SUMMARY OF THE INVENTION

[0009] Embodiments of the present invention overcome the foregoing problems and other shortcomings, drawbacks, and challenges of conventional sample preparation and sample analysis systems. While the invention will be described in connection with certain embodiments, it will be understood that the invention is not limited to these embodiments. To the contrary, embodiments of this invention include all alternatives, modifications, and equivalents as may be included within the spirit and scope of the present invention.

[0010] Disclosed herein is a sample preparation and analysis system includes a sample preparation system and a sample analysis system. The sample preparation system prepares samples in accordance with an assay that is selected from a database containing a plurality of unique assays. The sample analysis system includes an analyzer that is dynamically reconfigurable based on the selected assay so as to analyze the prepared sample in accordance with that selected assay. A data communication link communicates data from the sample preparation system to the sample analysis system to reconfigure the analyzer in accordance with the selected assay.

[0011] Disclosed herein is a method of preparing and analyzing a sample includes preparing a sample with a sample preparation system and analyzing the prepared sample with a sample analysis system. The sample is taken from a specimen in accordance with an assay that is selected from a database containing a plurality of unique assays. The sample analysis system includes an analyzer, which is dynamically reconfigured in response to the selected assay and analyzes the prepared sample in that regard. Data to dynamically reconfigure the analyzer is communicated between the sample preparation system and the sample analysis system over a data communication link.

[0011a] According to an aspect of the present invention, there is provided an automated biological specimen preparation and mass spectrometry analysis system for analyzing a plurality of biological specimens in accordance with assays selected from a database containing a plurality of unique assays including: a sample preparation system for preparing samples taken from the plurality of biological specimens; a sample analysis system including a mass spectrometer for quantifying one or more analytes in one or more of the prepared samples; a specimen dock configured to receive a plurality of containers each containing a respective biological specimen; a reagent station configured to receive a plurality of containers each

containing a reagent liquid; a sampling station configured to transfer a predetermined biological specimen and one or more predetermined reagent liquids to a sample vessel; an analysis staging station configured to store one or more sample vessels containing respective prepared samples; a transport mechanism configured to transfer the prepared samples from one of the sample vessels to the sample analysis system; and a first controller configured to determine a target time to result for each of the prepared samples and dynamically sequence each of the prepared samples for analysis in accordance with a sample prioritization criteria.

[0012] Disclosed herein is a sample preparation and analysis system that includes a sample preparation station and a sample analysis station. The sample preparation system prepares samples in accordance with an assay that is selected from a database containing a plurality of unique assays. The sample analysis system includes an analyzer that is dynamically reconfigurable based on the selected assay so as to analyze the prepared sample in accordance with that selected assay. A transport mechanism transports the prepared sample from the sample preparation system to the sample analysis system.

[0013] Disclosed herein is a method to prepare and analyze a sample by a sample preparation system and sample analysis system, respectively. The sample is taken from a specimen in accordance with an assay that is selected from a database containing a plurality of unique assays. The sample analysis system includes an analyzer, which is dynamically reconfigured in response to the selected assay and analyzes the prepared sample in that regard. A transport mechanism transports the prepared sample from the sample preparation system to the sample analysis system.

[0014] Disclosed herein is an encapsulated sample preparation and analysis system having a sample preparation system and a sample analysis system that includes a controller. The controller controls the operation the sample preparation system as well as the operation of a portion of the sample analysis system. Operation of the sample preparation system and the portion of the sample analysis system are in accordance with an assay, which is selected from a database containing a plurality of unique assays.

[0015] Disclosed herein is an encapsulated sample preparation and analysis system that includes a controller. The controller is configured to dynamically and automatically vary one or more parameters of a sample preparation system in order to prepare samples in accordance with respective assays. The assays are selected from a database containing a plurality of unique assays.

CLAIMS:

1. An automated biological specimen preparation and mass spectrometry analysis system for analyzing a plurality of biological specimens in accordance with assays selected from a database containing a plurality of unique assays comprising:

a sample preparation system for preparing samples taken from the plurality of biological specimens;

a sample analysis system including a mass spectrometer for quantifying one or more analytes in one or more of the prepared samples;

a specimen dock configured to receive a plurality of containers each containing a respective biological specimen;

a reagent station configured to receive a plurality of containers each containing a reagent liquid;

a sampling station configured to transfer a predetermined biological specimen and one or more predetermined reagent liquids to a sample vessel;

an analysis staging station configured to store one or more sample vessels containing respective prepared samples;

a transport mechanism configured to transfer the prepared samples from one of the sample vessels to the sample analysis system; and

a first controller configured to determine a target time to result for each of the prepared samples and dynamically sequence each of the prepared samples for analysis in accordance with a sample prioritization criteria.

2. The automated biological specimen preparation and mass spectrometry analysis system of claim 1, wherein:

the sample prioritization criteria includes the order of arrival of the biological specimens at the automated biological specimen preparation and mass spectrometry analysis system, the status of each sample as being designated as a priority sample or a normal sample, and at least one of the target time to result of each sample, the number of samples awaiting analysis in accordance with the same assay, or mass spectrometer reconfiguration necessary for selected assays that precede and follow a selected assay for a particular prepared sample.

3. The automated biological specimen preparation and mass spectrometry analysis system of claim 2, wherein the controller is further configured to monitor the sequence of each of the prepared samples for analysis and to reset the sequence when a new biological specimen is received at the specimen dock.

4. The automated biological specimen preparation and mass spectrometry analysis system of claim 2, wherein the controller is further configured to automatically set the target time to result for each prepared sample based on the type of the biological specimen from which the sample is prepared.

5. The automated biological specimen preparation and mass spectrometry analysis system of claim 2, wherein the controller is further configured to determine whether a user has specified a target time to result for a selected assay.

6. The automated biological specimen preparation and mass spectrometry analysis system of claim 2, wherein the controller is further configured to dynamically alter one or more operational parameters of the mass spectrometer in accordance with a selected assay.

7. The automated biological specimen preparation and mass spectrometry analysis system of claim 2, wherein the sample prioritization criteria further includes whether the mass spectrometer is configured and available to receive a particular prepared sample within a predetermined amount of time less than or equal to about six minutes.