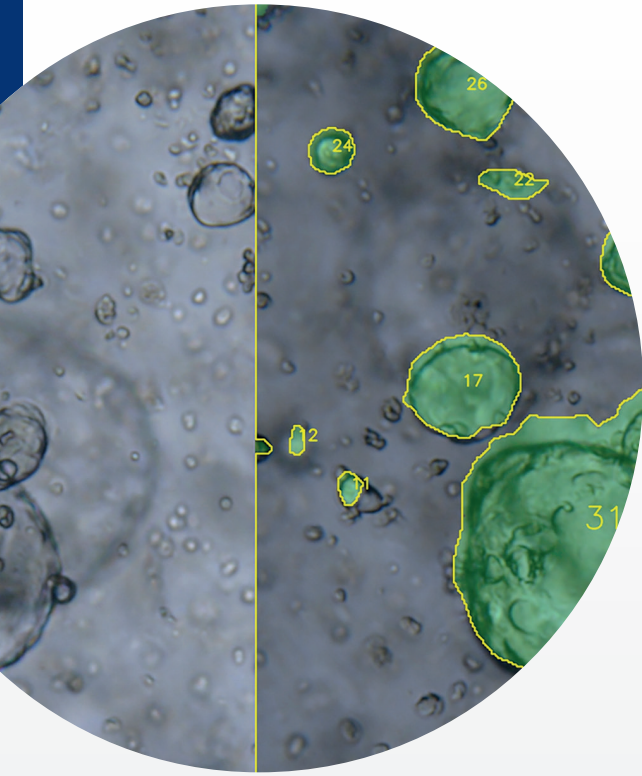# Countstar® Mira BF
Brightfield Cell Analyzer

Innovative All-in-one Design

3-fold Optical Zoom (5.0x, 6.6x, and 8.0x) combined with flexible consumable adapters

Learn more about Countstar® and the Mira BF

Impressive Internal Data Storage Capacity

With an internal 128GB large micro SD flash drive, you can store up to 50,000 measurements on the analyzer. The integrated search tools gives you a quick access to the database of results and images

Innovative Optical Zoom Technology

Offering three magnifications (5.0x, 6.6x, and 8.0x) and combining them with our patented Fixed Focus Technology, allows a unique look of cells and particles in the range from 2μm to 180μm, a first in this class of cell analyzers

Compact Dimensions

of the Countstar® Mira BF, 220mm x 285mm x 240mm (W x H x D), saves valuable lab bench space

Multiple Applications

Smart, preset, and customizable BioApps enable an uncomplicated and easy execution of experiments: Trypan Blue based cell density and viability analysis, precise object counts of particles, algae, spheroids, and yeasts, confluence studies, and analysis of organoids are only a few of possible applications on the Countstar® Mira BF

Advance, AI-based Image Analysis Algorithms

combined with our high-resolution CMOS 5 MP color camera and the all-new 3-fold optical zoom technology delivers you detailed images and precise analysis results

Economical Disposable Consumables

Our proprietary 5-cavity Countstar® chamber slides offer 250% higher capacity on the same footprint compared to classical 2-chamber chips. This allows for consecutive analysis of up to five samples, saving you time and costs, while reducing waste material

Intuitive Graphical User Interface

in combination with the 8 inch TFT touch screen allows for a detailed look of the monitored cells. The BioApp-based software menu makes it easy to operate the analyzer and gives access to a multitude of analysis features

Technical Features

1

T25 Mini Cell Culture Flasks

Dimensions: 25cm² bottom area

Applications: Confluence Analysis

2

Hemocytometer

Dimensions: 75mm x 32mm x 4.5mm (LxWxH)

Applications: Trypan Blue Viability / Cell Counting

3

8-Chamber μ-Slides

Dimensions: 75.5mm x 25.5mm x 11mm (LxWxH)

Applications: Organoid Analysis, Cell Confluence Studies

4

Petri Dishes

Dimensions: 35mm, 60mm, or 100mm in diameter

Applications: Organoid Analysis / Confluence Analysis

5

Countstar® Chamber Slides

Dimensions: 75.5mm x 25.5mm (LxW)

Applications: Organoid Analysis / Cell and Object counting / Trypan Blue Viability Assays

