37. The system of any one of claims 28 to 36, further comprising a valve associated with a fluid channel for controlled opening and closing of the fluid channel.

38. The system of any one of claims 28 to 37, wherein the control system comprises a display for displaying detection results.

39. The system of any one of claims 28 to 38, wherein the control system enables the completion of at least 10 sample analyses per hour.

40. The system of any one of claims 28 to 39, wherein:
- the a background electrolyte reservoir comprises a first background electrolyte reservoir and a second background electrolyte reservoir, with respective injection ports positioned so that background electrolyte injected through the respective injection ports will flow concurrently through portions of the fluid channel to pass through portions of the interface zoned of the fluid channel,
- the entrance to the first separation channel is positioned in the portion of the interface zoned through which the stream of background electrolyte from the first background electrolyte injection port will pass; and
- the entrance to the second separation channel is positioned in the portion of the interface zoned through which the stream of background electrolyte from the second background electrolyte injection port will pass.

~~41. A method for the separation and detection of analytes in a sample using electrophoresis in the presence of two or more different electrolytes concurrently, the method comprising providing an electrophoresis system comprising a single sample injection port in fluid communication with two or more separation channels, priming the separation channels with different background electrolytes, injecting the sample through the single sample injection port and into each of the separation channels, applying a voltage potential across each of the separation channels to effect a separation of the analytes in the respective channels during the flow of a different background electrolyte composition through each of the separation channels, and detecting the presence of the analytes in the sample.~~

~~42. The method of claim 41, wherein the electrophoresis system comprises:~~
~~- a fluid channel having a fluid channel inlet at one end and a fluid channel outlet at the opposite end,~~
~~- wherein the fluid channel inlet is in fluid communication with the sample~~

injection port, a first background electrolyte injection port and a second background electrolyte injection port, and

- wherein an interface zone of the fluid channel is positioned between the fluid channel inlet and the fluid channel outlet, with inlets to the two respective separation channels opening into portions of the interface zone,

- wherein the method comprises injecting said different background electrolytes through the first and second background electrolyte ports respectively to flow concurrently through said portions of the interface zone of the fluid channel.

43. The method of claim 42, wherein a ground electrode is located in the interface zone of the fluid channel.

44. The method of claim 43, wherein the ground electrode extends axially from the outlet end of the fluid channel and into the interface zone of the fluid channel.

45. The method of claim 43 or claim 44, wherein inlets to the separation channels are positioned an equal distance from the ground electrode.

46. The method any one of claims 42 to 45, wherein a separation distance between the inlet to the first separation channel and the inlet to the second separation channel is between 50 and 500 μm.

47. The method of claim 46, wherein the separation distance is between 1 and 20 times the width of the separation channels.

48. The method of any one of claims 41 to 47, wherein the sample is introduced into the separation channels over a time period of not more than 10 seconds.

49. The method of any one of claims 41 to 47, wherein the sample is introduced into the separation channels over a time period of not more than 5 seconds.

50. The method of any one of claims 41 to 49, wherein the cations and anions are detected and a result is produced within 1 minute of sample injection.

51. The method of any one of claims 41 to 50, wherein at least one anion and at least one cation species is capable of detection at a concentration as low as 1ppb.

52. The method of anyone of claims 41 to 51, comprising detecting anions selected from the group consisting of chloride, sulfate, thiocyanate, fluoride, phosphate, carbonate, nitrate, perchlorate, azide, chlorate and $CH_3SO_3^-$ ions, simultaneously with cations selected from the group consisting of calcium, potassium, sodium, $NH_4^+$ and magnesium

53. The method of claim 41, wherein the sample is hydrodynamically loaded into the two separation channels prior to effecting the separation of analytes simultaneously in the respective separation channels through controlled opening and closing of a valve associated with a fluid channel having an inlet associated with the sample injection port, an interface zone positioned at the entrance to the separation channels, and an outlet downstream of the interface zone.

54. The method of any one of claims 42 to 52, wherein the sample is hydrodynamically loaded into the two separation channels prior to effecting the separation of analytes simultaneously in the respective separation channels.

55. The method of claim 54, wherein the hydrodynamic loading of sample comprises the following steps:

- priming the two separation channels by closing the fluid channel outlet valve and hydrodynamically forcing background electrolyte from the first and second background electrolyte injection ports into the first and second separation channels;
- loading of sample into interface zone the fluid channel outlet open;
- closing the fluid channel outlet and injecting the sample through the sample injection port to hydrodynamically force the sample into the two separation channels to thereby load the sample into the separation channels;
- introducing different background electrolytes through the fluid channel and into portions of the interface zone of the fluid channel with the fluid channel outlet open; and
- applying a voltage potential across the separation channels to effect separation of the analytes during flow of different background electrolyte through portions of the interface zone of the fluid channel.

