

From Ideas to Insights:
Cell Culture Tools and Technologies
to Accelerate Discovery



Introduction

You must trust that all components of your experiments are working at optimal performance for maximum confidence in your results: cell cultures, consumables, measurement instruments, equipment, and software.

Your success is determined by everything working together: good experimental design, as well as all of the direct and indirect variables that can influence your results. Maximize control over these influencing variables, and you will improve your ability to go from ideas to insights.

Maximize control and minimize experimental artifacts in your cell cultures by carefully attending to details and using tools such as:

- The right grade of purified water for media preparation
- Functional and calibrated instruments, equipment, and consumables, including pipettes, balances, non-leaching housing for filters, and sterile pipette tips
- Software with easy-to-use and efficient built-in and customizable analysis capabilities

From the simplest foundational elements to the most sophisticated, elegant technologies, Sartorius offers a robust portfolio of solutions to help your cell cultures thrive and deliver the data you seek.

Application Spotlights



Contamination Control

Contamination with various organisms, predominantly mycoplasma and other bacteria, is by far one of the most commonly encountered issues within cell culture laboratories.

Ensure your cultures are maintained at a high level of integrity by using Sartorius contamination control and monitoring solutions.

See solutions beginning on page 5.



Passaging Cells

Cell passaging is a time when your cell culture is incredibly vulnerable: the cells are trypsinized, centrifuged, pipetted, and transferred. These processes expose them to conditions that could potentially be detrimental to their integrity and growth.

Make sure your cells survive each passaging with Sartorius tools for safe and gentle handling of cell cultures.

See solutions on page 6.

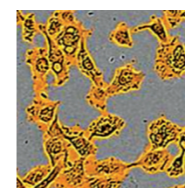


Protein Purification

Protein purification is often challenging because the protein can be degraded, precipitated, or otherwise lost at any step during a multi-day purification protocol, resulting in the loss of both time and precious materials. Increase the chance of retaining your pure and concentrated protein by using the most appropriate tools for protein purification, which helps decrease the length of the protocol or eliminate steps altogether.

Ensure maximum concentration of pure proteins by using Sartorius's protein purification solutions.

See solutions beginning on page 9.

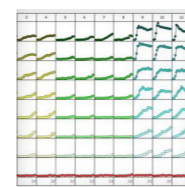


Cell Characterization

Biological heterogeneity (phenotypic, genotypic, and functional) in cell culture is a natural phenomenon that needs careful monitoring. Tracking changes in the culture manually introduces the possibility of human error, and does not support timely and objective data capture. The ability to properly characterize the dynamic properties of cells quickly and confidently generates better results, and keeps your experimental momentum going.

Move confidently from ideas to insights by using Sartorius's innovative cell characterization solutions.

See solutions on page 11.



Identifying Relevant Biology from an Image Set

Raw data must be processed through multiple steps before statistics may be meaningfully applied to the dataset. Images must be processed to remove systematic and sample-related artifacts. Then, identification of relevant biology is done through appropriate image segmentation. In the simplest method for image masking, called "thresholding," pixels are analyzed if above, or disregarded if below, a specific threshold. More complex interactions may also be analyzed with specialized algorithms. These analyses can be time-consuming and subjective. To address this, purpose-built software for data analysis relevant to a specific scientific question can make the process both faster and more objective.

See solutions on page 13.

Preparation

Build your research on a solid foundation to ensure that every day's results are reproducible, actionable, and publishable. Cell culture requires strong aseptic technique, safe methods for freezing, thawing, and passaging cells, and the right tools and technologies to maintain cell health and integrity.

Sartorius offers solutions to help ensure that:

- Cell cultures are not contaminated with mycoplasma, other bacteria, fungi, or even other cell types
- Water used for media and buffer preparation has been purified properly
- Cells are passaged at the most appropriate time, confluence, and developmental stage
- Samples are prepared in a manner that promotes a high survival rate and accurately represents the larger population

Contamination Control Solutions

arium® Ultrapure Water System for cell culture buffer and media preparation: a modular, intuitive pure water filtration system

For cell culture applications, such as media preparation, the use of Type 1 water, which is endotoxin, RNase, and DNase free, is essential. Sartorius offers multiple modular systems, optimized for your daily volume consumption. Equipped with ultrafiltration technology, arium pro UF and arium mini combined with CellPlus Ultrafilter fulfill your ultrapure water needs.

