CLAIMS

What is Claimed:

1. A method of processing a biological sample for a biological assay, comprising (a) contacting the biological sample with a contact medium comprising a particulate substance blasted with pressurized air under conditions sufficient to effectuate blasting of a region of non-interest (RONI) in the biological sample with blasted particulate substance, thereby causing at least partial transfer of the RONI to the contact medium; (b) removing the contact medium from the biological sample; and (c) dissecting a region of interest (ROI) in the biological sample or collecting the remaining biological sample.

2. The method of claim 1, wherein the biological sample is processed for analysis of one or more analytes of diagnostic interest.

3. The method of claim 1, wherein the biological sample comprises punch biopsy specimens, needle biopsy specimens, fresh tissues, tissue cultures, frozen tissue specimen, neutral formalin-treated tissues, organs, organelles, formalin fixed paraffin embedded (FFPE) tissues, ethanol-fixed paraffin-embedded (EFPE) tissues, hematoxylin and eosin (H&E) stained tissues, or glutaraldehyde fixed tissues.

4. The method of claim 1, wherein the biological sample comprises at least one analyte of diagnostic interest selected from genomic DNA (gDNA), methylated DNA, specific methylated DNA, messenger RNA (mRNA), fragmented DNA, fragmented RNA, fragmented mRNA, mitochondrial DNA (mtDNA), chloroplast DNA (ctDNA), viral RNA or viral DNA, microRNA, ribosomal RNA, in situ PCR product, polyA mRNA, RNA/DNA hybrid, lipid, carbohydrate, protein, glycoprotein, lipoprotein, phosphoprotein, specific phosphorylated or acetylated variant of a protein, or viral coat proteins; preferably nucleic acids selected from mRNA, gDNA, viral DNA or viral RNA.

5. The method of claim 1, wherein the particulate substance comprises aluminum oxide; silicon dioxide; metallic-based particles; magnetic or ferromagnetic particles or a combination thereof.

6. The method of claim 5, wherein the particulate substance is capable of binding to an analyte or a non-analyte in the biological sample; preferably, the particulate substance is capable of binding to the analyte via an interaction selected from ionic interaction, polar-apolar interaction, hydrophobic interaction, van der waal's interaction, chemical coupling, dielectric or zwitterion interaction or a combination thereof.

7. The method of claim 1, wherein the contact medium comprises pressurized air selected from pressurized helium, argon, xenon, nitrogen, carbon dioxide, or a combination thereof.

8. The method of claim 1, wherein the biological sample is mounted on a substrate, e.g., a substrate is selected from glass, silicon, poly-L-lysine coated material, nitrocellulose, polystyrene, cyclic olefin copolymers (COCs), cyclic olefin polymers (COPs), polypropylene, polyethylene, and/or polycarbonate.

9. The method of claim 8, wherein the biological sample comprises a nucleic acid analyte and the contact medium comprises a particulate substance comprising silica.

10. The method of claim 1, wherein the dissecting is micro-dissection, or laser micro-dissection.

11. The method of claim 1, wherein the contact medium is removed from the biological sample via vacuuming, pressure differential or gradient, gravity, a transport medium, or a transfer medium selected from magnetic field or electric field.

12. The method of claim 1, comprising collecting the particulate substance in the contact medium; preparing the particulate substance for analysis; and analyzing the particulate substance.

13. The method of claim 12, wherein the preparing the particulate substance for analysis comprises treating the particulate substance with a buffer (e.g., lysis buffer) and washing the particulate substance to remove non-analytes.

14. The method of claim 12, wherein analysis of particulate substance comprises polymerase chain reaction (PCR), quantitative PCR (qPCR), reverse transcriptase PCR (RT-PCR), nucleic acid sequence based amplification (NASBA), loop mediated isothermal amplification (LAMP), rolling circle amplification (RCA), immunoassay, immunoPCR (iPCR), enzyme activity assay, staining, imaging, whole genome amplification (WGA), in situ PCR, in situ WGA, colony formation, sequencing, single-molecule sequencing, nanopore analysis, nanopore sequencing, single-molecule imaging, DNA ball formation, electrophoresis, microelectromechanical systems (MEMS) electrophoresis, mass spectrometry, chromatography or HPLC, proximity ligation assay, electrochemical detection, plasmon resonance (SPR), hybridization assay FRET, or in situ hybridization assay FRET, or fluorescence in situ hybridization (FISH) FRET, cell sorting or FACS, electrochemiluminescence ELISA, and chemiluminescence ELISA.

15. The method of claim 1, wherein the biological sample comprises a two-dimensional tissue including a tissue section or slice; or a three-dimensional tissue including a tissue block comprising a spatial location of at least one of a region of interest (ROI) and a region of non-interest (RONI).

16. A method of assaying for an analyte in a biological sample comprising processing the biological sample by (a) contacting the biological sample with a contact medium comprising a particulate substance blasted with pressurized air under conditions sufficient to effectuate blasting of a region of non-interest (RONI) in the biological sample with blasted particulate substance, thereby causing at least partial transfer of the RONI to the contact medium; (b) removing the contact medium from the biological sample to obtain a processed biological sample; (c) dissecting the processed biological sample or collecting the entire processed biological sample; and (d) assaying for the analyte in the processed biological sample.

17. A bioanalytical system comprising (a) a first component for contacting a biological sample or a region therein with a contact medium comprising a particulate substance blasted with pressurized air under conditions sufficient to effectuate blasting of a region of non-interest (RONI) in the biological sample with blasted particulate substance, thereby causing at least a partial transfer of the RONI to the contact medium; (b) a second component for removing the contact medium from the biological sample; and (c) a third component for

dissecting a region of interest (ROI) in the biological sample or collecting the remaining biological sample.

18. The bioanalytical system of claim 17, wherein the first component comprises a pressurized particle micro-blaster (PMB) containing the contact medium.

19. The bioanalytical system of claim 17, wherein the second component comprises a vacuum, pressure differential or gradient, a medium for transporting the particulate substance (e.g., liquid or aerosol), or a transfer medium selected from magnetic field or electric field.

20. The bioanalytical system of claim 17, further including (d) a fourth component for analyzing the ROI, wherein the fourth component comprises an instrument selected from polymerase chain reaction (PCR), quantitative PCR (qPCR), reverse transcriptase PCR (RT-PCR), nucleic acid sequence based amplification (NASBA), loop mediated isothermal amplification (LAMP), rolling circle amplification (RCA), immunoassay, immunoPCR (iPCR), enzyme activity assay, staining, imaging, whole genome amplification (WGA), in situ PCR, in situ WGA, colony formation, sequencing, single-molecule sequencing, nanopore analysis, nanopore sequencing, single-molecule imaging, DNA ball formation, electrophoresis, microelectromechanical systems (MEMS) electrophoresis, mass spectrometry, chromatography or HPLC, proximity ligation assay, electrochemical detection, plasmon resonance (SPR), hybridization assay FRET, or in situ hybridization assay FRET, or fluorescence in situ hybridization (FISH) FRET, cell sorting or FACS, electrochemiluminescence ELISA, and chemiluminescence ELISA.