

CLAIMS

1. A system for detecting at least one species present in a fluid, preferably at least one circulating cell or cell aggregate present in a human or animal biological fluid, and in particular circulating tumor cells (CTC) present in a blood fluid, the detection system comprising filtration means for said fluid, said filtration means comprising a filtering membrane, said filtering membrane comprising at least one pore adapted to retain a species of a given type present in the fluid, said filtration means further comprising at least one opening adapted to ensure, in operation within the fluid, a continuity of circulation of the biological fluid even when said at least one pore is occupied.
2. The system according to claim 1, further comprising a plurality of electrodes arranged around said at least one pore, said electrodes forming one or more electrical circuits polarized by an AC electrical signal allowing the measurement of complex impedance variations between these electrodes, as soon as one or more cells are housed in or near a pore, the measurement of the variation of the complex impedance modulus and its phase allowing to discriminate the type of cells.
3. The system according to claim 2, wherein the AC electrical signal applied to the electrodes has a frequency such that an electric field created by the electrodes enables the capture or release of cells in the pores by virtue of the dielectrophoretic force generated between the electrodes.
4. The system according to the previous claim, wherein a polarization frequency induces a positive dielectrophoretic force during the capture so as to center the cells between the electrodes and to retain the cells in the pores.
5. The system according to claim 3, further comprising an inductor connected to the electrodes so as to form an electromagnetic resonator circuit,

the electrodes and inductor forming a circuit for detecting, preferably remotely searchable, the presence of trapped cells.

6. The system according to any one of the previous claims, wherein the
5 filtering membrane is made of a material selected from the group comprising glass or metal, e.g. Nickel, Gold or polymer, ferromagnetic material, magnetic material, e.g. NiFe, or the combination of glass and Silicon or Nickel and Silicon, Silicon Nitride, Silicon Oxide, Silicon or a biocompatible and non-toxic material.

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7. The system according to any one of the previous claims, wherein the pores are circular or oval or polygonal or slit-shaped, said pores being circular.

8. The system according to any one of the previous claims, wherein the
15 pores of the membrane are arranged in groups of several pores, each group having a pattern, and the groups can be connected to each other via a row of pores.

9. The system according to the previous claim, wherein the pattern formed
20 by a group has a shape: hexagonal, circular.

10. The system according to any one of claims 8 to 9, wherein the membrane comprises several groups of pores arranged in a square or star-shaped structure.

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11. The system according to any one of claims 1 to 10, wherein the pores of the membrane are randomly arranged.

12. The system of any one of the previous claims, wherein the filtration
30 means comprise a planar support comprising a recessed area in which the

filtering membrane is located, and in which said opening is formed, said opening being arranged at the periphery of the filtering membrane.

13. The system according to any one of the previous claims, comprising a
5 compartment in which the filtration means are housed, the compartment comprising an inlet module and an outlet module joined together to allow fluid to flow from the inlet module to the outlet module passing through the filtration means.

10 14. The system according to any one of the previous claims, comprising an inlet rack and an outlet rack, a blade supporting the filtration means, the inlet rack and the outlet rack being joined together so that the blade is between the inlet rack and the outlet rack to allow fluid to flow from the inlet rack to the outlet rack passing through the filtration means.

15 15. A capture assembly comprising a plurality of systems according to any one of claims 1 to 14, arranged in series, each system comprising filtration means adapted to retain one type of species.

20 16. A method for capturing cells circulating in a fluid, comprising a step of circulating a fluid in a system according to any one of claims 2 to 15, the method comprising a step of applying an electrical signal to electrodes having a frequency such that an electric field created by the electrodes enables captured cells to be captured or released from the pores by virtue of the
25 dielectrophoretic force generated between the electrodes.

17. The capture method according to claim 16, wherein a polarization frequency induces a positive dielectrophoretic force during the capture so as to center the cells between the electrodes and to retain the cells in the pores.

18. The capture method according to claim 16, wherein a polarization frequency induces a negative dielectrophoretic force to detach all captured cells, the frequency being typically at 1 MHz.
- 5 19. The capture method according to claim 16, wherein the frequency induces a dielectrophoretic force to selectively detach a cell type, the frequency being between 50 kHz and 150 kHz, preferably at 100 kHz for detaching the tumor cells.
- 10 20. The capture method according to claim 16, wherein a polarization frequency is increased in steps between 10 kHz and 200 kHz in order to detach the captured cells at different times depending on their dielectric properties.