Key Advantages:

- Purity: Obtain the purest water possible with arium ultrafilters, which reliably remove endotoxins, RNases, and DNases
- Ease-of-use: Navigate the menu intuitively with easy-to-use touch display
- Flexibility: Enjoy the modularity of the arium water system that can be tailored to your application and integrated seamlessly into any lab



Microsart® RESEARCH Mycoplasma and Bacteria Detection Kits: fast, effortless contaminant detection for confidence in the integrity of your cell culture

Real-time PCR kits optimized for fast and reliable direct screening of cell cultures, cell culture supernatants, and media.

Key Advantages:

- Speed: Get your results in less than 3 hours with real-time PCR-based detection
- Ease-of-use: No DNA extraction or other sample preparation required
- Comprehensive results: Test for mycoplasma and bacteria in the same qPCR run
- Confidence: Ensure the highest level of qPCR specificity through use of TaqMan® probes
- Internal control included: With duplex real-time PCR using FAM® and ROX®, the DNA sequence for internal control is included in the ready-to-use master mix



Sartolab® RF/BT Vacuum Filtration Units: sterile filtration with high flow rates and low protein binding for maximum efficiency and purity

Ready-to-use filtration units for sterile filtration of culture media and components. The large filtration area and optimal design guarantee high flow rates with high total throughput. Sartolab® RF/BT filtration units are designed for vacuum filtration of volumes from 100 mL to 1 L.

Key Advantages:

- Sample retention, greater confidence in results: Minimize sample loss and reduce the risk of false or variable results with Sartolab RF/BT low protein binding and low extractables
- Maintenance of protein integrity, faster flow rates: Reduce foaming and protein denaturation and accelerate your filtration with faster flow rates enabled by support grid and asymmetric Polyethersulfone (PES) membrane



TaqMan is a registered trademark of Roche Diagnostics GmbH. FAM and ROX are trademarks of Applied Biosystems.

Cell Passaging Solutions

Minisart® Syringe Filters: fast, sterile filtration for media additives and lower-volume applications

Innovative design features, large surface areas, and fast flow rates make Minisart® syringe filters the ideal choice for sterile filtration and clarification of media additives and drugs.

Key Advantages:

- Speed: Rely on high flow rates for fast filtration and secure removal of bacteria with Minisart's 6.2 cm² effective filtration area and slightly asymmetric PES membrane structure
- Confidence: Experience reductions in interference and variability, and minimize risk of inaccuracies in your results, due to low absorption



Tacta® and Picus® Pipettes and SafetySpace Filter Tips: ergonomic, reliable design for accurate, reproducible liquid dispensation

Sartorius pipettes, both mechanical and electronic, are used across the globe in research institutes, universities, healthcare, and industrial laboratories to gently handle cells during passage and to deliver accurate volumes during plating. They are known for their user friendliness and accuracy, as well as their attractive, yet practical, design.

Key Advantages:

- Obtain reproducible results with repeatable pipetting
- Prevent cross-contamination between samples
- Ensure no sample is lost
- Avoid leakage with perfect fit between the tip and the pipette
- Minimize repetitive strain injury