56. The method of any one of claims 42 to 52, wherein the sample is electrokinetically loaded into the two separation channels prior to effecting the

separation of cations and anions simultaneously in the respective separation channels.

57. The method of claim 56, wherein the electrokinetic loading of the sample comprises applying a voltage potential across the two separation channels of between 0.2kV to 5kV for between 0.2 and 3 seconds.

58. The method of any one of claims 41 to 57, wherein the width of the separation channels is between 10 and 100 µm.

59. The method of any one of claims 41 to 58, wherein the depth of the separation channels is between 10 and 100 µm.

60. The method of any one of claims 41 to 59, wherein the separation channels are of rectangular or semi-circular cross-section.

61. The method of any one of claims 41 to 60, wherein the analytes are anions and cations, and cations are separated in a first of the two separation channels, and the anions are separated in a second of the two separation channels.

62. A method the simultaneous separation and detection of analytes in a sample through two or more separation channels using electrophoresis, comprising:

- providing an electrophoresis system comprising:
  - an injection system comprising a single sample injection port, a first background electrolyte injection port and a second background electrolyte injection port;
  - a fluid channel having a fluid channel inlet at one end and a fluid channel outlet at the opposite end, wherein the fluid channel inlet is in fluid communication with the sample injection port, wherein an interface zone is positioned between the fluid channel inlet and the fluid channel outlet; and wherein the first and second background electrolyte injection ports are positioned so that background electrolyte injected through the respective ports will flow concurrently through portions of the fluid channel and pass through portions of the interface zone of the fluid channel;
  - a first separation channel having an entrance at one end and an outlet at the other end, the entrance of the first separation channel being positioned in a portion of the interface zone of the fluid channel through which the

stream of background electrolyte from the first background electrolyte injection port will pass;

- a second separation channel having an entrance at one end and an outlet at the other end, the entrance of the second separation channel being positioned in a portion of the interface zone of the fluid channel through which the stream of background electrolyte from the second background electrolyte injection port will pass;
- a grounded electrode positioned in the fluid channel;
- a charged electrode positioned to apply a potential across the first separation channel;
- a first detector positioned to detect analytes passing through a detection zone of the first separation channel;
- a charged electrode positioned to apply a potential across the second separation channel; and
- a second detector positioned to detect analytes passing through a detection zone of the second separation channel;

- priming the two separation channels with background electrolyte, by concurrently introducing background electrolytes from the first and second background electrolyte injection ports into their respective portions of interface zone of the fluid channel, and hydrodynamically forcing background electrolyte from the first background electrolyte port into the first separation channel and background electrolyte from the second background electrolyte port into the second separation channel;
- loading the sample into the interface zone of the fluid channel by injecting the sample through the single sample injection port to pass into the interface zone of the fluid channel;
- loading the sample into the two separation channels;
- concurrently introducing background electrolyte from the first and second background electrolyte injection ports through the fluid channel and into their respective portions of the interface zone of the fluid channel;
- applying a voltage potential across the two separation channels to simultaneously effect a separation of the analytes in the first separation channel, and effect a separation of analytes in the second separation channel; and
- detecting the presence of the separated analytes through the first detector and the second detector.

63. The method of claim 62, wherein the grounded electrode extends axially from the

outlet end of the fluid channel and into the interface zone of the fluid channel.

64. The method of claim 62 or claim 63, wherein inlets to the separation channels are positioned an equal distance from the ground electrode.

65. The method any one of claims 62 to 64, wherein a separation distance between the inlet to the first separation channel and the inlet to the second separation channel is between 50 and 500 μm.

66. The method of claim 65, wherein the separation distance is between 1 and 20 times the width of the separation channels.

67. The method of any one of claims 62 to 66, wherein the sample is introduced into the separation channels over a time period of not more than 10 seconds.

68. The method of any one of claims 62 to 66, wherein the sample is introduced into the separation channels over a time period of not more than 5 seconds.

69. The method of any one of claims 62 to 68, wherein the analyte comprises anions and cations, the first charged electrode is a positively charged electrode, the second charged electrode is a negatively charged electrode, the first detector detects anions, and the second detector detects cations.

70. The method of any one of claims 69, wherein the cations and anions are detected and a result is produced within 1 minute of sample injection.

71. The method of any one of claims 69 to 70, wherein at least one anion and at least one cation species is capable of detection at a concentration as low as 1ppb.

72. The method of any one of claims 62 to 71, wherein the loading of the sample into the separation channels comprises hydrodynamically loading the sample into the separation channels.