Adapters for Your Favorite Consumables

The Countstar® Mira BF Automated Cell Analyzer analyzes cells and particles using our proprietary Countstar® chamber slide. By switching to one of the alternative adapter plates, a standard hemocytometer of type Neubauer, Thoma, or Fuchs-Rosenthal can be used as sample carriers. With these adapters, the Countstar® Mira BF is also compatible with 35/60/100mm cell culture petri dishes and T25 mini cell culture flasks. The sliding adapter allows also the non-invasive, repeated analysis of 4-, 8-, 12-, or 18 chamber μ-slides for monitoring adherent cells, organoids, and 3D cell spheres during their cultivation. Future development of customized adapters may allow the analysis of more culture vessels.
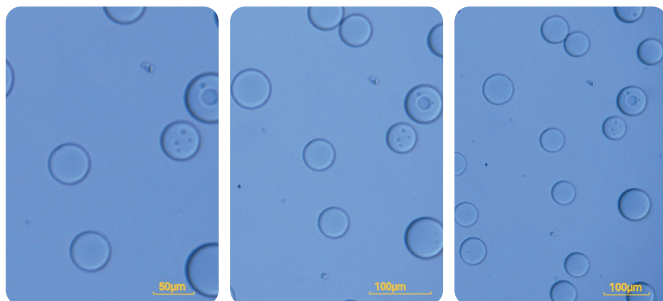
## Innovative, Optical Zoom Technology (5.0x, 6.6x, 8.0x)

The Countstar® Mira BF Automated Cell Analyzer uses the easily adjustable Optical Zoom Technology, which allows analysis of objects/cells in a range of 2μm up to 180μm. This flexibility will meet the needs of many researchers who want to analyze a wide range of cell species with a single instrument.

Innovative technical structure of the 3-fold optical zoom

The all new Optical Zooming Technology

5.0x 6.6x 8.0x

Cross linked agarose beads (approx. 45μm Ø) in 5.0x, 6.6x, and 8.0x magnification:
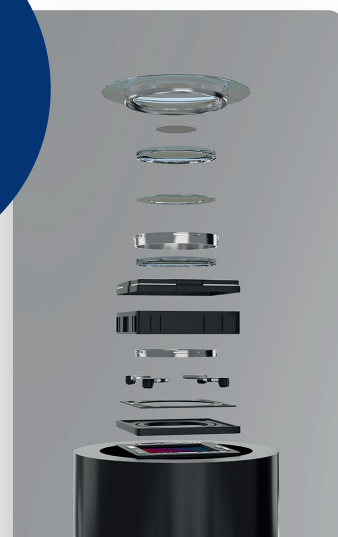
Pre-installed, Customizable BioApps Offering a Variety of Analytical Assays

The layout of the Android-based Graphical User Interface (GUI) of the Countstar® Mira BF allows for a simple and efficient user experience. A number of preset and customizable BioApps (assay templates), fitted to a variety of cell types, can be added and modified to meet current and future research goals. Using a BioApp requires a simple click of the desired BioApp, naming the sample, selecting the dilution, and a test can be performed, making the analysis simple and convenient. The design of the GUI streamlines any experiment and provides immediate and detailed access to the acquired hi-res images and multiple result data.

Assay management menu to edit, import, and copy the BioApps

Analyze various organisms using versatile BioApps (assay templates)
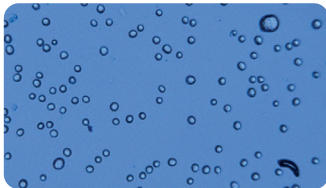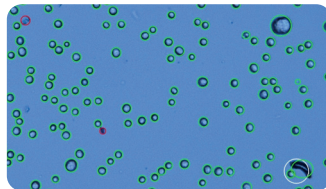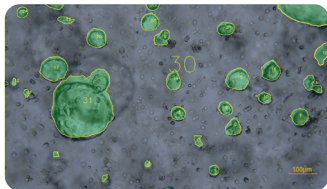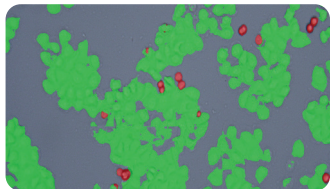

Mammalian cells

Fungis

Green algae

Selection of BioApps

Counting / Viability

Organoid Analysis

Confluence

Magnification	5.0x	6.6x	8.0x
ideal object size	> 10µm	5-10µm	2-5µm
Count/Viability	+/+	+/+	+/+
	MCF-7	T-Lymphocytes	—
	HEK293	Brewer's yeast	*Chlorella sp. FACHB-8*
Typical sample organisms	Mesenchymal Stem Cells	Embryonal Zebrafish Cells	—
	Intestinal Organoids	—	—
	iPS Cell Spheres	—	—

AI-based Image Recognition Algorithms

The AI (Artificial Intelligence) based, self-learning image analysis algorithms of the Countstar® Mira BF are capable of accurately identifying and quantifying small aggregated suspension cells, organoids, and a wide variety of adherent cells. Beyond that, the Countstar®

Mira BF offers a wide range of analysis functions by providing the ability to analyze organoids, 3D cell spheres, and other, 2-180µm large dimension particles. The powerful imaging capabilities of the Countstar® Mira BF allow customized solutions based on future needs.

