

CLAIMS

1. A method of identifying risk of breast cancer in a human subject, the method comprising:

5 determining in a biological sample of the subject, whether a copy number amplification of a region specific to human chromosome 1q21 is present,

 wherein the presence of a copy number amplification of the region specific to human chromosome 1q21 represents an elevated risk of breast cancer in the subject,

10 wherein said risk of breast cancer is at least one of a risk of recurrence of breast cancer, a risk of metastasis of breast cancer, a risk of non-abatement of breast cancer and a risk of breast cancer-based mortality.

2. The method of claim 1, wherein the determining step comprises evaluating a
15 copy number ratio of at least one continuous genomic region located on human chromosome 1q21 in the subject to a reference continuous genomic region in the subject, wherein a copy number ratio exceeding a threshold value is indicative of a copy number amplification.

- 20 3. The method of claim 2, wherein the threshold value is obtained by evaluating a copy number ratio of the at least one continuous genomic region in a healthy subject to a reference continuous genomic region in the healthy subject.

4. The method of claim 2 or 3, wherein said evaluating a copy number ratio of the
25 at least one continuous genomic region comprises evaluating an average copy number ratio of at least two continuous genomic regions located on human chromosome 1q21 and wherein said evaluating an average copy number comprises:

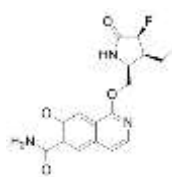
30 obtaining a copy number ratio of each of the at least two continuous genomic regions; and

 averaging the copy number ratios of the at least two continuous genomic regions to obtain an average copy number ratio.

5. The method according to any one of the claims 2 to 4, wherein the threshold value is obtained by evaluating a mean copy number ratio of the at least one continuous genomic region located on human chromosome 1q21 based on two or more healthy reference subjects and wherein said evaluating a mean copy number ratio based on two or more healthy reference subjects comprises:
- 5 evaluating a copy number ratio of the at least one continuous genomic region of a first healthy reference subject;
- evaluating a copy number ratio of the at least one continuous genomic region of a second healthy reference subject;
- 10 optionally evaluating a copy number ratio of the at least one continuous genomic region of one or more subsequent healthy reference subject to obtain one or more subsequent copy number ratios; and
- adding the copy number ratios of the two or more healthy reference subjects; and
- 15 computing a mean of the copy number ratios.
6. The method of any one of claims 2 to 5, wherein the at least one continuous genomic region is selected from the group consisting of: a human TUFT1 gene, a gene from the human S100 family and combinations thereof.
- 20 7. The method of any one of claims 2 to 6, wherein the step of evaluating a copy number ratio of at least one continuous genomic region located on human chromosome 1q21 comprises evaluating a copy number ratio of a human TUFT1 gene, a human S100A7 gene and a human S100A8 gene.
- 25 8. The method of any one of the preceding claims, wherein the biological sample is a fluid biological sample selected from the group consisting of: blood, plasma, serum and combinations thereof.
- 30 9. The method of claim 8, wherein the determining step comprises determining whether a copy number amplification is present in a cell free DNA.

10. Use of a therapeutic agent capable of suppressing IRAK1, IRAK4, S100A7, S100A8 or S100A9 in the manufacture of a medicament for treating breast cancer in a subject, wherein the subject is determined to have in his/her biological sample, a copy number amplification of a region specific to human chromosome 1q21.

11. The use of claim 10, wherein the therapeutic agent comprises at least one of pacritinib, thymoquinone, a compound having the chemical formula



or therapeutically effective analogs thereof.

12. The use of claim 10 or claim 11, wherein the subject was previously ineffectively treated for breast cancer by an earlier therapy, wherein the earlier therapy is different from a therapy using the therapeutic agent.

13. A kit for determining whether a copy number amplification of a region specific to human chromosome 1q21 is present in a biological sample, the kit comprising:

oligonucleotides for hybridizing to a human TUFT1 gene, a human S100A7 gene and a human S100A8 gene.

14. The kit of claim 13, wherein the oligonucleotides comprise primers for amplifying the human TUFT1 gene, the human S100A7 gene and the human S100A8 gene.

15. The kit of claim 13 or claim 14, wherein the oligonucleotides comprise at least one of the sequences:

TTTTAATCAGAGGGTGAGGGTGAT (SEQ ID NO. 1);

GCTTCTCAATGTTGGAGGATACA (SEQ ID No. 2);

GTCAAGATTGAGGAGGAAGAAGC (SEQ ID No. 3);

TTCATAGATGGCTATGCCTCGG (SEQ ID No. 4);

GGTGTTTCCCCACTAGCCA (SEQ ID No. 5);

CCCAGAGAGTGTATTGGCCC (SEQ ID No. 6);
TGCTATGTGGCCTTGGACAGATCACC (SEQ ID No. 7);
AGTTTAAAGATCTCAGAGAGAGCCGAGGCA (SEQ ID No. 8); and
CCTTAGCGTATCACATGTGGACATGGACA (SEQ ID No. 9).

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16. The kit of any one of claims 13-15, wherein the kit further comprises an oligonucleotide for hybridizing to a human RPP30 gene.

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17. The kit of claim 16, wherein the oligonucleotide comprises a primer for amplifying the human RPP30 gene.

18. The kit of claim 16 or claim 17, wherein the oligonucleotide for hybridizing to a human RPP30 gene comprises at least one of the sequences:

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GTTAGAGAGTCTCCAGGCCC (SEQ ID No. 10);
ACTGTAATCCAGCAAAAGCGG (SEQ ID No. 11); and
TGTCCACAGACTTTCTCAAAAGATAGGGCC (SEQ ID No. 12).

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19. The method or the kit of any one of claims 1-9 or 13-18, wherein the method or the kit has a sensitivity of no less than 85% and a specificity of no less than 85% in detecting a copy number amplification of a region specific to human chromosome 1q21.

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20. The method, the use or the kit of any one of the preceding claims, wherein the human chromosome 1q21 comprises a region spanning from human chromosome chr1q21.1 to chr1q21.3.