or surfaces inside the cartridge, e.g., for analysis of compositions within detection chambers of the cartridge or for monitoring and controlling the movement of liquids through the fluidic networks defined within the cartridge.

[0174] One preferred embodiment of the invention is a cartridge that includes one or more sample chambers, one or more detection chambers (preferably, detection chambers adapted for use in ECL measurements as described above) and one or more waste chambers. The chambers are connected in series by fluid conduits so that a sample introduced into a sample chamber can be delivered into one or more detection chambers for analysis and then passed into one or more waste chambers for disposal. Preferably, this cartridge also includes one or more reagent chambers for storing liquid reagents, the reagent chambers connected via conduits to the other components so as to allow the introduction of the liquid reagents into specified sample or detection chambers. The cartridge may also include vent ports in fluidic communication with the sample, detection and/or waste chambers (directly or through vent conduits) so as to allow the equilibration of fluid in the chambers with the atmosphere or to allow for the directed movement of fluid into or out of a specified chamber by the application of positive or negative pressure.

[0175] In an alternative embodiment, a sample chamber and a waste chamber are both arranged upstream from a detection chamber having first and second inlet/outlet conduits (preferably, a detection chamber having an elongated shape, the inlet/outlet conduits being arranged at or near the opposite ends of the elongated dimension). The cartridge is configured to allow the introduction of sample into the detection chamber via the first inlet/outlet conduit and then the reversal of flow to direct the sample fluid back out the first inlet/outlet conduit and to the waste chamber. Preferably, a reagent chamber is located downstream of the detection chamber and the cartridge is configured to allow introduction of the reagent to the detection chamber via the second inlet/outlet conduit (i.e., in "reverse flow" relative to the introduction of sample). This arrangement is particularly well suited to measurements that suffer from strong sample interference, the reverse flow being especially efficient at washing residual sample from the detection chamber. This embodiment is especially useful in ECL-based assays for markers (e.g., cell wall markers of gram positive bacteria) in samples containing a nitrous acid-containing extraction buffer (see, e.g., the extraction methods and reagents disclosed in U.S. Provisional Patent Application 60/436,591, filed Dec. 26, 2002, entitled Methods Compositions and Kits for Biomarker Extraction, hereby incorporated by reference). One preferred embodiment of the invention uses a cartridge configured with a reverse flow wash to conduct art ECL binding assay for a panel of upper respiratory pathogens including streptococcal species and optionally other pathogens such as influenza A and B and RSV (preferably by employing an array of antibodies against markers of the pathogens, the array preferably being formed on one or more electrodes, most preferably an electrode array as described above and in FIGS. **1-4**).

[0176] The reverse flow wash significantly reduces the detrimental effects of nitrous acid on ECL measurements. In preferred embodiments, the washing efficiency is such that the fraction of sample (or reagent) left in a detection chamber after a wash is less than $1/1000$; more preferably less than $1/10{,}000$, even more preferably less than $1/100{,}000$

[0177] The sample chamber is a chamber defined within a cartridge that is adapted for receiving a sample to be analyzed in the cartridge. The sample chamber includes a sample introduction port for introducing sample into the chamber. The port is preferably an opening in the cartridge that provides access to the sample chamber. Alternatively, the port may be a membrane or septa through which a sample may be injected into the sample chamber, e.g., through the use of a needle or cannula. Preferably, the cartridge also includes a sealable closure for sealing the sample introduction port and preventing leakage of the sample and possible exposure of the user and/or associated instruments to biohazards. Preferably the sealing/capping mechanism utilizes a hinged configuration so that the sample chamber is easily accessed and sealed. In particularly preferred embodiments the sealing/capping mechanism incorporates a flexible hinge, e.g., rubber, plastic or the like. Most preferably, the sample chamber is adapted and configured to receive a modular detachable insert that includes a cap for sealing the sample chamber. Use of a modular detachable insert within the sample chamber also allows for independent selection of materials for the main cartridge body. In an alternative embodiment, sealing of the sample introduction port is achieved by applying an adhesive tape to the port. The sample chamber may contain dry reagents used in carrying out the assay that reconstitute on addition of a liquid sample. Optionally, the sample chamber contains an anti-foam agent to prevent foaming of the sample in the cartridge.

[0178] In one embodiment, the sealing/capping mechanism further comprises a latching mechanism to prevent the sealing/capping mechanism from opening during use. Still further, the sealing/capping mechanism may comprise a retention component to prevent the mechanism from being dislodged from the cartridge. For example, the mechanism may include a retaining ring or retaining tabs affixed or molded to the body of the mechanism to secure the mechanism within the port. Optionally, the port has ledges that secure the retaining components in place once the cap is inserted into the cartridge body. An example of the sealing/capping mechanism is shown in FIGS. **35***a-b*. As shown for cap **3500** in FIG. **35***a*, the sealing/capping mechanism is optionally fabricated as a single unit, e.g., molded from a thermoplastic elastomer material. FIG. **35***a* illustrates one embodiment of the retention component, **2391**, comprising two retaining tabs molded to the body of the sealing/capping mechanism. FIG. **35***b* illustrates a latching mechanism, **2392**, that may be used in the sealing/capping mechanism.

[0179] The sample chamber is connected to a sample conduit for transferring fluids from the sample chamber to other fluidic components in the cartridge. The sample chamber may also be connected to a vent port and/or a reagent chamber (e.g., through fluidic conduits). In a preferred configuration for receiving liquid samples, the sample chamber is connected to a sample conduit and a vent port. A cross-sectional view of a preferred embodiment is shown in FIG. **27**. Sample chamber **2710** has sample introduction port **2720** and is linked to sample conduit **2730** and sample vent port **2740** (through vent conduit **2750**). Sample conduit **2730** is advantageously arranged to intersect sample chamber **2710** at or near the bottom of the chamber (relative to the orientation of the cartridge during operation) so as to allow for efficient transfer of a large fraction of the sample volume without the introduction of bubbles. Vent conduit **2750** is advantageously arranged to intersect sample chamber **2710** above sample conduit **2730** and at a height that is greater than the anticipated sample fill level height to avoid possible contamination