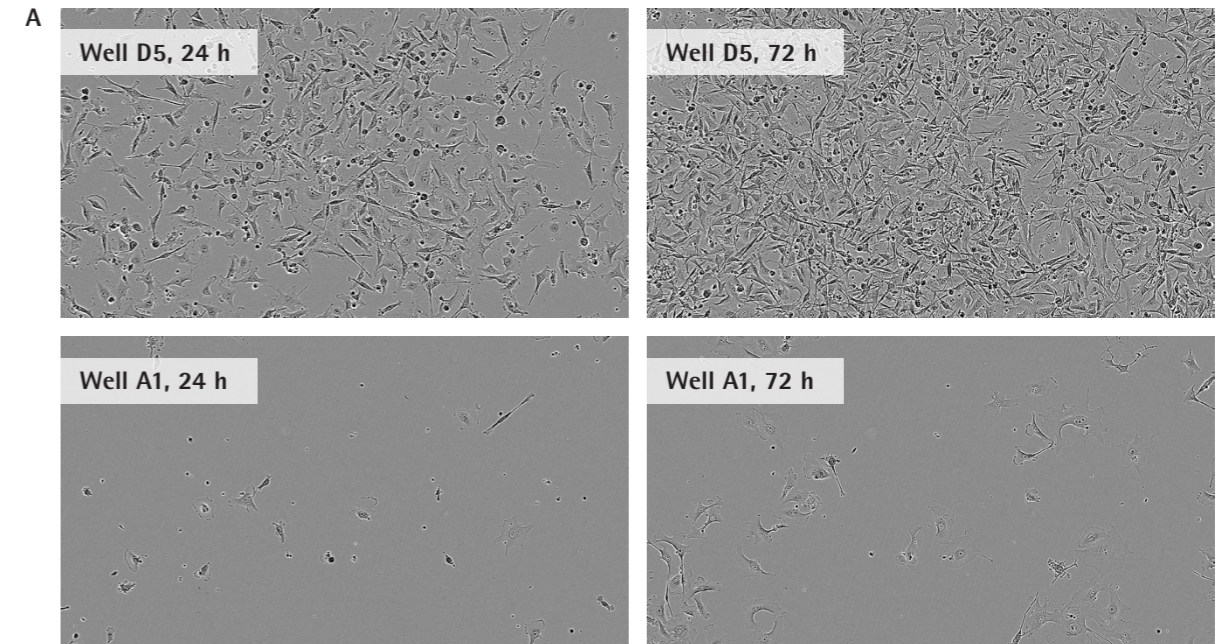


Midi Plus Pipetting Controller: accurate, gentle liquid and cell handling at larger volumes

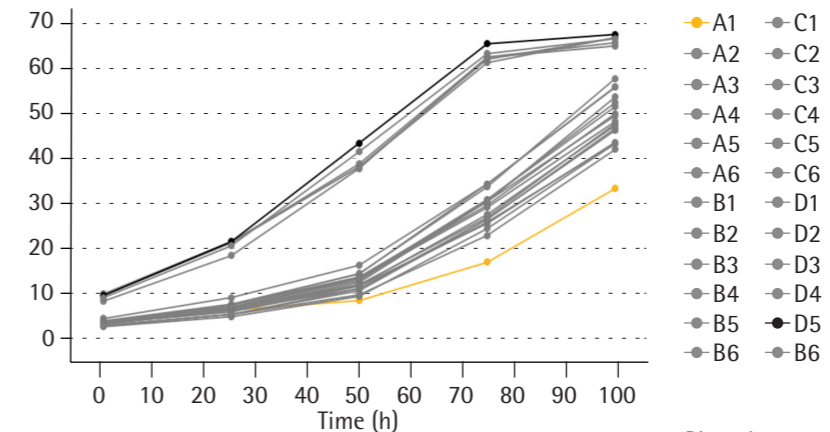
A lightweight electronic pipette controller, Midi Plus allows you to seamlessly work with larger volumes during cell passaging.

Key Advantages:

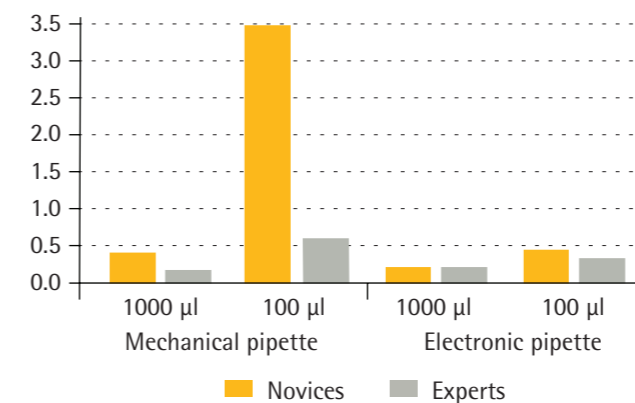
- Fast yet gentle: Aspirate and dispense cells as rapidly and as gently as you choose with stepless speed control
- Mobility and flexibility: Remain mobile, even during cell plating, due to cordless operation



B Growth vs. time for untreated MDA-MB-231 cells using conventional pipetting technique in a 24-well plate



C Mechanical vs electronic pipette % random error



Pipetting accuracy and precision impact uniformity of cell culture confluence.

A 24-well plate seeded at the same cell density using conventional pipetting technique.

A: Disparity in confluence between wells A1 and D5 is shown in these representative images using the IncuCyte imager at 24 and 72 hours after seeding.

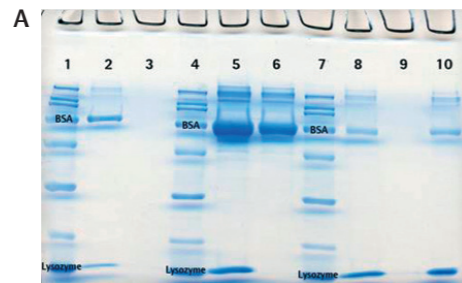
B: Up to 50% variability between the wells is shown with these growth curves, including all 24 wells analyzed using IncuCyte software. Wells A1 and D5 are highlighted in different colors and bolded.

