SARTORIUS

Cell Selection and Retrieval

CellCelector Sample Deposition

High-Throughput, High Viability Sample Deposition

- Standard and cooled destination deck trays
- Settings to maximize viability and efficiency during sample deposition
- Automatic tool sensors for uneven surfaces
- Robust cross-contamination control

CellCelector Destination Deck Trays

Scientists need flexibility in choosing the right environmental conditions for their specific life science research applications. The CellCelector Flex Platform provides two destination deck tray options, allowing users to select the temperature controls and configurations best suited to their needs.

Standard Destination Deck Tray
The standard destination deck tray contains a total of 8 positions: 4 slots for the storage of plastic tips or stainless steel capillaries, 2 slots for the deposition of picked objects, and 2 slots to store sterilization solutions or buffers required for picking.

Destination and buffer slots can be individually heated up to 45 °C to help maintain samples at physiologically relevant temperatures, with temperatures continuously measured and compared against target temperatures entered by the user.

Cooled Destination Deck Tray
The cooled destination deck tray contains 2 slots for picking tips, 2 slots for destination plates, and 2 slots for sterilization or buffer solutions.

Destination and buffer positions can be heated to 45 °C, whilst destination positions can be individually cooled close to 0 °C, minimizing any potential sample degradation for downstream single cell sequencing or enabling hydrogel applications.

Destination Deck Tray Positions for Tips and Capillaries
Racks containing plastic disposable tips for semi-solid media or stainless steel adherent colony capillaries can be loaded into each picking tip position (Fig. 1 – Red Positions). The software can be configured for racks containing different diameter stainless steel capillaries are loaded onto the destination deck tray and automatically select the most suitable capillary based on the particle size.

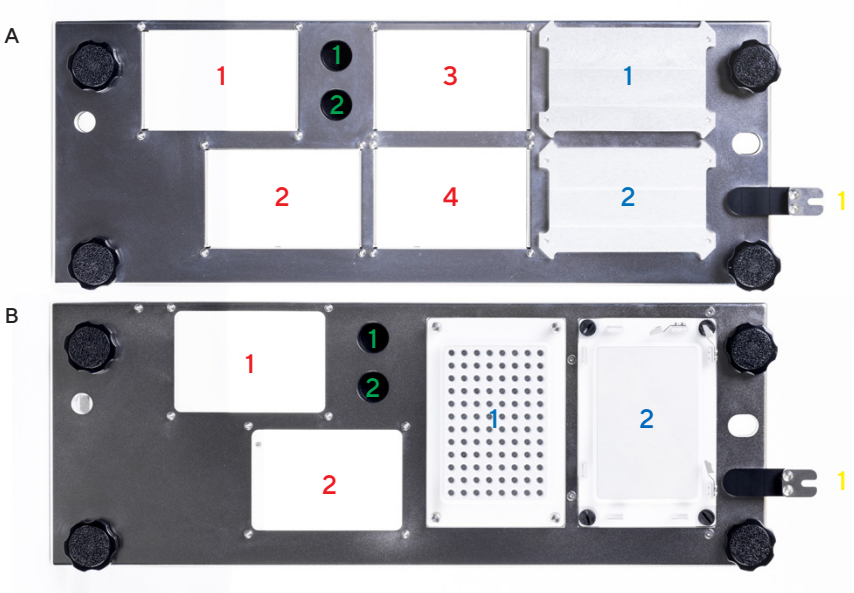

Figure 1: Top view of the (A) standard and (B) cooled destination deck trays.
Red numbers indicate positions for picking tips, capillaries or PCR tubes; Green numbers indicate heatable liquid positions for enzymes, medium, buffer or sterilization solutions; Blue numbers indicate destination positions for cell transfer. Both positions are independently heatable up to 45 °C on the standard deck tray, whereas the cooled deck tray can heat or cool each position to 45 °C or ~ 0 °C, respectively, independently of one another. Yellow numbers indicate positions where used plastic tips can be ejected.

Slots for Destination Plates

A wide variety of destination plates or slides can be selected (e.g. 6-well, 96-well, 384-well, glass slides) and placed within destination positions for subsequent cell transfer (Fig. 1 – Blue Positions). Cells can be deposited in a pre-configured order and deposit coordinates can be imported as csv lists. The software also controls the number of particles transferred to each well which can be useful for pooling pre-defined numbers.

Destination Deck Tray Adapters

A wide range of different adapters are available for both the standard and cooled deck trays to allow object deposition into a variety of different vessels. This can range from adapters to hold microfluidic chips, PCR tubes, or standard microplates.

The standard deck tray has the additional advantage that two positions for tips and capillaries can be converted into additional positions for destination plates. However, these two additional positions can not be heated or cooled.

Table 1 highlights all the available adapters for both destination trays.

Deposition Onto the Microscope Stage

Particles picked from source plates can also be deposited back into target wells or plates found directly on the microscope stage, making the real-time visualization of the deposited object immediately possible following transfer. Examples can include sample deposition between different wells of the same microplate, different glass slides, Petri dishes, or custom made vessels.