Result Output, Data Storage, and Export

The intuitive software of the Countstar® Mira BF gives an easy access to all acquired images and result data. Sorted in the Assay (BioApp) data library by date and time, a selection of the desired experiment is done by a few clicks on the touch screen. The internal storage capacity of 128GB enable the operator to store up to 50,000 tests.

Beyond standard results such as cell concentration, viability (mortality) rate, diameter, roundness, and agglomeration rate, the Countstar® Mira BF can determine and display the cell culture confluence status, the rate of adherent cells, the number of organoids, their sizes, and their central light transmittance. Diagrams, generated inside the software, will visualize the results of the experiments.
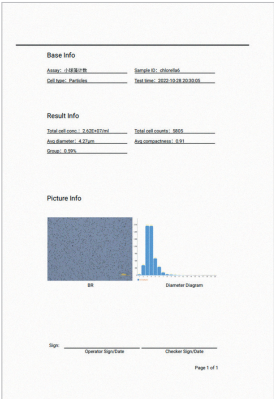
Analytical tools and the hi-res images visualize the cell growth status and the cell size distribution to optimize cell culture conditions. Export tools for images, csv data, and pdf reports are integrated for an advanced experiment analysis.

High resolution images paired with analytical data will help to better understand the dynamic changes of a cell culture and to optimize the growth conditions
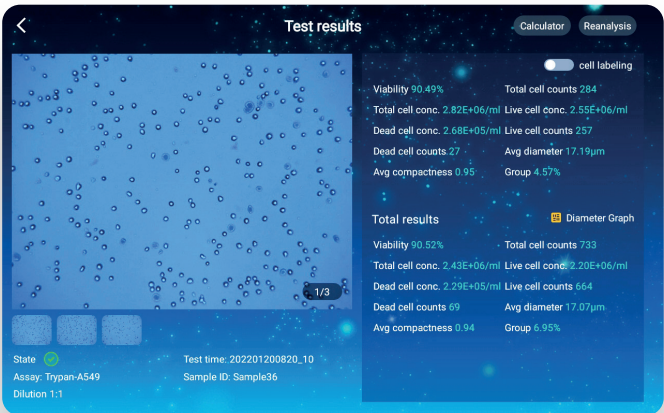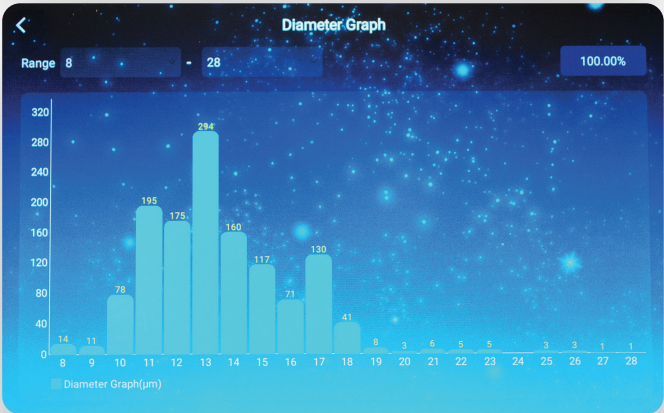

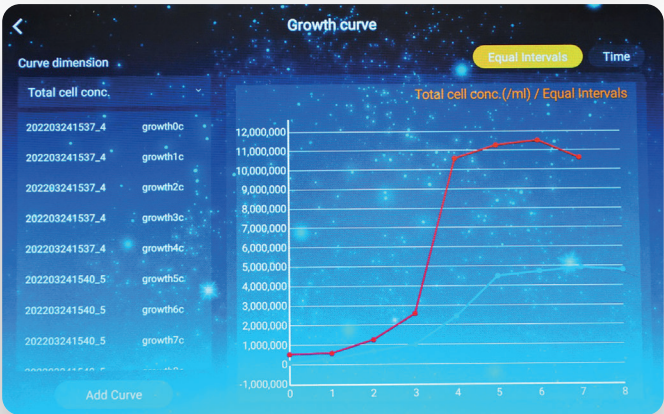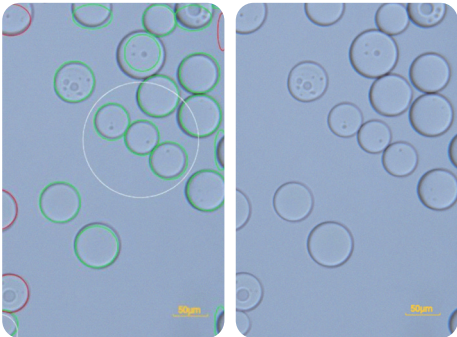*Overview menu showing results of a single analysis*