C: Pipetting error depends on experience level as well as on the type of pipette used.

Experiment

You work hard to design the best experiments to test your hypotheses. On the days you are performing these crucial experiments, you need everything in your laboratory to work reliably. Whether you are running time-course experiments, analyzing protein expression, or doing any number of other manipulations with your cell culture, everything in your lab must work impeccably to deliver data you can trust.

To help you translate your ideas into insights, we offer a diverse portfolio of cell culture tools and technologies.



B Task	Time	Recovery
Vivaflow® 200 set up and run through	1 h 25 min	100%
Vivaflow® 200 Diafiltration set up and run through	1 h 20 min	100%
Vivapure® purification	45 min	95%
Vivaspin® Lysozyme desalting concentration	30 min	97%
Total	3 h 45 min	92%

Achieving protein purification by concentration, buffer exchange, and ion exchange membrane chromatography.

A: Coomassie-stained SDS gel loaded with samples from protein (lysozyme) purification steps using Vivaflow, Vivaspin, and Vivapure. Lanes 1, 4, 7: Marker. Lane 2: Original sample, BSA and Lysozyme added to RPMI. Lane 3: Filtrate after concentration with Vivaspin, no protein leakage into the filtrate. Lane 5: Concentrate after buffer exchange with Vivaspin, protein concentrated 10x. Lane 6: Filtrate after cation exchange using Vivapure, all lysozyme is bound to Vivapure. Lane 8: Eluate after cation exchange using Vivapure, Lysozyme eluted from the Vivapure membrane. Lane 9: Filtrate after elution from Vivapure, no Lysozyme remained on the Vivapure membrane. Lane 10: Concentrate after buffer exchange and concentration using Vivaspin, Lysozyme band is easily detectable.

B: Summary of time and protein recovery during each purification step.

Protein Purification Solutions

Vivaspin® Turbo Ultrafiltration Centrifugal Concentrators: high speed, maximum recovery

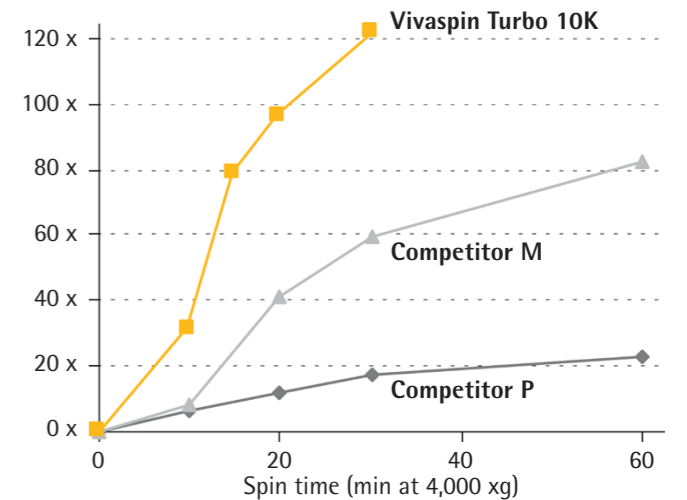
The patented angular dead-stop technology allows easy recovery of the concentrate and prevents the sample from drying out. The easy-to-read printed scale simplifies calculation of concentration results.

Key Advantages:

- Speed: Obtain results faster in a high-speed concentration step with high recovery rate due to the vertical membrane design and thin channel filtration chamber
- Maximum protein retention: Find the ideal concentrator for highest flow-through speed and maximum retention with a broad range of Vivaspin volume capacities and MWCOs



A Concentration factor



B	Sartorius	Competitor M	Competitor P
Time to 20 x	10 min	15 min	40 min
Recovery	>95%	>95%	90%

Protein concentration speed.

A: Protein solution was concentrated using Vivaspin (yellow) and two competing brands of spin concentrators (grey). Sample concentrated using Vivaspin showed a rapid and sustained rise in concentration factor. Compared to two competitors, using Vivaspin yielded a higher concentration faster.

B: Summary table of centrifugation time to achieve 20 x concentration factor. Compared to Competitor M and Competitor P, using Vivaspin allowed faster concentration with higher protein recovery.

Vivaspin columns give you higher protein concentration—faster—compared to competitor columns.

