

From the Bench to Breakthroughs:
Tools and Technologies
to Accelerate the Journey



turning science **into solutions**



Introduction

To significantly improve speed without sacrificing quality or confidence in your results, everything is important in your workflow: your cells, your measurement instruments, and your supporting equipment and consumables. No matter your research field or in which stage of the process you are—whether in preparation, experimentation, or analysis of your data—a systems-level holistic approach is a must.

Your success is determined by everything working together: good experimental design, as well as all 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 the bench to breakthroughs.

Directly improve your throughput and minimize handling with high-end instrumentation, and improve your speed-to-result by carefully attending to details, such as using:

- 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 pre-sterilized pipette tips
- Software tools 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 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. All 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.

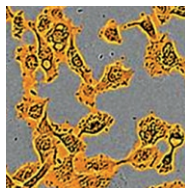
See solutions beginning on page 6.



Protein Purification and Concentration

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 pure proteins that maintain their activity by using Sartorius's protein purification and concentration solutions.

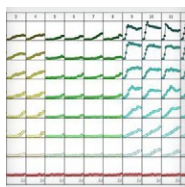
See solutions beginning on page 10.



Cell Characterization and QC

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 for 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 moving. Move confidently from the bench to breakthroughs by using Sartorius's innovative cell characterization solutions.

See solutions beginning on page 13.



Analyzing Image Data at Throughput

You need data analysis solutions to gain biological insight quickly, with repeatability, and at scale, starting with the capture of raw data through to image processing (for instance, filtering out signal noise and eliminating artifacts) and identifying biologically relevant information. Ensure you capture your breakthroughs by using Sartorius's intuitive and efficient software solutions.

See solutions beginning on page 15.



Preparation

Build your research on a solid foundation to ensure that every day's results are reproducible and actionable. 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 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 high survival rate and accurately represents the larger population

Contamination Control Solutions

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



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:

- Compliance: Ensure your GLP/GMP compliance with our IQ/OQ service
- Purity: Obtain the purest water possible with arium ultra-filters, 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

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:** Lower variability and minimize risk of inaccuracies in your results due to low adsorption
- **Compliance:** All materials of the filter are biosafe and meet the current USP Biological Reactivity test for plastics Class VI

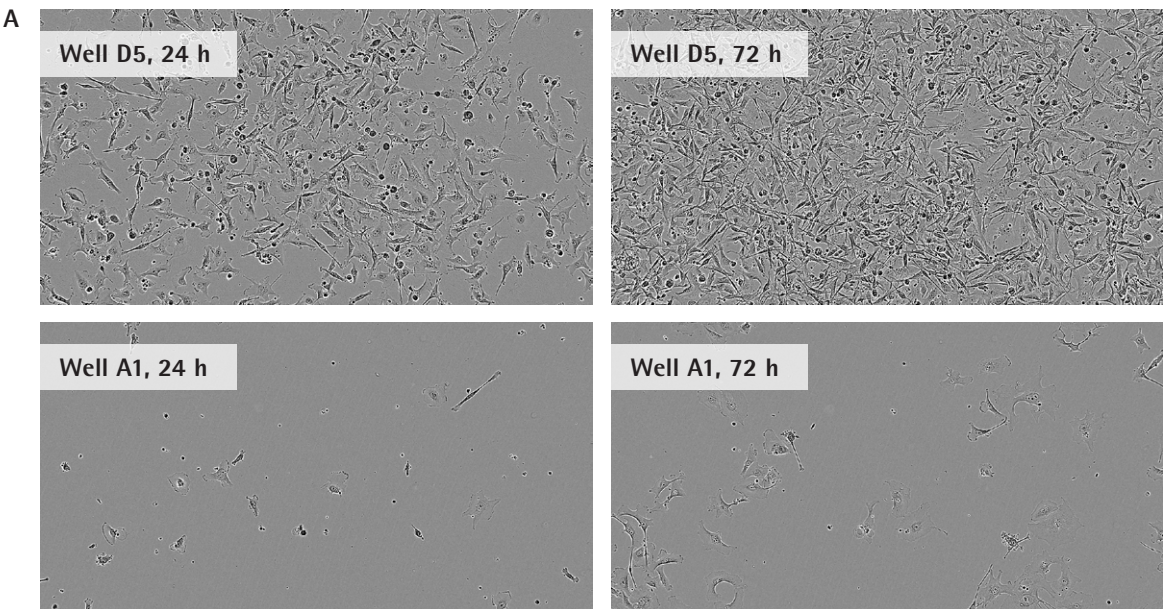


Picus® and Picus® NxT Pipettes and SafetySpace Filter Tips: ergonomic, reliable design for accurate, reproducible liquid dispensation