Automatically generated diameter distribution histogram of a selected sample

*Comparison of growth curves of two similar cultivation experiments*

Output Formats

MS Excel tab sheet

PDF report

Labelled / Original Images

System Operation

Fast and Intuitive Handling

The experiment preparation menu: Select one or more chambers, enter the corresponding sample ID, define the used dilution and click on Start - a convenient and time-saving analysis experience, completed in less than 20 sec.
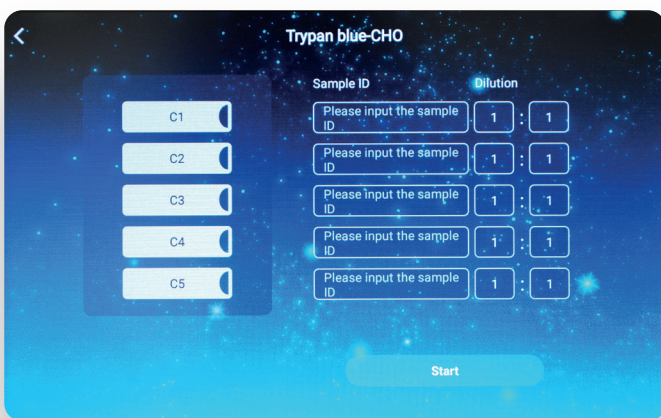
Test Preparation Menu

The consumables management library allows a quick selection of the appropriate sample carrier for a Bio-App. The focus data for the consumables are already pre-registered. New consumables with different geometry can be added to this library, and their focus layer value can be easily determined in the Manual Analysis menu.

The preset experiment protocols in the BioApp library do not require any user interaction during the analysis. Up to five chambers can be analyzed consecutively. Up to three (3) regions of interest can be acquired in a single chamber of a Countstar® Chamber slide to optimize the assays's accuracy and precision.

Consumable Management

Running a Sample

- Select a BioApp on the screen
- Select a chamber, Sample ID and dilution
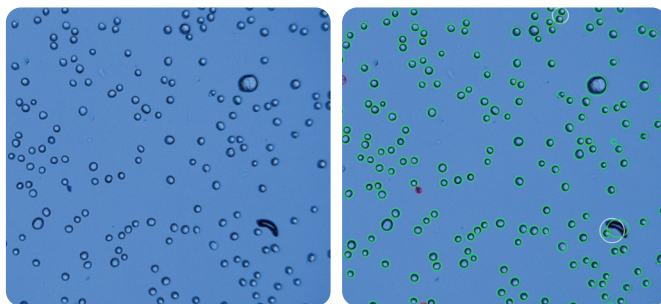- Click "Start" to initiate the imaging

Versatile: Powerful BioApps for Various Cell Types

Histogram of a concentration gradient, using MFC-7 cells, stained by Trypan Blue. Five aliquots of each dilution step were analyzed in the Countstar® Mira BF.

Coefficient of variation (cv) of the five (5) aliquot results per single dilution step. All values of the single gradients are below 5%.
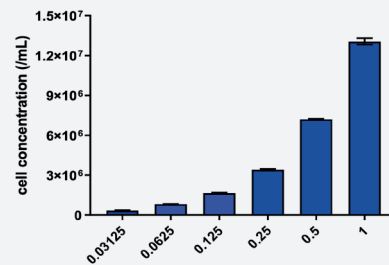
Trypan Blue BioApps

The classical Trypan blue staining method is one of the most commonly used identification method for the classification and quantification of viable and dead cells inside mammalian cell cultures.
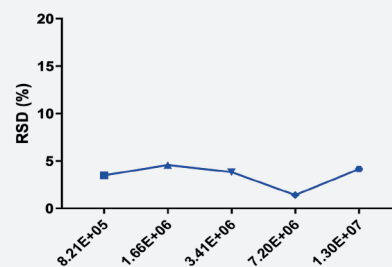
Due to the intact membrane structure in living cells, the Trypan Blue dye will be prevented from entering a cells cytoplasm. Dying cells that lose activity and whose membranes get disintegrated cause a permeability for the stain Trypan Blue. The intensive staining of the cells interior allows for a clear, reliable, and fast discrimination between the living and dead cells.
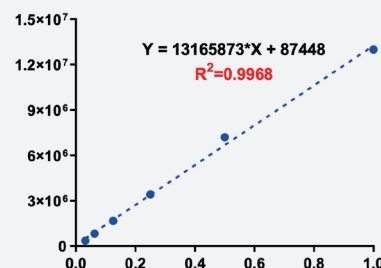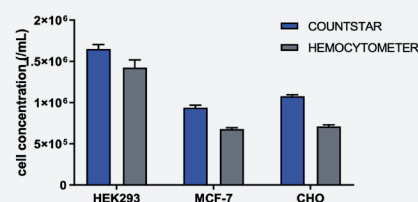

$$Y = 13165873*X + 87448$$
$$R^2 = 0.9968$$

Linear regression of the MCF-7 concentration gradient, confirming a nearly perfect execution of the dilution series with an R-value of > 0.99.


