CLAIMS

1. A system for analysis of a biological sample, comprising:

a mobile device that receives an integrated chip to analyze the biological sample loaded thereon, wherein the mobile device and the integrated chip together comprise an extraction module, an amplification module, and a detection module; and

a control mechanism,

wherein during operation of the system, the mobile device and the integrated chip perform at least one cycle of operations comprising:

a) using the extraction module to extract an analyte from the biological sample;

b) using the amplification module to generate one or more products from the analyte; and

c) using the detection module to detect the analyte or the one or more products generated from the analyte; and

wherein the integrated chip and the mobile device use the control mechanism to selectively apply nanoscale control during one or more cycles of the extraction, generation, and detection operations.

2. The system of claim 1, wherein during operation of the system, the mobile device and integrated chip use the detection module to detect the analyte or the one or more products generated from the analyte by at least one of:

measuring an optical signal corresponding to the analyte or the one or more products generated from the analyte;

sequencing the analyte or the one or more products generated from the analyte; and

performing electrophoresis on the analyte or the one or more products generated from the analyte.

3. The system of claim 1, wherein the analyte is a nucleic acid, and wherein the one or more products are partial or entire copies of the nucleic acid.

4. The system of claim 3, wherein during operation of the system, the mobile device and integrated chip use the amplification module to amplify the nucleic acid to generate a population of the one or more products.

5. The system of claim 1, wherein the analyte is a nucleic acid, and wherein the one or more products are complementary to the nucleic acid.

6. The system of claim 5, wherein the nucleic acid comprises RNA, and wherein during operation of the system, the mobile device and integrated chip use the amplification module to perform a reverse transcription reaction to generate DNA that is complementary to the RNA.

7. The system of claim 1, wherein applying nanoscale control comprises applying a hydrodynamic stress to at least one of the analyte and the one or more products.

8. The system of claim 1, wherein applying nanoscale control comprises adjusting a rotational orientation of at least one of the analyte and the one or more products.

9. The system of claim 1, wherein applying nanoscale control comprises hydrodynamically focusing at least one of the analyte and the one or more products.

10. The system of claim 1, wherein applying nanoscale control comprises applying an electromagnetic tension to at least one of the analyte and the one or more products.

11. The system of claim 1, wherein applying nanoscale control comprises applying a mechanical force to at least one of the analyte and the one or more products.

12. The system of claim 1, wherein applying nanoscale control comprises adjusting a translational position of at least one of the analyte and the one or more products.

13. The system of claim 1, wherein applying nanoscale control comprises adjusting, on a length scale of 100 nm or less, at least one environmental parameter associated with the at least one of the analyte and the one or more products.

14. The system of claim 13, wherein the at least one environmental parameter comprises a temperature of the at least one of the analyte and the one or more products.

15. The system of claim 13, wherein the at least one environmental parameter comprises a concentration of at least one reagent combined with the at least one of the analyte and the one or more products.

16. A method for analysis of a biological sample, comprising:

(1) loading the biological sample onto a chip;

(2) performing an extraction operation to extract an analyte from the biological sample;

(3) performing an amplification operation to generate one or more products from the analyte; and

(4) performing a detection operation to detect the analyte or the one or more products generated from the analyte; and

during at least one cycle of the extraction, amplification, and detection operations, exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte.

17. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises applying a hydrodynamic stress to at least one of the analyte and the one or more products.

18. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises adjusting a rotational orientation of at least one of the analyte and the one or more products.

19. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises adjusting a translational position of at least one of the analyte and the one or more products.

20. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises hydrodynamically focusing at least one of the analyte and the one or more products.

21. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises applying an electromagnetic tension to at least one of the analyte and the one or more products.

22. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises applying a mechanical force to at least one of the analyte and the one or more products.

23. The method of claim 16, wherein exerting nanoscale control over at least one of the analyte and the one or more products generated from the analyte comprises adjusting, on a length scale of 100 nm or less, at least one environmental parameter associated with at least one of the analyte and the one or more products.

24. The method of claim 23, wherein the at least one environmental parameter comprises a temperature of the at least one of the analyte and the one or more products.

25. The method of claim 23, wherein the at least one environmental parameter comprises a concentration of at least one reagent combined with the at least one of the analyte and the one or more products.

26. The method of claim 16, wherein performing the amplification operation comprises generating the one or more products by at least one of replicating and amplifying the analyte.

27. The method of claim 16, wherein the analyte is a nucleic acid, and wherein the one or more products are partial or entire copies of the nucleic acid.

28. The method of claim 16, wherein the analyte is a nucleic acid, and wherein the one or more products are complementary to the nucleic acid.

29. The method of claim 28, wherein the nucleic acid comprises RNA, and wherein the amplification operation comprises performing a reverse transcription reaction to generate DNA that is complementary to the RNA.

30. A method for measuring an agent, pathogen, or biomarker in a biological sample, or diagnosing a condition, the method comprising:

performing at least one cycle of operations on the sample, the cycle of operations comprising:

a) extracting an analyte from the sample;

b) generating a product from the sample; and

c) detecting at least one of the analyte and the product;

applying nanoscale control to molecules during the at least one cycle of operations, wherein applying nanoscale control comprises controlling at least one of a rotational orientation of the molecules, a tension applied to the molecules, a force applied to the molecules, and a stress applied to the molecules; and

based on the detected at least one of the biological material and the product, at least one of:

detecting a presence of at least one of a biomarker in the sample, a bacterial, parasitic, or fungal pathogen in the sample, a signature of a DNA in the sample, or a signature of an RNA in the sample;

determining a quantified measure of at least one of a biomarker in the sample, a bacterial, parasitic, or fungal pathogen in the sample, or a viral load in the sample; and

determining a diagnosis based on a presence of at least one of a biomarker in the sample, a bacterial, parasitic, or fungal pathogen in the sample, or a virus in the sample.