Vivaflow® Tangential Flow Ultrafiltration and Concentration Devices: flexible and modular for scale-up applications

A modular design with plug-and-play convenience to provide optimal performance, flexibility, and economy

Key Advantages:

- Speed: Scale rapidly with this modular design by serially connecting multiple units to a single peristaltic pump and concentrating up to 5 L
- Maximum sample recovery: minimal (low/ultra-low) protein binding



Concentration times for 5 kDa MWCO using Vivaflow 200, PES

Filtrate volume (ml)	Time taken (hr:min:secs)	Filtrate volume (ml)	Time taken (hr:min:secs)
0	0:00:00	1000	0:40:50
100	0:03:16	1100	0:45:46
200	0:06:50	1200	0:50:36
300	0:10:45	1300	0:55:32
400	0:14:38	1400	1:00:24
500	0:18:36	1500	1:05:26
600	0:22:43	1600	1:10:28
700	0:26:57	1700	1:15:52
800	0:31:14	1800	1:21:50
900	0:36:01		

Vivapure IEX Membrane Chromatography: a fast, easy alternative to column chromatography

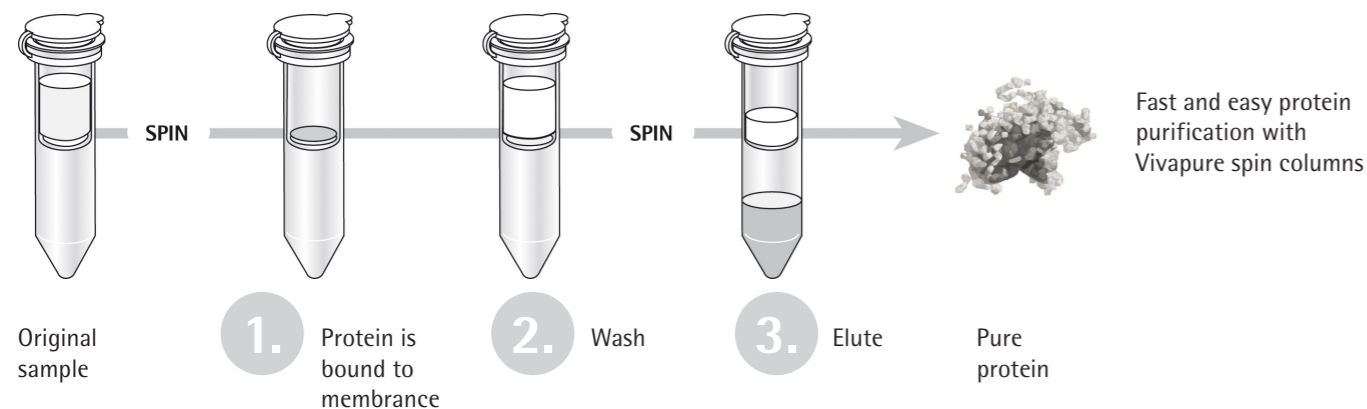
Purify your sample faster using only a three-step protocol by replacing time-consuming column chromatography with membrane chromatography.

Key Advantages:

- Speed: Purify proteins faster using Sartobind Membrane Adsorber
- Ease-of-use: Ensure consistency of your results with these ready-to-use columns



Get pure protein from your sample in three easy steps.