Comparison of the Countstar® Mira BF results with manual hemocytometer counts. Three mammalian cell lines were analyzed (HEK293, MFC-7, and CHO).

HEK 293 cells, stained by Trypan Blue. Left: Original acquired image; Right: Labelling by the AI image recognition algorithms:
green: viable cells; red: dead cells, white: agglomerated cell complexes

Versatile Object Count BioApps

The selectable 5.0x, 6.6x, and 8.0x optical zoom options of the Countstar® Mira BF automatic cell analyzer allows the operator to detect and quantify the concentration of small-sized (2-8 µm) particle suspensions such as Chlorella algae and Pichia fungi.

At the same time, the AI-based image recognition algorithms can quantify and qualify a wide range of samples with irregular morphology or unusual cell formations like budding Saccharomyces yeast or cell spheroid-forming clusters or filaments.
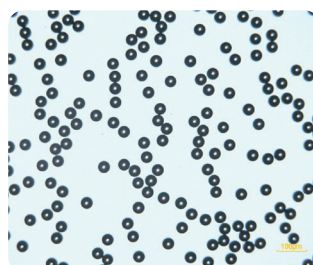
Compared to manual counts, the Countstar® Mira BF also obtains more accurately the concentration and dimensions of large objects such as porous glass microcarriers or polymer-based particles to meet the laboratory needs of a wide group of researchers.
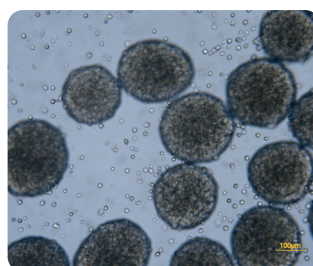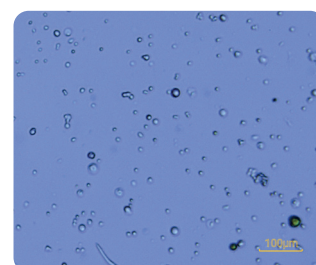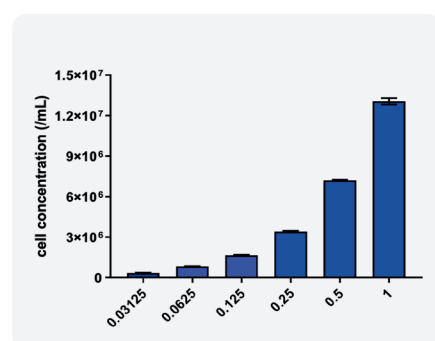

iPSC-based spheroids
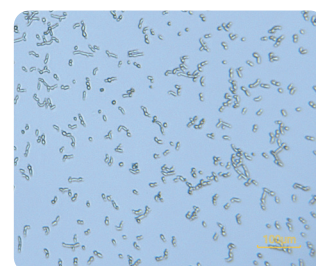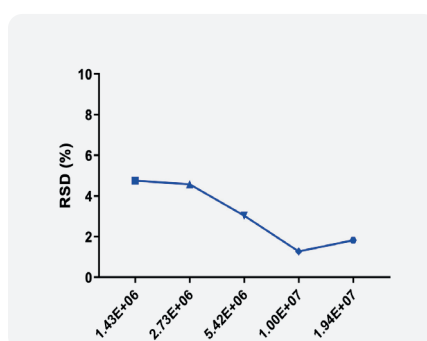

Yeast Pichia pastoris
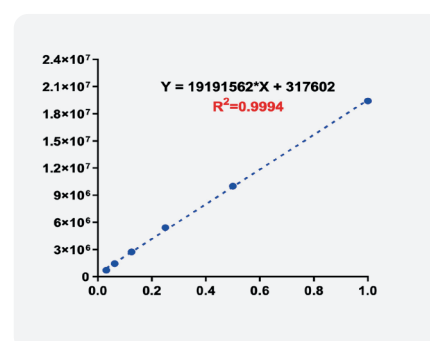

40µm monodisperse particles

Embryonic Zebrafish cells

Histogram of counts of a concentration gradient with common Chlorella (FACHB-8)

Coefficients of variation of the dilution series. Five aliquots of each dilution were analyzed. All cv values are below 5%.


