Claims

1. A microfluidic platform for investigating cell-based interactions, the platform comprising:

a chip base made of a suitable plastics material with the appropriate optical properties, the chip base having a plurality of ports in fluid communication with a microfluidic channel for containing a culture medium in which cells are held.

2. A microfluidic platform as defined in claim 1, wherein the chip base is made from an engineering plastics material that can be injection molded and is optically clear.

3. A microfluidic platform as defined in claim 2, wherein the plastics material is selected from the group consisting of: polycarbonates (PC), polystyrenes (PS), polyethylenes (PE), cyclic olefin co-polymers (COC), cyclic olefin polymers (COP).

4. A microfluidic platform as defined in any one of claims 1 to 3, further comprising a gas permeable laminate bonded to a bottom surface of the chip base.

5. A microfluidic platform as defined in claim 4, wherein the gas permeable laminate is made from a polymer with low bulk density.

6. A microfluidic platform as defined in claim 5, wherein the polymer of low bulk density is selected from the group consisting of: polymethylpentene (PMP) and poly(1-trimethylsilyl-1-propyne) (PTMSP), or from polymethylated polymers such as polymethylated poly(diphenylacetylene), or from polymers that achieve sufficient gas permeability through other means.

7. A microfluidic platform as defined in claim 4, wherein the gas permeable laminate is optically clear.

8. A microfluidic platform as defined in any one of claims 4 to 7, wherein the laminate is bonded to the chip base by heat lamination, solvent bonding, adhesion (with wet or dry adhesives), or by other means depending on the specific materials used for the chip base and laminate respectively.

9. A microfluidic platform as defined in claim 1, wherein the chip base has a plurality of microfluidic channels of elongate configuration arranged in a linear array, each microfluidic channel being substantially parallel to an adjacent channel.

10. A microfluidic platform as defined in claim 9, wherein each microfluidic channel has a pair of ports, one port provided at each end respectively.

11. A microfluidic platform as defined in claim 10, wherein the ports all open onto an upper surface of the chip base.

12. A microfluidic platform as defined in claim 10, wherein the microfluidic channels are arranged into pairs with a third microfluidic channel provided there between, the third channel being configured so as to permit controlled fluid communication between the pair of microfluidic channels and the third microfluidic channel.

13. A microfluidic platform as defined in claim 12, wherein the third microfluidic channel is filled with a hydrogel or other extracellular matrix.

14. A microfluidic platform as defined in any one of claims 9 to 13, wherein all of the microfluidic channels are formed in a bottom surface of the chip base and a gas permeable laminate is bonded to the bottom surface of the chip base to enclose the channels.

15. A microfluidic platform as defined in claim 10, wherein the chip base is formed with a plurality of reservoirs molded into the upper surface thereof which are not in fluid communication with the ports, wherein, in use, each reservoir is adapted to hold sterile water, a hydrogel or other substance to create a humid environment around the device.

16. A microfluidic platform as defined in claim 1, wherein the chip base is of generally elongate, rectangular configuration, with the ports arranged along its respective longitudinal edges.

17. A method of manufacturing a microfluidic platform for investigating cell-based interactions, the method comprising the steps of:

molding a chip base from a suitable plastics material with appropriate optical properties, the chip base having a plurality of ports in fluid communication with a microfluidic channel for containing a culture medium in which cells are held.

18. A method of manufacturing a microfluidic platform as defined in claim 13, wherein the step of molding the chip base involves injection molding using an engineering plastics material that is optically clear.

19. A method of manufacturing a microfluidic platform as defined in claim 14, wherein the plastics material is selected from the group consisting of: polycarbonates (PC), polystyrenes (PS), polyethylenes (PE), cyclic olefin co-polymers (COC), and cyclic olefin polymers (COP).

20. A method of manufacturing a microfluidic platform as defined in claim 13, wherein the method further comprises the step of bonding a gas permeable laminate to a bottom surface of the chip base.

21. A method of manufacturing a microfluidic platform as defined in claim 16, wherein the gas permeable laminate is optically clear and is made from a polymer with low bulk density.