Cell Characterization Solutions

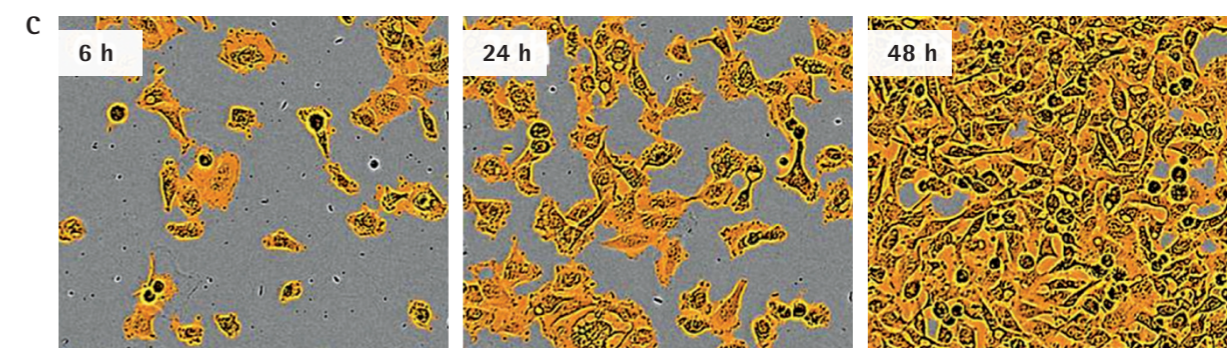
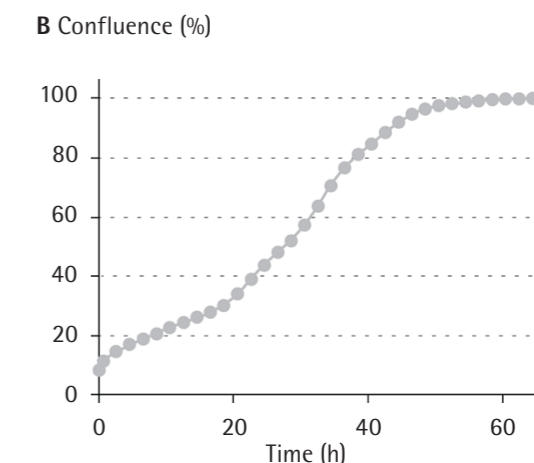
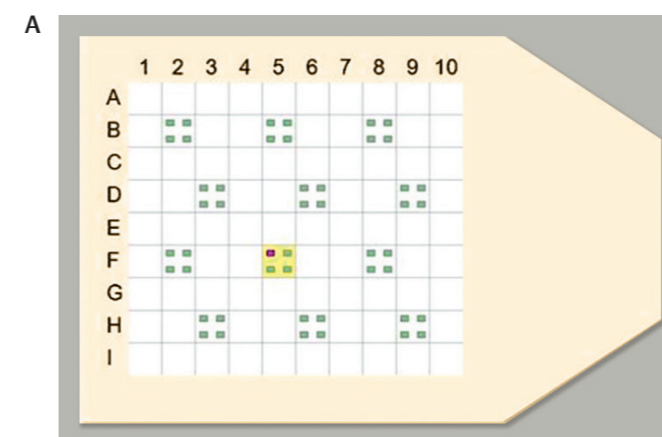
IncuCyte® S3 Live-Cell Analysis System: real-time, non-perturbing visualization of cell culture health, growth, and viability

Automatically acquire and analyze images in real time, around the clock. Gain critical insights from advanced cell models. Assess cell health without disturbing your cell cultures. Whether assaying cell health or investigating cellular behavior, see what happens and when—without ever removing your cells from the incubator.



Key Advantages:

- Real-time, non-perturbing data acquisition: Track cell growth, including morphology and confluence with label-free phase segmentation
- Information-rich data: Ensure consistency and reduce variability by quickly optimizing using whole-well imaging and detection of spatial variation in the overall monolayer



Cell proliferation tracking over time using label-free phase segmentation (confluence) metric.

A: IncuCyte T-flask view to show flask-consistent cell growth.

B: Proliferation time-course for HT-1080 human fibrosarcoma cells.

C: IncuCyte HD-phase time-lapse images of HT-1080 cells (confluence mask overlaid) at 6, 24, and 48 hours.



Analysis: The Culmination of Your Best Efforts

In the era of big data and automation, you are constantly under pressure to deliver more data faster, while using less time and fewer resources. We believe the solution is not always simply more data, but better, higher-quality data and analytical processes. Developing algorithms that can distinguish cell types, track changes over time, and allow for complex benchmarking dynamically among multiple wells and plates has become vital. These developments allow for a streamlined, fast, discovery process by helping you crunch through mountains of data in a more meaningful way to help you answer your scientific questions more easily and reliably.

Achieve the insight you seek with Sartorius data analysis solutions.