Linear plot of the concentration gradient. The regression coefficient is above 0.99

The Countstar® Mira BF is equipped with BioApps enabling each user to quantify organoids derived from enzymatic digestion of tissue in a sample. Using the proprietary Countstar® chamber slides, three (3) to five (5) different fields of view can be acquired per single chamber. This increases the sample volume monitored, resulting in a higher accuracy of the test data.

Indicators such as the number of organoids, the area covered in the view frame, the average area of the organoids, the cell's average diameter, shape factor (roundness), the number of cells and the total area can be measured. A diameter distribution histogram and an area distribution histogram for each image can be generated in the Countstar® Mira BF software.

Growth curves help in visualizing the effects of nutrition supply to determine the ideal point of a passage and the response time to drugs by organoids.
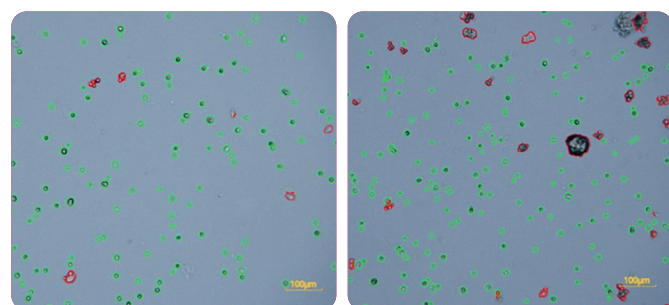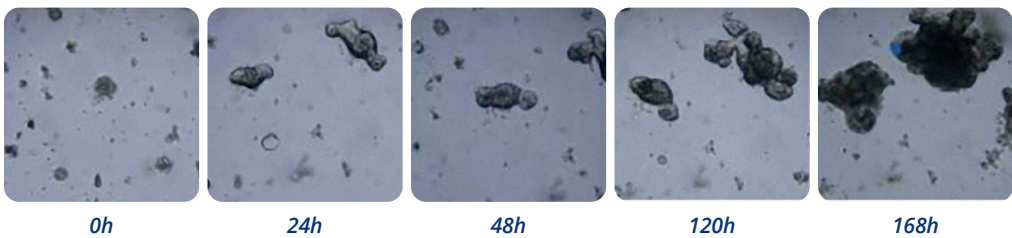

Small (digested) organoids of a mouse model (low density). Left: directly after digestion; Right two days later. The red circles mark an organoid, green circles individual cells.

Organoid BioApp

Stem cell derived 3D Cyst-Bud formation in a mice model – scheme of proliferation and organoid structure development:
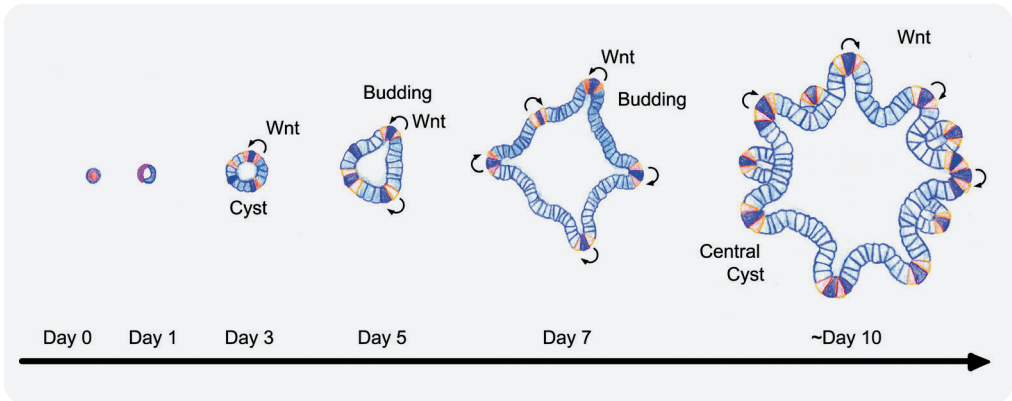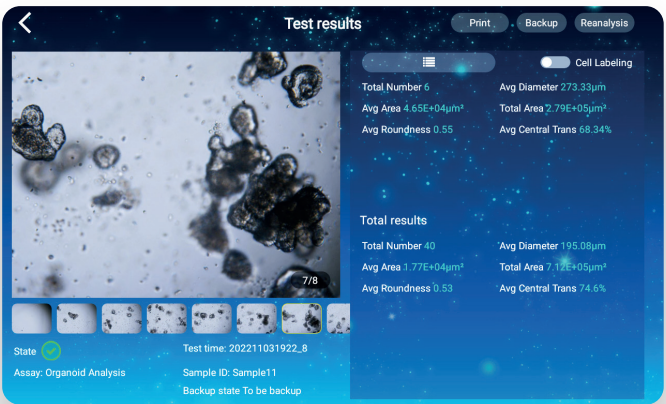

