What is claimed is:

1. A method of selectively treating a subject having cancer, comprising selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis of the subject having a glutamine at position 859 of the catalytic p110α subunit of PI3K.

2. A method of selectively treating a subject having cancer, comprising:

c) assaying a biological sample from the subject for the presence or absence of a glutamine at position 859 of the catalytic p110α subunit of PI3K; and

d) selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the sample has a glutamine at position 859.

3. A method of selectively treating a subject having cancer, comprising either:

a) selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the sample has a glutamine at position 859 of the catalytic p110α subunit of PI3K; or

b) selectively administering a therapeutically effective amount of a different PI3K inhibitor compound to the subject on the basis that the sample does not have a glutamine at position 859 of the catalytic p110α subunit of PI3K.

4. A method of selectively treating a subject having cancer, comprising:

assaying a biological sample from the subject for the presence or absence of a glutamine at position 859 of the catalytic p110α subunit of PI3K; and

selectively administering either:

i) a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-

amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the sample has a glutamine at position 859; or

ii) a therapeutically effective amount of a different PI3K inhibitor compound to the subject on the basis that the sample does not have a glutamine at position 859.

5. A method of selectively treating a subject having cancer, comprising:

d) assaying a biological sample from the subject for the presence or absence of glutamine at position 859 of the catalytic p110α subunit of PI3K;

e) thereafter selecting the subject for treatment with *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, on the basis that the subject has a glutamine at position 859 of the catalytic p110α subunit of PI3K; and

f) thereafter administering *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof to the subject on the basis that the subject has a glutamine at position 859 of the catalytic p110α subunit of PI3K.

6. A method of selectively treating a subject having cancer, comprising:

a) determining for the presence or absence of glutamine at position 859 of the catalytic p110α subunit of PI3K in a biological sample from the subject, wherein the presence of glutamine at position 859 indicates that there is an increased likelihood that the subject will respond to treatment with the PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof; and

b) thereafter selecting the subject for treatment with PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof on the basis that the sample from the subject has glutamine at position 859 of the catalytic p110α subunit of the catalytic p110α subunit of PI3K.

7. A method of selectively treating a subject having cancer, comprising selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-

amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis of the subject having a nucleic acid sequence that encodes a glutamine at position 859 of the catalytic p110α subunit of PI3K.

8. A method of selectively treating a subject having cancer, comprising:

a) assaying a biological sample from the subject for the presence or absence of nucleic acid sequence mutation in the catalytic p110α subunit of PI3K, wherein the mutation results in an amino acid substitution of glutamine at position 859 of the catalytic p110α subunit of PI3K; and

b) selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the nucleic acid sequence sample has no mutation and encodes a glutamine at position 859.

9. A method of selectively treating a subject having cancer, comprising either:

a) selectively administering a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the subject has a nucleic acid sequence that encodes a glutamine at position 859 of the catalytic p110α subunit of PI3K, or

b) selectively administering a therapeutically effective amount of a different PI3K inhibitor compound to the subject on the basis that the subject has a nucleic acid sequence that does not encode a glutamine at position 859 of the catalytic p110α subunit of PI3K.

10. A method of selectively treating a subject having cancer, comprising:

assaying a biological sample from the subject for the presence or absence of nucleic acid sequence mutation in the catalytic p110α subunit of PI3K, wherein the mutation results in an amino acid substitution of glutamine at position 859 of the catalytic p110α subunit of PI3K; and

selectively administering either:

i) a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-

amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the nucleic acid sequence encodes a glutamine at position 859 in the catalytic p110α subunit of PI3K; or

ii) a therapeutically effective amount of a different PI3K inhibitor compound to the subject on the basis that the nucleic acid sequence has a mutation in catalytic p110α subunit of PI3K at position 859 and does not encode glutamine.

11. A method of selectively treating a subject having cancer, comprising:

a) assaying a biological sample from the subject for the presence or absence of nucleic acid sequence mutation in the catalytic p110α subunit of PI3K, wherein the mutation results in an amino acid substitution of glutamine at position 859 of the catalytic p110α subunit of PI3K;

b) thereafter selecting the subject for treatment with *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, on the basis that the sample from the subject lacks the mutation and encodes glutamine at position 859 of the catalytic p110α subunit of PI3K; and

c) thereafter administering *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof to the subject lacking the mutation.

12. A method of selectively treating a subject having cancer, comprising:

a) assaying a biological sample from the subject for the presence or absence of nucleic acid sequence mutation in the catalytic p110α subunit of PI3K, wherein the mutation results in an amino acid substitution of glutamine at position 859 of the catalytic p110α subunit of PI3K, wherein the absence of a mutation in the nucleic acid sequence indicates that there is an increased likelihood that the subject will respond to treatment with the PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof; and

b) thereafter selecting the subject for treatment with PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof on the basis that the sample from the subject lacks a mutation in the nucleic acid sequence such that the nucleic acid sequence encodes a glutamine at position 859 of the catalytic p110α subunit of PI3K.