Deposition Onto the Destination Deck Tray

A number of settings can be adjusted to ensure maximum viability throughout the selection and transfer process, regardless of cell type or research application.

- **Dispensing speed at deposit** – the dispensing speed of the cell and buffer can be reduced to minimize cellular stress
- **Time after deposition** – can be altered depending on medium or hydrogel viscosity to ensure capillary contents are fully dispensed
- **Air gap deposition into the target well** – ensures that the total contents are deposited into a target well and can be varied depending on research application (Fig. 2)
- **Height above the plate during deposition** – calculated automatically depending on the target plate used (Fig. 3), or can be manually adjusted depending on the volume of media in each well.

Adapter	Deck Tray	Available Positions	Adapter Description
Microscope Slides	Standard	Target slots 1 or 2	Used to place up to four microscope slides or Ampligrids
96 well PCR plate	Standard	Tip slots 2 or 3	Used for 96 well PCR plates
F/U bottom plates	Standard	Tip slots 2 or 3	Used to place Flat or U bottom microplates
2 × 40 mm Petri Dishes	Standard	Target slots 1 or 2	Used to place up to two 40 mm diameter Petri Dishes
2 × 60 mm Petri Dishes	Standard	Target slots 1 or 2	Used to place up to two 60 mm diameter Petri Dishes
93 mm Petri Dish	Standard	Occupies target slots 1 and 2	Used to place one 93 mm diameter Petri Dish
F/U bottom plates	Cooled	Target slots 1 or 2	Used to place Flat or U bottom microplates
96 well PCR plate	Cooled	Target slots 1 or 2	Used for 96 well PCR plates or individual PCR tubes (0.1 mL or 0.2 mL)
384 well PCR plate	Cooled	Target slots 1 or 2	Used to place 384 well PCR plate
Microscope slides	Cooled	Target slots 1 or 2	Used to place up to three microscope slides
2 × WaferGen™ chips	Cooled	Target slots 1 or 2	Used to place up to 2 WaferGen™ chips
PCR tubes	Universal	Used to place individual PCR tubes (0.1 or 0.2 mL), PCR tube strips or tube lids. Includes container to be used with dry ice for passive cooling	

Table 1: Standard, cooled and universal destination tray adapters to facilitate use of a range of different destination vessels.

Direction of Destination Deck Tray Deposition

Objects can be deposited horizontally - row by row, or vertically – column by column. Wells can also be skipped, so that cells are only deposited into every second or third well.

Cells can also be deposited into multiple destination plates, which can be useful when building replica plates for stem cell colonies; with the number of deposited objects being configurable between wells, allowing for the pooling of cells.

Automatic Tool Sensors for Object Deposition

Many plate surfaces can be extremely uneven, making fixed deposition heights problematic. An automatic sensor on each of the picking modules can be used to interactively set the deposition height on a well-by-well basis (Fig. 2), so that the capillary tip remains at exactly the same height above the plate base for each deposit.

Robust Cross-Contamination Control

Following sample acquisition, deposition of both the medium and airgap from the glass capillary (Fig. 2) results in a completely empty capillary, with no requirement for any further sterilization.

However, several robust sterilization protocols can also be implemented during the picking run to completely negate any risk of cross-contamination between picks and provide user peace of mind.

Plates containing several sterilization solutions can be used throughout an assay, and semi-solid media plastic Precision Tips and adherent colony stainless steel capillaries can be automatically exchanged between picks to avoid any potential cross-contamination.

Single cell glass capillaries can be automatically sterilized between picks using 70% Ethanol, or any other sterilization solution of the operator's choice. Pre-defined volumes of sterilization solution are aspirated into the glass capillary and then dispensed back into the sterilization container, with the process being repeated according to the number of desired rinsing loops. Capillaries remain in the sterilization solution for a configurable amount of time before being removed, dried, and then moved to the next object to be transferred

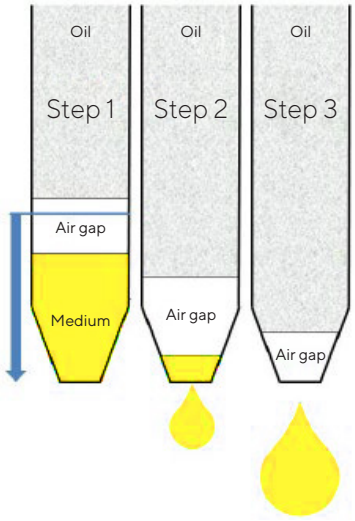

Figure 2: Impact of the airgap during cell deposition

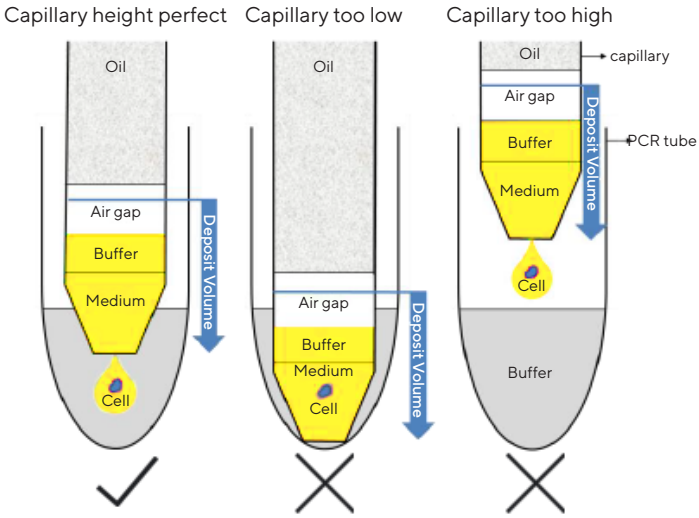

Figure 3: Optimal deposition height. Setting the correct deposition height is crucial for achieving the most gentle transfer possible, and can be easily faciliated using the automatic tool sensor

