CLAIMS

~~What is claimed is:~~

1. A flow cell, comprising:

a plurality of inlet ports, each inlet port of the plurality of inlet ports sized to receive a flow of reagent from a corresponding reagent of a plurality of reagents into the flow cell;

an outlet port sized to pass ~~a~~ the flow of reagent from each inlet port out of the flow cell; and

a flow channel positioned between, and in fluid communication with, each inlet port of the plurality of inlet ports and the outlet port, the flow channel comprising:

a manifold section having a plurality of manifold branches in fluid communication with a common line, the manifold section having a swept volume comprising a swept volume of the plurality of manifold branches and the common line, each manifold branch of the plurality of manifold branches connected to a corresponding inlet port of the plurality of inlet ports, and

a detection section having a swept volume, the detection section in fluid communication with the common line and the outlet port, the detection section operable to perform a plurality of different chemical reactions between the plurality of reagents and analytes positioned in the detection section;

wherein the swept volume of the manifold section is at least about 10 times smaller than the swept volume of the detection section.

2. The flow cell of claim 1, wherein the manifold section and the detection section of the flow channel are substantially planar.

3. The flow cell of claim 1, wherein the plurality of manifold branches are in fluid communication with the common line through a plurality of forked junctions, each of the plurality of forked junctions directing a corresponding flow of reagent through the common

line and into the detection section, at least one forked junction forming an acute angle between respective manifold branches.

~~4. The flow cell of claim 1, wherein the manifold section has a swept volume that is at least about 10 times smaller than a swept volume of the detection section.~~

~~5~~4. The flow cell of claim 1, wherein the flow channel comprises a swept volume and a geometry such that a flush factor, used to achieve a flush efficiency of at least about 99.95 percent concentration of a reagent positioned in the detection section, is about 2.5 or less.

~~6~~5. The flow cell of claim 1, comprising:

a top layer defining a top surface of the flow channel;

a bottom layer defining a bottom surface of the flow channel; and

an intermediate layer defining a geometry of the flow channel.

~~7~~6. The flow cell of claim ~~6~~5, comprising a gap height defined by a distance between the bottom surface of the flow channel and the top surface of the flow channel, wherein the gap height is substantially constant throughout the flow channel and is within a range of about 60 to 100 microns.

~~8~~7. The flow cell of claim 1, wherein the flow channel comprises a swept volume and a geometry such that a flush factor, used to achieve a flush efficiency of at least about 99 percent concentration of a reagent positioned in the detection section, is about 2.0 or less.

~~9~~8. The flow cell of claim 1, wherein:

the plurality of reagents is from a plurality of respective reagent wells positioned in one of a cartridge or an instrument, and

the one of the cartridge or the instrument comprises a plurality of valves external to the flow cell, each valve being positioned between a corresponding reagent well of the plurality of respective reagent wells and a corresponding inlet port of the plurality of inlet ports such that each valve controls a flow of reagent from the corresponding reagent well of the plurality of respective reagent wells.

~~10~~9. An instrument, comprising:

a plurality of reagent wells, each reagent well of the plurality of reagent wells operable to contain a reagent therein;

a plurality of valves, each valve of the plurality of valves in fluid communication with a corresponding reagent well of the plurality of reagent wells, each valve of the plurality of valves operable to control a flow of reagent from the corresponding reagent well of the plurality of reagent wells; and

a flow cell, operable to fluidically couple to the instrument, the flow cell comprising:

a plurality of inlet ports, each inlet port in fluid communication with a corresponding valve of the plurality of valves, each inlet port of the plurality of inlet ports sized to receive a flow of reagent from the corresponding reagent well of the plurality of reagent wells;

an outlet port sized to pass the flow of reagent from each inlet port out of the flow cell; and

a flow channel positioned between, and in fluid communication with, each inlet port of the plurality of inlet ports and the outlet port, the flow channel comprising:

a manifold section having a plurality of manifold branches in fluid communication with a common line, the manifold section having a swept volume comprising a swept volume of the plurality of manifold branches and the common line, each branch connected to an inlet port of the plurality of inlet ports, and

a detection section having a swept volume, the detection section in fluid communication with the common line and the outlet port, the detection section operable to perform a plurality of different chemical reactions between the plurality of reagents and analytes positioned in the detection section;

wherein the swept volume of the manifold section is at least about 10 times smaller than the swept volume of the detection unit.

~~11~~10. The instrument of claim ~~10~~9, wherein the manifold section of the flow channel is the only common area where flow paths of reagents are routed together prior to flowing into the detection section of the flow channel.

~~12~~11. The instrument of claim ~~10~~9, wherein the manifold section and the detection section of the flow channel are substantially planar.

~~13~~12. The instrument of claim ~~10~~9, wherein the manifold branches are in fluid communication with the common line through a plurality of forked junctions which direct each flow of reagent through the common line and into the detection section, the forked junctions forming only acute angles between manifold branches.

~~14. The instrument of claim 10, wherein the manifold section has a swept volume that is at least about 10 times smaller than a swept volume of the detection section.~~

~~15~~13. The instrument of claim ~~10~~9, wherein the flow channel comprises a swept volume and a geometry such that a flush factor, used to achieve a flush efficiency of at least about 99.95 percent concentration of a reagent positioned in the detection section, is about 2.5 or less.

~~16~~14. The instrument of claim ~~12~~11, comprising:

a top layer defining a top surface of the flow channel;

a bottom layer defining a bottom surface of the flow channel;

a intermediate layer defining a geometry of the flow channel; and

a gap height defined by a distance between the bottom surface of the flow channel and the top surface of the flow channel, wherein the gap height is substantially constant throughout the flow channel.

~~17~~15. The instrument of claim ~~10~~9, wherein the flow cell is positioned within the instrument.

~~18. A method comprising:~~

connecting a flow cell to an instrument, the flow cell comprising a plurality of inlet ports, an outlet port and a flow channel in fluid communication therebetween, the flow channel comprising a manifold section and a detection section;

operating a first valve of a plurality of valves of the instrument to select a first reagent of a plurality of reagents, each reagent positioned in a reagent well of one of a cartridge or the instrument;

pumping the first reagent through a first inlet port of the plurality of inlet ports and through the flow channel of the flow cell;

performing a first chemical reaction between the first reagent and analytes positioned in the detection section of the flow channel, wherein at least some of the first reagent remains in the flow channel as a remaining reagent after completion of the first chemical reaction;

operating a subsequent valve of the plurality of valves to select a subsequent reagent of the plurality of reagents; and

pumping the subsequent reagent through a subsequent inlet port of the plurality of inlet ports and through the flow channel to flush out the remaining reagent from the flow channel such that a concentration of at least about 99.95 percent of reagent positioned in the detection section is the subsequent reagent using a total flush volume of the subsequent reagent that is equal to or less than about 2.5 times a swept volume of the flow channel.

19. The method of claim 18, comprising:

performing a subsequent chemical reaction between the subsequent reagent and the analytes positioned in the detection section after the concentration of at least about 99.95 percent of the subsequent reagent positioned in the detection section has been achieved, wherein at least some of the subsequent reagent remains in the flow channel as a second remaining reagent after completion of the subsequent chemical reaction.

20. The method of claim 19, comprising repeating the operating the subsequent valve, pumping the subsequent reagent and performing a subsequent chemical reaction.