13. A method of selectively treating a subject having cancer, comprising:

assaying a nucleic acid sample obtained from the subject having cancer for the presence of a mutation in a nucleic acid molecule encoding the catalytic p110α subunit of the PI3K polypeptide that results in a substitution of glutamine at position 859 of the encoded catalytic p110α subunit;

thereafter either selectively administering:

a) a therapeutically effective amount of *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), or a pharmaceutically acceptable salt thereof, to the subject on the basis that the nucleic acid encodes a glutamine at position 859 of the catalytic p110α subunit of PI3K; or

b) a therapeutically effective amount of a different PI3K inhibitor compound to the subject on the basis that the nucleic acid does not encode a glutamine at position 859 of the catalytic p110α subunit of PI3K.

14. A method of genotyping an individual comprising detecting a genetic variant that results in an amino acid variant at position 859 of the encoded catalytic p110α subunit of PI3K, wherein a lack of variant at position 859 indicates that (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) should be administered to the individual.

15. A method for genotyping an individual comprising detecting for the absence or presence of CAA at position 2575-2577 in the catalytic p110α subunit of PI3K gene obtained from said individual, wherein the presence of CAA indicates the individual has an increased likelyhood of responding to (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide).

16. The method according to any one of the preceding claims, wherein the cancer is selected from the group consisting of glioblastoma, melanoma, ovarian cancer, breast cancer, non-small-cell lung cancer (NSCLC), endometrial cancer, prostate cancer, colon cancer, and myeloma.

17. The method according to any one of the preceding claims, wherein the sample is a tumor sample.

18. The method of claim 17, wherein the tumor sample is a fresh frozen sample or a parrafin embedded tissue sample.

19. The method of according to any one of claims 1-6 and 14, wherein the detecting can be performed by immunoassays, immunohistochemistry, ELISA, flow cytometry, Western blot, HPLC, and mass spectrometry.

20. The method according to any one of claims 7-13 and 15, wherein the presence or absence of a mutation in a nucleic acid molecule encoding the catalytic p110α subunit of the PI3K can be detected by a technique selected from the group consisting of Northern blot analysis, polymerase chain reaction (PCR), reverse transcription-polymerase chain reaction (RT-PCR), TaqMan-based assays, direct sequencing, dynamic allele-specific hybridization, high-density oligonucleotide SNP arrays, restriction fragment length polymorphism (RFLP) assays, primer extension assays, oligonucleotide ligase assays, analysis of single strand conformation polymorphism, temperature gradient gel electrophoresis (TGGE), denaturing high performance liquid chromatography, high-resolution melting analysis, DNA mismatch-binding protein assays, SNPLex®, capillary electrophoresis, Southernblot,

21. The method of claim 7-12 or 15, wherein said detecting step comprises sequencing the catalytic p110α subunit gene of PI3K or a portion thereof.

22. A method for producing a transmittable form of information for predicting the responsiveness of a patient having cancer to treatment with (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), comprising:

a) determining whether a subject has an increased likelihood that the patient will respond to treatment with (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-

trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), wherein the subject has an increased likelihood based on having a glutamine at position 859 of the catalytic p110α subunit gene of PI3K, and

b) recording the result of the determining step on a tangible or intangible media form for use in transmission.

23. A method for producing a transmittable form of information for predicting the responsiveness of a patient having cancer to treatment with (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), comprising:

a) determining whether a subject has an increased likelihood that the patient will respond to treatment with (S)-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide), wherein the subject has an increased likelihood based on the nucleic acid sequence encoding a glutamine at position 859 of the catalytic p110α subunit gene of PI3K; and

b) recording the result of the determining step on a tangible or intangible media form for use in transmission.

24. A kit for determining if a tumor is responsive for treatment with PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof comprising providing one or more probes or primers for detecting the presence of a mutation at the PI3K gene locus and instructions for use.

25. A kit for predicting whether a subject with cancer would benefit from treatment with PI3K alpha subunit inhibitor compound *(S)*-Pyrrolidine-1,2-dicarboxylic acid 2-amide 1-({4-methyl-5-[2-(2,2,2-trifluoro-1,1-dimethyl-ethyl)-pyridin-4-yl]-thiazol-2-yl}-amide) or a pharmaceutically acceptable salt thereof, the kit comprising:

c) a plurality of agents for determining for the presence of a mutation at position 859 of the catalytic p110α subunit of PI3K; and
d) instructions for use.

Claims

1. An invention not claimed in any divisional application.