73. The method of claim 72, wherein the hydrodynamic loading of sample comprises the following steps:

- loading of sample into interface zone the fluid channel outlet open; and

- closing the fluid channel outlet and injecting the sample through the sample injection port to hydrodynamically force the sample into the two separation channels to thereby load the sample into the separation channels.

74. The method of any one of claims 62 to 71, wherein the sample is electrokinetically loaded into the two separation channels prior to effecting the separation of cations and anions simultaneously in the respective separation channels.

75. The method of claim 74, wherein the electrokinetic loading of the sample comprises applying a voltage potential across the two separation channels of between 0.2kV to 5kV for between 0.2 and 3 seconds.

76. The method of any one of claims 62 to 75, wherein the width of the separation channels is between 10 and 100 µm.

77. The method of any one of claims 62 to 76, wherein the depth of the separation channels is between 10 and 100 µm.

78. The method of any one of claims 62 to 77, wherein the separation channels are of rectangular or semi-circular cross-section.

79. An electrophoresis system for the simultaneous separation and detection of analytes in a sample, the system comprising:

- a first background electrolyte reservoir for storing a first background electrolyte and a second background electrolyte reservoir for storing a second background electrolyte;
- an injection system comprising a single sample injection port, a first background electrolyte injection port and a second background electrolyte injection port;
- a fluid channel having a fluid channel inlet at one end and a fluid channel outlet at the opposite end, wherein the fluid channel inlet is in fluid communication with the sample injection port, wherein an interface zone of the fluid channel is positioned between the fluid channel inlet and the fluid channel outlet; and wherein the first and second background electrolyte injection ports are positioned so that background electrolyte injected

concurrently through the respective ports can flow concurrently through portions of the fluid channel to pass through portions of the interface zone of the fluid channel;

- a first separation channel having an entrance at one end an outlet at the other end, the entrance of the first separation channel being positioned in a portion of the interface zone of the fluid channel through which the stream of background electrolyte from the first background electrolyte injection port will pass;
- a second separation channel having an entrance at one end an outlet at the other end, the entrance of the second separation channel being positioned in a portion of the interface zone of the fluid channel through which the stream of background electrolyte from the second background electrolyte injection port will pass;
- a grounded electrode positioned in the fluid channel;
- a first charged electrode positioned to apply a potential across the first separation channel;
- a first detector positioned to detect analytes passing through a detection zone of the first separation channel;
- a second charged electrode positioned to apply a potential across the second separation channel;
- a second detector positioned to detect analytes passing through a detection zone of the second separation channel; and
- a controller for controlling the injection system, flow of the first and second background electrolytes through the fluid channel and the application of a voltage across the electrodes.

80. The system of claim 79, wherein the grounded electrode is located in the interface zone between the entrances to the two separation channels.

81. The system of any one of claims 79 to 80, wherein the grounded electrode is cylindrical.

82. The system of any one of claims 79 to 81, wherein the grounded electrode extends axially from the outlet end of the fluid channel and into the interface zone of the fluid channel.

83. The system of any one of claims 79 to 82, wherein inlets to the separation

channels are positioned an equal distance from the grounded electrode.

84. The system of claim 83, wherein the separation distance between the inlet to the first separation channel and the inlet to the second separation channel is between 50 and 500 μm.

85. The system of claim 83 or claim 84, wherein the separation distance is between 1 and 20 times the internal diameter of the separation channels.

86. The system of any one of claims 79 to 85, further comprising a valve associated with a fluid channel for controlled opening and closing of the fluid channel.

87. The system of any one of claims 79 to 86, wherein the control system comprises a display for displaying detection results.

88. The system of any one of claims 79 to 87, wherein the control system enables the completion of at least 10 sample analyses per hour.

89. The system of any one of claims 79 to 88, wherein the width of the separation channels is between 10 and 100 μm.

90. The system of any one of claims 79 to 89, wherein the depth of the separation channels is between 10 and 100 μm.

91. The system of any one of claims 79 to 90, wherein the width of the main fluid channel is between 50 and 500 μm.

92. The system of any one of claims 79 to 91, wherein the depth of the main fluid channel is between 10 and 100 μm.

93. The system of any one of claims 79 to 92, wherein the separation channels are of rectangular or semi-circular cross-section.

94. The system of claim 93, wherein the separation channels are of rectangular cross-section, and the depth of the separation channels is the same as that for the main fluid channel.

95. The system of claim 94, wherein the separation channels have a width that is less than 30% of the width of the main fluid channel.

96. The system of any one of claims 79 to 95, wherein the first charged electrode is a positively charged electrode, and the second charged electrode is a negatively charged electrode.