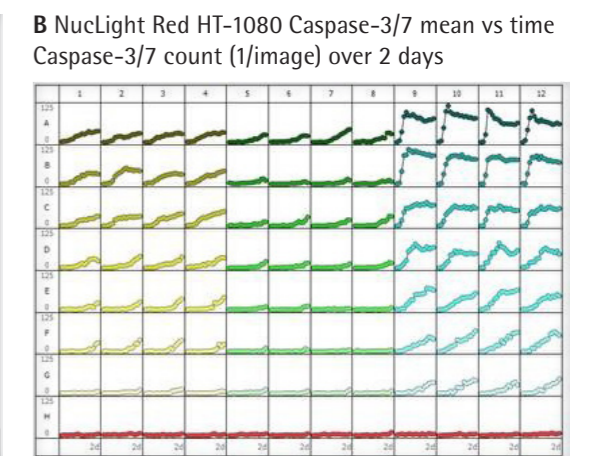
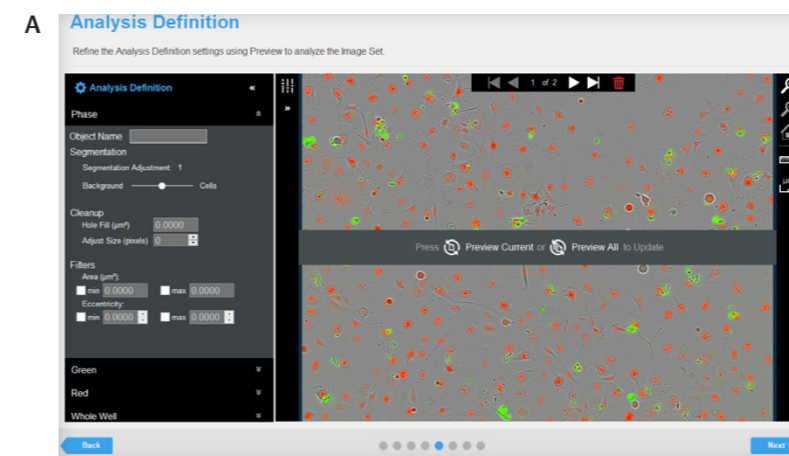
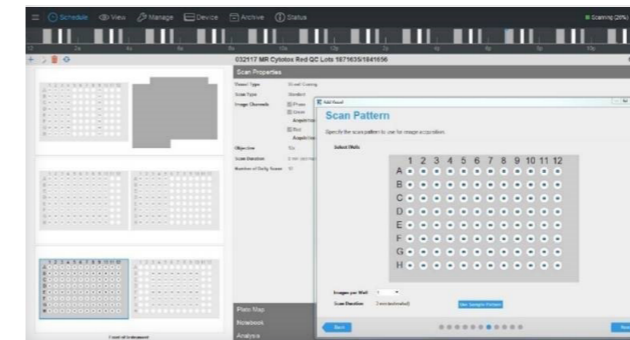
Cell Analysis Solutions

IncuCyte® Live-Cell Analysis System Software: powerful, intuitive data analysis

View and analyze your data in real-time, or catalogue the state of your cells for a long-term study. The system software allows efficient and reproducible image analysis, as well as powerful visualization of insights.

Key Advantages:

- The intuitive Analysis Wizard allows for a quick setup of analysis parameters (scan time, wells/image channels)
- Powerful image visualization and analysis tools enable real-time decision-making
- Advanced graphing options enable analysis of thousands of images, quickly and with minimal effort



Identifying relevant biology by image segmentation.

Performing cell analysis.

A: Setting up IncuCyte Analysis Definition to process images into data.

B: Microplate graph allows you to quickly visualize results, look for outliers, and determine trends in data.

Take Your Research from Ideas to Insights

Sartorius offers solutions for every step of your cell culture workflow, from preparation to performance of experiments to data analysis.

Maximize control and minimize experimental artifacts in your cell cultures, and progress more quickly from ideas to insights with Sartorius consumables, instruments, technology, and software for cell culture applications.

To find additional information on our cell culture solutions, visit our website at www.sartorius.com/research-cellculture



Sales and Service Contacts

For further contacts, visit www.sartorius.com

Europe

Germany

Sartorius Lab Instruments
GmbH & Co. KG
Otto-Brenner-Strasse 20
37079 Goettingen
Phone +49.551.308.0

France & Suisse Romande

Sartorius France
2, rue Antoine Laurent de Lavoisier
ZA de la Gaudrée
91410 Dourdan
Phone +33.1.70.62.50.00

Austria

Sartorius Austria GmbH
Modecenterstrasse 22
1030 Vienna
Phone +43.1.7965760.0

Belgium

Sartorius Belgium N.V.
Rue Colonel Bourg 105
1030 Bruxelles
Phone +32.2.756.06.90

Finland & Baltics

Sartorius Biohit Liquid Handling Oy
Laippatie 1
00880 Helsinki
Phone +358.9.755.951

Hungary

Sartorius Hungária Kft.
Kagyló u. 5.
2092 Budakeszi
Phone +3623.457.227

Ireland

Sartorius Ireland Ltd.
Unit 41, The Business Centre
Stadium Business Park
Ballycoolin Road
Dublin 11
Phone +353.1.8089050