Development of intestinal mice organoids, repeatedly observed in a 4-chamber μ-slide (ibidi) by the Countstar® Mira BF over 168 h:

| 0h | 24h | 48h | 120h | 168h |

Detailed analysis of the amount and the morphological changes in a cultivation of organoids has become an important field of research in the development of cell-based assays, in drug screening, and cell culture quality control.

The BioApps of the Countstar® Mira BF will analyze six (6) important parameters – the number of organoids, average area, average circularity, average central transmittance, diameter distribution of organoids, and growth behavior – all obtained by imaging and analyzing them over the complete time span of the experiment to monitor the growth and differentiation of organoids.

In the "Observe and Take Pictures" mode, the user has the ability to select manually the field of view and adjust the focus layer of the vessel bottom.

The Countstar® Mira BF captures the images in the selected areas, analyzes subsequently those images to determine the number of organoids in the region of interest. In addition, the diameter of the organoids, the total area, the center transmittance of the cell clusters, and their shape factor (roundness) are analyzed as specific indicators of the observed organoids.

Result view of the organoid analysis. Each classified organoid gets an individual number, referring to the detailed result list in the menu.
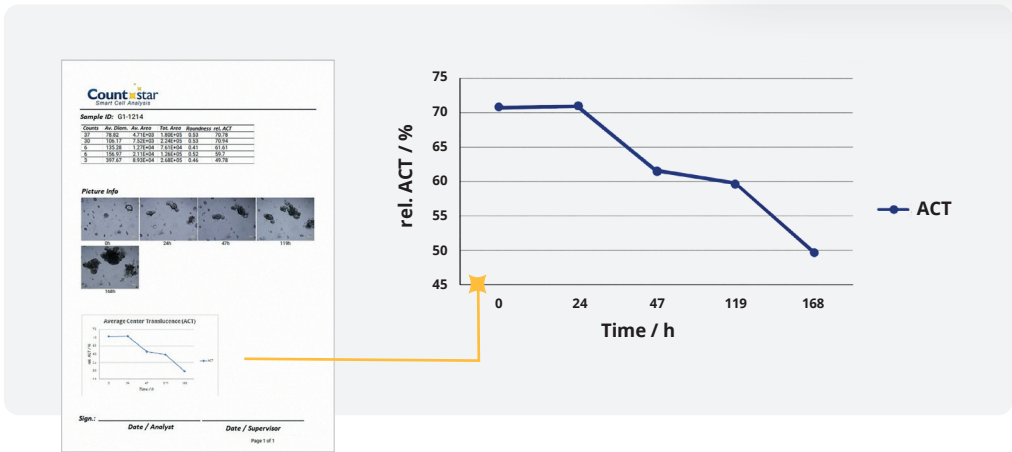

Pdf report of a organoid study, summarizing images, data, and the ACT graph
Average center light transmittance (ACT) of the observed mice organoids: The graph represents the relative brightness of the organoids center. It characterizes the maturity of the organoids. While the intestinal organoids grow and maturate, their average transmittance values in the center gradually decrease.

Confluence BioApp

Example: Confluence analysis of HEK293 cells, grown in 10cm cell culture petri dishes over time is shown below. A threshold of cell confluency (percentage of the area covered by cells in relation to the possible total growth area), is usually defined to assess the timing of the cells passaging. Precise timing is critical for maintaining the cell phenotype and culture quality.

The Countstar® Mira BF Automated Cell Analyzer features the ability to analyze the confluency of adherent cells grown in petri dishes and T25 flasks. Using innovative, artificial intelligence (AI) based image recogni-

tion algorithms, the adherent cell area and the non-adherent single cells are marked to obtain the confluency and adherence rate simultaneously. The evaluation of the cell proliferation by generating a growth curve in the software provides a new method for precise and accurate assessment of different cell lines.
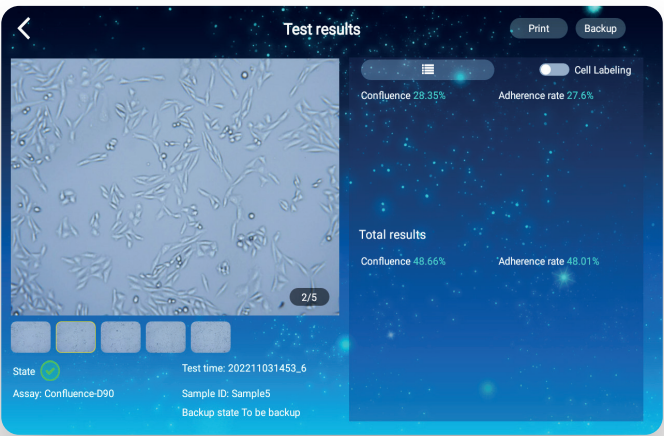
Result view of a confluence analysis of HEK293 cells, grown over 72h in a 10cm cell culture dish