22. A method of manufacturing a microfluidic platform as defined in claim 17, wherein the polymer of low bulk density is selected from the group consisting of: polymethylpentene (PMP) and poly(1-trimethylsilyl-1-propyne) (PTMSP), polymethylated polymers such as polymethylated poly(diphenylacetylene), or polymers that achieve sufficient gas permeability through other means.

23. A method of manufacturing a microfluidic platform as defined in claim 16, wherein the step of bonding the laminate to the chip base involves laminating the laminate to the chip base by heat lamination.

24. A method of manufacturing a microfluidic platform as defined in claim 16, wherein the step of bonding the laminate to the chip base involves solvent bonding, adhesion bonding (with wet or dry adhesives), or other bonding means depending on the specific materials used for the chip base and laminate respectively.

25. A microfluidic platform for investigating cell-based interactions, the platform comprising:

a chip base having a plurality of ports in fluid communication with a microfluidic channel for containing a fluid culture medium in which cells are held, each port having an internal inlet, connecting the port with the microfluidic channel, and a trough for containing a small reservoir of culture medium fluid adjacent to the inlet wherein, in use, culture medium can be aspirated from the microfluidic channel via the trough rather than directly via the internal inlet.

26. A microfluidic platform as defined in claim 21, wherein the inlet is provided centrally of the port and the trough is of annular configuration surrounding the inlet.

27. A microfluidic platform as defined in claim 22, wherein the bottom of the trough is of semicircular cross-section.

28. A microfluidic platform as defined in claim 21, wherein the ports of the microfluidic platform are designed as modular attachment interfaces.

29. A microfluidic platform as defined in claim 24, wherein the ports are adapted to receive a modular luer connector for attaching standard luer fittings, such as tubing connectors and syringe pumps to the microfluidic platform.

30. A microfluidic platform as defined in claim 21, wherein a plurality of the microfluidic platforms can be received and held in a single microplate holder.

31. A microfluidic platform as defined in claim 30, wherein the holder further comprises a plurality of internal reservoirs, which are not in fluid communication with the chips, wherein, in use, each reservoir is adapted to hold sterile water, a hydrogel or other substance to create a humid environment around the chips.

What is claimed is:

1. A microfluidic platform for investigating cell-based interactions, the platform comprising:
a chip base comprising a plurality of ports in fluid communication with a microfluidic channel for containing a fluid culture medium in which cells are held, each port comprising:
an internal inlet, connecting the port with the microfluidic channel,
a trough for containing a small reservoir of culture medium fluid adjacent to the inlet, and
an upper reservoir above said trough and said internal inlet,
wherein, in use, the fluid culture medium can be aspirated from the microfluidic channel via the trough rather than directly via the internal inlet.

2. The microfluidic platform as defined in claim 1, wherein the inlet is provided centrally of the port and the trough is of annular configuration surrounding the inlet.

3. The microfluidic platform as defined in claim 2, wherein the bottom of the trough is of semicircular cross-section.

4. The microfluidic platform as defined in claim 1, wherein the ports of the microfluidic platform are designed as interfaces for modular attachments.

5. The microfluidic platform as defined in claim 4, wherein the ports are adapted to receive a modular luer connector as a modular attachment for attaching standard luer fittings to the microfluidic platform.

6. The microfluidic platform as defined in claim 1, wherein the microfluidic platform is configured such that a plurality of the microfluidic platform can be received and held in a single microplate holder.

7. The microfluidic platform as defined in claim 6, wherein the holder further comprises a plurality of internal reservoirs, which are not in fluid communication with the chips, wherein, in use, each reservoir is adapted to hold sterile water, a hydrogel or other substance to create a humid environment around the chips.

8. The microfluidic platform as defined in claim 5, wherein the standard luer fittings are selected from the group consisting of tubing connectors, and syringe pumps.

9. A microfluidic platform for investigating cell-based interactions according to claim 1, wherein the chip base is made of a suitable plastics material with appropriate optical properties.

10. The microfluidic platform as defined in claim 9, wherein the chip base is made from an engineering plastics material that can be injection molded and is optically clear.

11. The microfluidic platform as defined in claim 10, wherein the plastics material is selected from the group consisting of polycarbonates (PC), polystyrenes (PS), polyethylenes (PE), cyclic olefin co-polymers (COC), and cyclic olefin polymers (COP).

