

CLAIMS

1. Biological sample processing system comprising an imaging unit (2) comprising a
5 digital image processing system and at least one microscope including at least one lens (14),
a sample processing station (3) comprising a handling platform (3) including a support (17)
and a displacement mechanism for moving the support (17), and a sample processing unit
(7) mounted on the handling platform (5), the sample processing unit (7) comprising a tissue
10 slide holder (11) for mounting thereon a tissue slide (34) with a biological sample (36) fixed
thereon and a microfluidic cartridge holder (9) for mounting a microfluidic cartridge (4)
thereon, the tissue slide holder (11) coupled to the microfluidic cartridge holder (9) via a
coupling (13) allowing the microfluidic cartridge and the tissue support to be mounted and
removed from the sample processing unit in an opened position and in a closed position for
15 the tissue support (34) to be in sealing contact with the microfluidic cartridge (4),
characterized in that the sample processing station comprises a plurality of said sample
processing units mounted on the handling platform (5) and moveable from a position allowing
mounting of the tissue slide, respectively microfluidic cartridge, or removal thereof, to a
position in which a viewing window (19) in the microfluidic cartridge holder (9) is positioned in
20 alignment with the lens of said at least one microscope.
2. Biological sample processing system according to the preceding claim wherein the
microfluidic cartridge holder viewing window (19) comprises a recess (43) within which the
lens (14) is partially inserted in the imaging position.
- 25 3. Biological sample processing system according to any preceding claim wherein the
sample processing station (3) comprises at least three, preferably four or more sample
processing units (7).
4. Biological sample processing system according to any preceding claim wherein the
30 handling platform (5) comprises a rotating displacement mechanism for rotating the support
(17) between positions.
5. Biological sample processing system according to any preceding claim wherein each
sample processing unit (7) is coupled to at least one reagent supply tube and at least one
35 reagent outlet tube.
6. Biological sample processing system according to any preceding claim wherein each
sample processing unit comprises a clamping mechanism (15) including a locking

mechanism (16) and a pressure actuator (18) configured to apply pressure on the tissue support (34) against the microfluidic cartridge (5) in a closed position, the clamping mechanism comprising a compressed gas piston.

5 7. Biological sample processing system according to any preceding claim wherein each sample processing unit comprises a temperature control system including a cooling and heating system coupled to the tissue slide holder (11).

8. Biological sample processing system according to any preceding claim wherein the
10 microfluidic cartridge holder (9) and tissue holder (11) are pivotally coupled together via a hinge coupling (13).

9. Biological sample processing system according to any preceding claim wherein the microfluidic cartridge holder is in a form of a moveable lid and the tissue slide holder (11) in a
15 form of a base statically fixed to the support (17) of a handling platform (5).

10. Microfluidic cartridge for a biological sample processing system (1) comprising a substrate (6), a fluid flow network (8) formed within the substrate (6), a seal (10) mounted on the substrate, a cavity (29a) of a reaction chamber (29) formed in the substrate, and a
20 viewing window (12), the microfluidic cartridge configured to be placed against a tissue support (34) to cover said cavity and constitute a side of the reaction chamber (29), the reaction chamber thus being formed between the tissue support and microfluidic cartridge, the fluid flow network comprising an inlet (26), inlet channel network (27) and a plurality of chamber entry orifices (28), and the fluid flow network comprising further comprising an
25 outlet (32), outlet channel network (31), and a plurality of chamber exit orifices (30), the chamber entry orifices and chamber exit orifices arranged on opposed sides of the cavity of the reaction chamber for flow of reagents through the reaction chamber, the seal (10) surrounding the cavity of the reaction chamber (29) and chamber entry and exit orifices (28, 30), **characterized in that** the viewing window (12) comprises a transparent cover less than
30 1 mm thick and having an outer surface within a recess formed in the substrate of the viewing window (12) relative to an outer surface of the substrate (6), configured to enable a lens (14) of a microscope to be partially inserted in said viewing window recess.

11. Microfluidic cartridge according to the preceding claim wherein the transparent cover
35 (33) is made of glass or sapphire.

12. Microfluidic cartridge according to any preceding claim wherein the transparent cover has a thickness of less than 0.5 mm, preferably of less than 0.3 mm thickness.

13. Microfluidic cartridge according to any preceding claim further comprising spacer elements defining a height of the reaction chamber (29) when a tissue support (34) is placed and pressed thereagainst.
- 5 14. Microfluidic cartridge according to either of the two directly preceding claims wherein the spacer elements are arranged on an outer side of the seal with respect to the reaction chamber.
- 10 15. Biological sample processing system (1) according to any of claims 1 to 9 further including a plurality of microfluidic cartridges according to any of claims 10 to 14.