12h

46h

80h
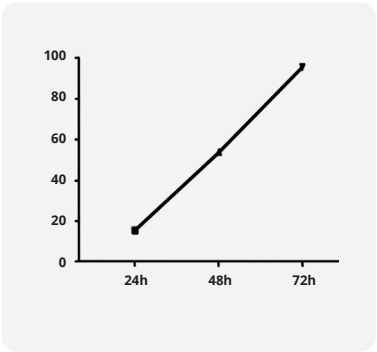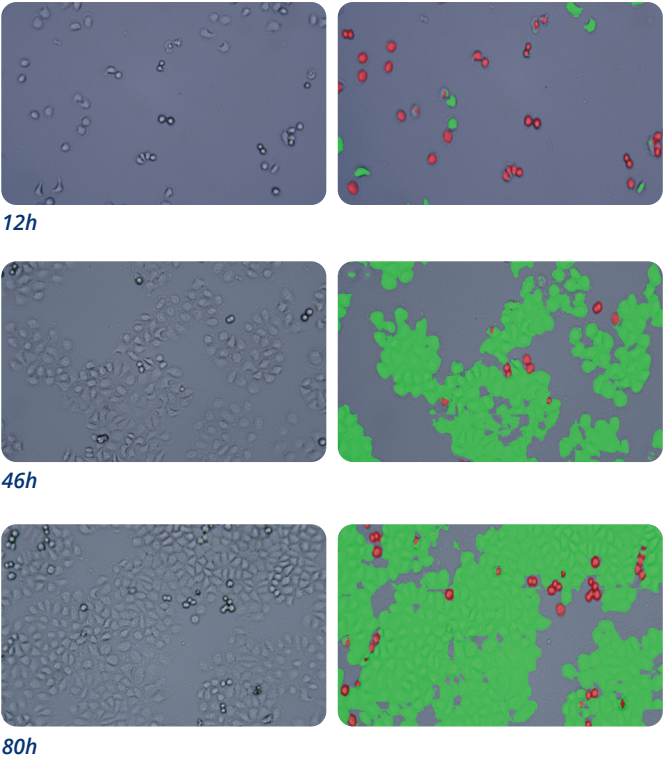
HEK293 cell three-day confluence study showing the original (left column) and labelled (right column) images. Above the corresponding confluence progression graph is displayed, that can be generated directly in the DATA module of the Countstar® Mira BF software. The graph describes the duplication rate of the cell monolayer over time, providing quantitative and qualitative parameters about the cell's vitality.

Technical Specifications

Diameter Range of Detectable Single Cells	2-180µm
Max. Detectable Organoid Diameter Range	≤ 800µm
Overall Concentration Range	1×10^4 - 3×10^7 cells/mL
Optimal Conc. Range (cv < 5.0%)	5×10^5-1×10^7 cells/mL (5.0x mag.) 1×10^6-2×10^7 cells/ml (6.6x magn.) 1×10^6-3×10^7 cells/ml (8.0x magn.)
Optical zoom	5.0x, 6.6x, 8.0x
Camera system	5 MP CMOS color camera
USB interface	2x USB 2.0 (FAT32 format of external storage device is required)
Internal Storage Capacity	128GB (up to 50,000 tests)
Power Requirements	110-230V/AC, 50/60Hz
Screen Size	8 inch, glove sensitive touchscreen
Display resolution	1280x800 (HD)
Weight	4 kg
Dimensions (WxDxH)	240x220x285mm
Exchangeable Adapters	Three-in-one adapter (Petri Dish, T-Flask, Hemocytometer) Slidable adapter (Microscope Slides, µ-Slides)

Ordering Information

Product Description	Model name	Article numbers
Automated Image Based Cell Analyzer	Countstar® Mira BF	05 14 01 01 0001
Object Carriers (50 pcs./box)	Countstar® Chamber Slides	00 00 02 04 0010
Staining suspension	0.2% Trypan Blue (20ml)	00 00 02 01 0112

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