12. The microfluidic platform as defined in claim 9, further comprising a gas permeable laminate bonded to a bottom surface of the chip base.

13. The microfluidic platform as defined in claim 12, wherein the gas permeable laminate is made from a polymer with low bulk density.

14. The microfluidic platform as defined in claim 13, wherein the polymer of low bulk density is selected from the group consisting of polymethylpentene (PMP), poly(1-trimethylsilyl-1-propyne) (PTMSP), polymethylated polymers, polymethylated poly(diphenylacetylene), and polymers that achieve sufficient gas permeability through other means.

15. The microfluidic platform as defined in claim 12, wherein the gas permeable laminate is optically clear.

16. The microfluidic platform as defined in claim 15, wherein the laminate is bonded to the chip base by heat lamination, solvent bonding, adhesion (with wet or dry adhesives), or by other means depending on the specific materials used for the chip base and laminate respectively.

17. The microfluidic platform as defined in claim 9, wherein the chip base has a plurality of microfluidic channels of elongate configuration arranged in a linear array, each microfluidic channel being substantially parallel to an adjacent channel.

18. The microfluidic platform as defined in claim 17, wherein each microfluidic channel has a pair of ports, one port provided at each end respectively.

19. The microfluidic platform as defined in claim 18, wherein the ports all open onto an upper surface of the chip base.

20. The microfluidic platform as defined in claim 18, wherein the microfluidic channels are arranged into pairs with a third microfluidic channel provided there between, the third channel being configured so as to permit controlled fluid communication between the pair of microfluidic channels and the third microfluidic channel.

21. The microfluidic platform as defined in claim 20, wherein the third microfluidic channel is filled with a hydrogel or other extracellular matrix.

22. The microfluidic platform as defined in claim 21, wherein all of the microfluidic channels are formed in a bottom surface of the chip base and a gas permeable laminate is bonded to the bottom surface of the chip base to enclose the channels.

23. The microfluidic platform as defined in claim 18, wherein the chip base is formed with a plurality of reservoirs molded into the upper surface thereof which are not in fluid communication with the ports, wherein, in use, each reservoir is adapted to hold sterile water, a hydrogel or other substance to create a humid environment around the device.

24. The microfluidic platform as defined in claim 9, wherein the chip base is of generally elongate, rectangular configuration, with the ports arranged along its respective longitudinal edges.

25. A method of manufacturing a microfluidic platform for investigating cell-based interactions according to claim 9, the method comprising:
molding the chip base from the suitable plastics material so as to include the plurality of ports.

26. The method of manufacturing a microfluidic platform as defined in claim 25, wherein the step of molding the chip base comprises injection molding using an engineering plastics material that is optically clear.

27. The method of manufacturing a microfluidic platform as defined in claim 26, wherein the plastics material is selected from the group consisting of polycarbonates (PC), polystyrenes (PS), polyethylenes (PE), cyclic olefin co-polymers (COC), and cyclic olefin polymers (COP).

28. The method of manufacturing a microfluidic platform as defined in claim 25, wherein the method further comprises the step of bonding a gas permeable laminate to a bottom surface of the chip base.

29. The method of manufacturing a microfluidic platform as defined in claim 28, wherein the gas permeable laminate is optically clear and is made from a polymer with low bulk density.

30. The method of manufacturing a microfluidic platform as defined in claim 29, wherein the polymer of low bulk density is selected from the group consisting of polymethylpentene (PMP), poly(1-trimethylsilyl-1-propyne) (PTMSP), polymethylated polymers, polymethylated poly(diphenylacetylene), and polymers that achieve sufficient gas permeability through other means.

31. The method of manufacturing a microfluidic platform as defined in claim 28, wherein the step of bonding the laminate to the chip base comprises laminating the laminate to the chip base by heat lamination.

32. The method of manufacturing a microfluidic platform as defined in claim 28, wherein the step of bonding the laminate to the chip base comprises solvent bonding, adhesion bonding (with wet or dry adhesives), or other bonding means depending on the specific materials used for the chip base and laminate respectively.