Italy

Sartorius Italy S.r.l.
Via Torino 3/5
20814 Varedo (MB)
Phone +39.0362.5557.11

Netherlands

Sartorius Netherlands B.V.
Phone +31.30.60.53.001
info.netherlands@sartorius.com

Poland

Sartorius Poland sp.z o.o.
ul. Wrzesinska 70
62-025 Kostrzyn
Phone +48.61.6473830

Russian Federation

LLC "Sartorius RUS"
Vasilyevsky Island
5th line 70, Lit. A
199178 St. Petersburg
Phone +7.812.327.53.27

Spain & Portugal

Sartorius Spain, S.A.
Avda. de la Industria, 32
Edificio PAYMA
28108 Alcobendas (Madrid)
Phone Spain +34.913.586.095
Phone Portugal +351.800.855.800

Switzerland

Sartorius Mechatronics Switzerland AG
Ringstrasse 24a
8317 Tagelswangen (ZH)
Phone +41.44.746.50.00

U.K.

Sartorius UK Ltd.
Longmead Business Centre
Blenheim Road, Epsom
Surrey KT19 9QQ
Phone +44.1372.737159

Ukraine

LLS "Sartorius RUS"
Post Box 440 "B"
01001 Kiev, Ukraine
Phone +380.44.411.4918

Americas

USA

Sartorius Corporation
565 Johnson Avenue
Bohemia, NY 11716
Phone +1.631.254.4249
Toll-free +1.800.635.2906

Argentina

Sartorius Argentina S.A.
Int. A. Ávalos 4251
B1605ECS Munro
Buenos Aires
Phone +54.11.4721.0505

Brazil

Sartorius do Brasil Ltda
Avenida Senador Vergueiro 2962
São Bernardo do Campo
CEP 09600-000 - SP- Brasil
Phone +55.11.4362.8900

Canada

Sartorius Canada Inc
1173 North Service Road West, D4
Oakville, ON L6M 2V9
Phone +1.905.569.7977
Toll-Free +1.800.668.4234

Mexico

Sartorius de México, S.A. de C.V.
Libramiento Norte de Tepetzotlan s/n,
Colonia Barrio Tlacateco,
Municipio de Tepetzotlan,
Estado de México,
C.P. 54605
Phone +52.55.5562.1102
leadsmex@sartorius.com

Asia | Pacific

Australia

Sartorius Australia Pty. Ltd.
Unit 5, 7-11 Rodeo Drive
Dandenong South Vic 3175
Phone +61.3.8762.1800

China

Sartorius (Shanghai) Trading Co., Ltd.
3rd Floor, North Wing, Tower 1
No. 4560 Jinke Road
Zhangjiang Hi-Tech Park
Pudong District
Shanghai 201210, P.R. China
Phone +86.21.6878.2300

Hong Kong

Sartorius Hong Kong Ltd.
Unit 1012, Lu Plaza
2 Wing Yip Street
Kwun Tong
Kowloon, Hong Kong
Phone +852.2774.2678

India

Sartorius Weighing India Pvt. Ltd.
#69/2-69/3, NH 48, Jakkasandra,
Nelamangala Tq
562 123 Bangalore, India
Phone +91.80.4350.5250

Japan

Sartorius Japan K.K.
4th Fl., Daiwa Shinagawa North Bldg.
8-11, Kita-Shinagawa 1-chome
Shinagawa-ku, Tokyo, 140-0001 Japan
Phone +81.3.3740.5408

Malaysia

Sartorius Malaysia Sdn. Bhd
Lot L3-E-3B, Enterprise 4
Technology Park Malaysia
Bukit Jalil
57000 Kuala Lumpur, Malaysia
Phone +60.3.8996.0622

Singapore

Sartorius Singapore Pte. Ltd
10 Science Park Rd
The Alpha #02-13/14
Singapore Science Park II
Singapore 117684
Phone +65.6872.3966

South Korea

Sartorius Korea Ltd.
8th Floor, Solid Space B/D,
PanGyoYeok-Ro 220, BunDang-Gu
SeongNam-Si, GyeongGi-Do, 463-400
Phone +82.31.622.5700

Thailand

Sartorius (Thailand) Co. Ltd.
129 Rama 9 Road,
Huaykwang
Bangkok 10310
Phone +66.2643.8361-6

Discover our cell culture solutions at www.sartorius.com/research-cellculture