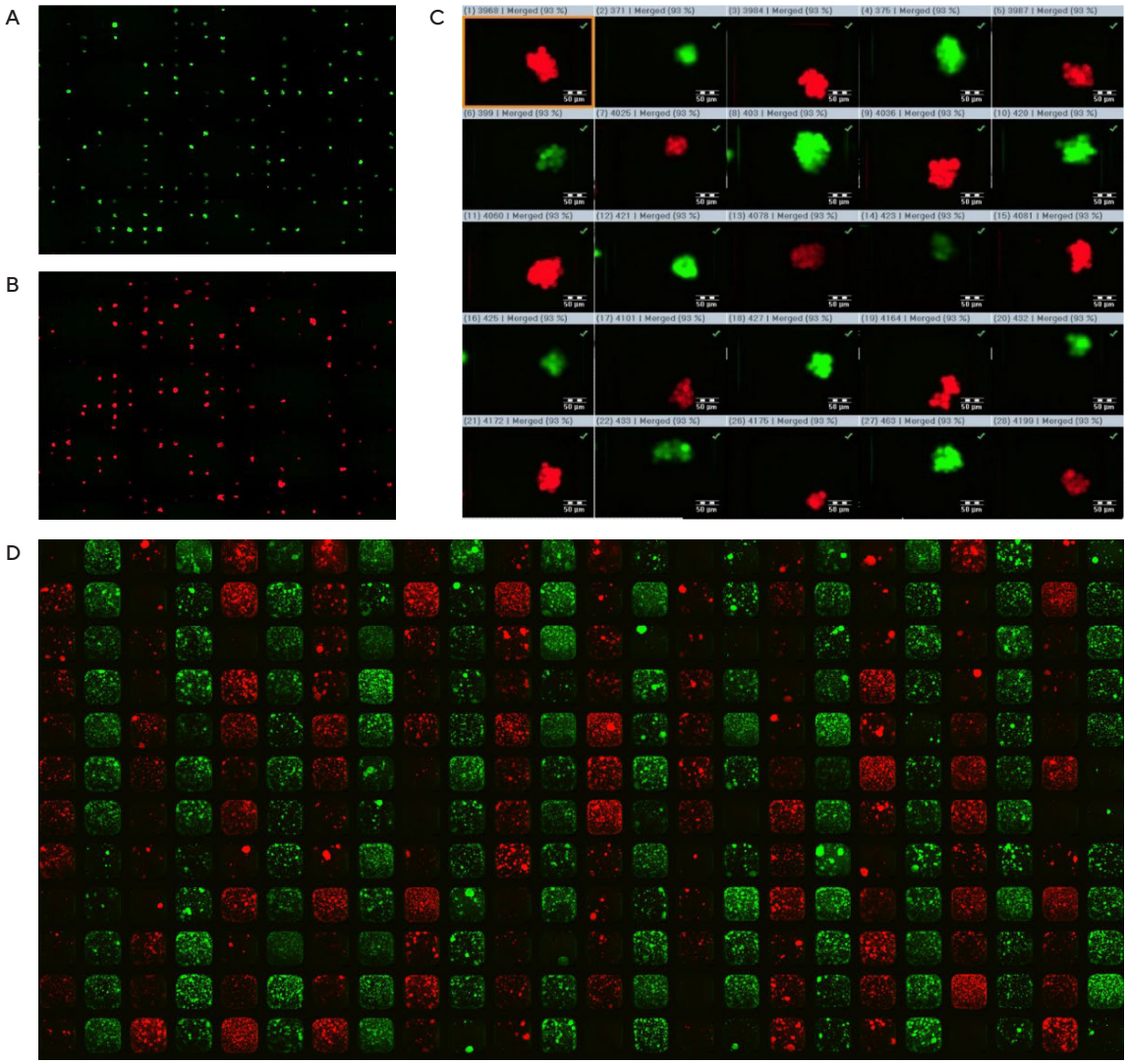

Figure 4: To determine the level of cross-contamination using single cell glass capillaries, (A) red fluorescent protein and (B) green fluorescent protein labelled colonies were picked one after another, with (C) picking visually confirmed on the CellCelector, and (D) colonies sequentially deposited into a 384-well plate. Colonies were grown for a further 7 days and then reanalysed using both fluorescence imaging and flow cytometry. No mixed colonies could be found in any well, indicating the complete absence of any cross-contamination. Experimental design and data courtesy of the National Research Council, Montreal.

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