

- 1 Placing a 6-well MTP plate under the microscope.
- 2 CellCultivator cultivates cells fully automatically. The integrated microscope monitors cell growth, thereby allowing optimum control of the culture process.

CELLMONITOR AUTOMATIC MICROSCOPE FOR CONTINUOUS CELL MONITORING

Industry and research are increasingly relying on automated protocols during cultivation of cells for performance of standardized cellular screenings. Observation and evaluation of the cell cultures play an important role in this case. A fully automatic microscope takes charge of inspecting the cells in the automated process. In combination with suitable pattern recognition, a large number of cells can be assessed objectively, rapidly and reliably in this manner. The result is greater efficiency, uniform cell status evaluation, optimum control and documentation of the culture process.

Automatic cell culture control

CellMonitor from Fraunhofer IPM is an automatic microscope with an intelligent image processing system developed at the Fraunhofer FIT for continuous monitoring of cell culture processes. It acquires, accor-

ding to needs, parameters such as, for instance, degree of coverage, fluorescence or morphological cell characteristics. Consequently, processes for each individual culture can be automatically controlled and optimized.

Cell culture conditions in the microscope unit

The reverse microscope functions rapidly and fully automatically – from transfer of the carrier plates onto the microscope stage, including focusing, lens change and activation of the light sources to image acquisition and processing. Multititer plates (MTPs) of various sizes are used as specimen carriers. Standardized cell culture conditions prevail in the microscopic unit (37 °C, up to 90 % relative humidity and 5 per cent CO₂ content). Special actuators maintain these specific conditions.

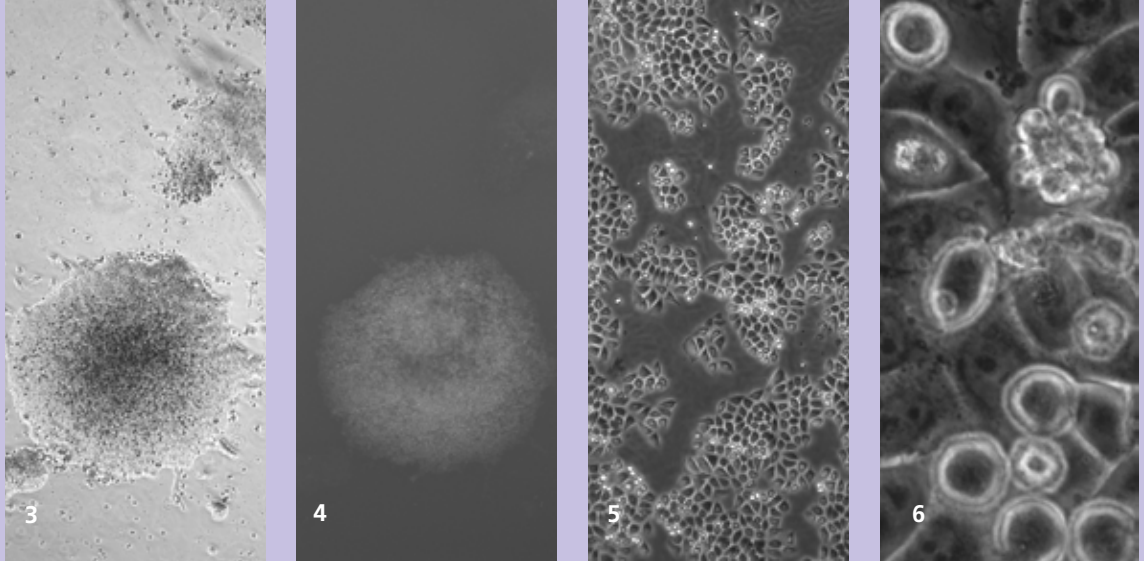
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Functions and options

Magnification, wavelengths for transmitted light and fluorescence tests are adapted to the respective application. Supplementations of the optics with spectroscopic units or 3D visualisation by holography are available on request.

Self-learning software

The microscopic optics combined with pattern recognition adapted to the specific culture allow condition-based processing of the cultures. The software can be trained by means of self-learning algorithms for determining the degree of coverage or the number of fluorescent cells, for example. The software's learning ability allows extrapolation of the processes to different cell types.

CellCultivator: fully automatic cell cultivation system

CellMonitor works on its own or in combination with automatic cell culture systems and is part of CellCultivator, a fully automatic modular system for cell cultivation which the Fraunhofer IPM has developed in conjunction with Fraunhofer IPA and FIT. CellCultivator can be flexibly adapted to existing processes and guidelines. The system consists of six modules: robotics for cell culture (IPA), liquid handling unit (IPA), automatic microscope with pattern recognition function (IPM/FIT), colony picker (IPA/IPM), airlock and storage incubator (IPA).

Technical specifications

Transmitted light with phase contrast option

Fluorescence with incident illumination

Maintenance-free illumination by high-power LEDs

Magnifications and apertures: 1.25x/0.04; 5x/0.12 und 40x/0.6

Hardware autofocus for rapid scanning

Complete scan of a 6-well MTP with 1.25x lens (approx. 200 images) within 4 min

Software autofocus for precise adjustment to specific image features

3–6 Overview images (1.25x), one with an adherent cell colony labelled with fluorescent protein (GFP) (3 transmitted light, 4 fluorescence); 5 scan (5x) of adherent HeLa cells (phase contrast); 6 HeLa cells in 40x resolution (phase contrast).