQ ID NO:25 and SEQ ID NO:26 and the or each probe has the sequence of SEQ ID NO:53;~~
- l. ~~the pair of primers have the sequences SEQ ID NO:27 and SEQ ID NO:28 and the or each probe has the sequence of SEQ ID NO:54;~~
- m. ~~the pair of primers have the sequences SEQ ID NO:29 and SEQ ID NO:30 and the or each probe has the sequence of SEQ ID NO:55;~~
- n. ~~the pair of primers have the sequences SEQ ID NO:31 and SEQ ID NO:32, the or each probe has the sequence of SEQ ID NO:52, and the 3' blocking oligonucleotide has the sequence of SEQ ID NO:39;~~
- o. ~~the pair of primers have the sequences SEQ ID NO:33 and SEQ ID NO:34, and the or each probe has the sequence of SEQ ID NO:53;~~
- p. ~~the pair of primers have the sequences SEQ ID NO:35 and SEQ ID NO:36, the or each probe has the sequence of SEQ ID NO:54, and the 3' blocking oligonucleotide has the sequence of SEQ ID NO: 41;~~
- q. ~~the pair of primers have the sequences SEQ ID NO:37 and SEQ ID NO:38, the or each probe has the sequence of SEQ ID NO:55, and the 3' blocking oligonucleotide has the sequence of SEQ ID NO:42; or~~
- r. ~~any combination thereof.~~