CLAIMS:

1. A method of diagnosing cancer in a subject, the method comprising

contacting a red blood cell-containing sample from the subject with a reagent capable of detecting a tumor-associated DNA or RNA molecule in the sample; and

diagnosing the subject with a cancer when the tumor-associated DNA or RNA molecule is detected in the sample.

2. A method of diagnosing cancer in a subject, the method comprising

contacting a red blood cell-containing sample substantially free of other blood components other than RBCs from the subject with a reagent capable of detecting a tumor-associated molecule in the sample; and

diagnosing the subject with a cancer when the tumor-associated molecule is detected in the sample.

3. The method according to claim 1, wherein the reagent is specific to a tumor-associated genetic mutation.

4. The method according to claim 1, wherein the cancer is a cancer of the lung, cervix, breast, prostate, thyroid, colon, or pancreas.

5. The method according to claim 1, wherein the reagent comprises multiple reagents, each capable of detecting a different specific tumor-associated molecule.

6. The method according to claim 1, wherein the reagent comprises primers capable of binding tumor-associated DNA or RNA.

7. The method according to claim 1, wherein the specific tumor-associated genetic mutation found in the sample is identified.

8. The method according to claim 1, wherein the tumor-associated genetic mutation is found in the EGFR, ALK, KRAS, ROS1, BRAF, NTRK, MET, RET, ERBB2, PIK3CA, BRCA1, BRCA2, FGFR2, FGFR3, EZH2, or PDGFRA gene.

9. The method according to claim 8, wherein the tumor-associated genetic mutation is found in the KRAS gene.

10. The method according to claim 1 for use in administration of a treatment for cancer to the subject, when the subject is diagnosed with cancer.

11. The method according to claim 10, wherein the treatment is specific to the identified tumor-associated genetic mutation.

12. The method according to claim 1, wherein the diagnostic method is performed at the point of care.

13. The method according to claim 1, further comprising filtering the blood sample to remove non-RBC blood cells.

14. The method according to claim 1, wherein the sample volume is 10 μL or less.

15. The method according to claim 1, wherein the sample contains at least 1 million RBC.

16. Use of a reagent capable of detecting a tumor-associated DNA or RNA molecule in a biological sample containing red-blood cells for diagnosing the subject with a cancer when the tumor-associated DNA or RNA molecule is detected in the sample.