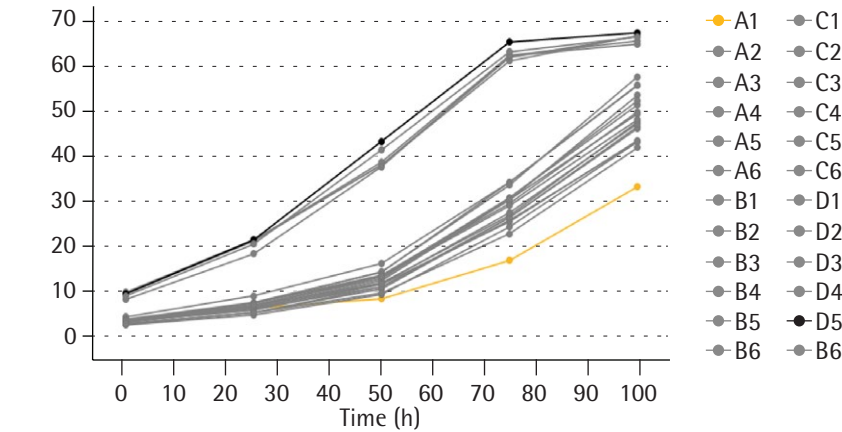
Sartorius pipettes, both mechanical and electronic, are used across the globe in research institutes, universities, healthcare, and industrial laboratories to gently handle cells during passage and to deliver accurate volumes during plating. Accelerate your productivity with their intuitive user interface and accuracy, and reduce strain with their award-winning ergonomic design.

Key Advantages:

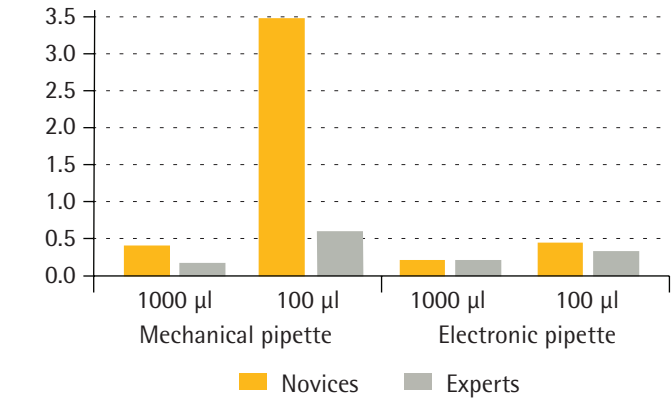
- **Reliable:** Obtain reproducible results with repeatable pipetting
- **SafetySpace Filter Tips:** Prevent cross-contamination between samples
- **Efficient:** Avoid leakage with perfect fit between the tip and the pipette



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.

MYCAP® CCX Aseptic Cell Expansion System

Cell culture expansion must be done aseptically to prevent cell culture contamination. Because MYCAP® CCX combines integral tubing and a gas exchange cartridge in the same cap, cell growth and passaging are done without opening the flask, ensuring aseptic passaging without the need for work in a biosafety hood.



- Key Advantages:**
- Easy, aseptic passaging: Never open the flask, never remove the cap. Integral tubing and gas exchange cartridge allows for cell passaging outside the biosafety cabinet and healthy cell growth in the incubator
 - Flexible: Find a flask that fits your cell culture needs exactly with a broad range of volumes, cap types and connectors

Available from 250 mL through 3,000 mL flasks.
Visit www.sartorius.com for complete order information.

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



Experiment

Careful preparation helps ensure success at the heart of your drug development program: your assays. You need efficient solutions to help you collect cells, isolate proteins, and assess cell health and viability.

To help you move from the bench to the next breakthrough therapy, we offer a portfolio of cell culture tools and technologies that helps you profile and screen drug molecules, select your best candidates, and decrease your time to actionable information.

Protein Purification and Concentration Solutions

Sartoclear Dynamics® Lab Kits: advanced technology for quickly and efficiently harvesting animal cell cultures with high cell densities

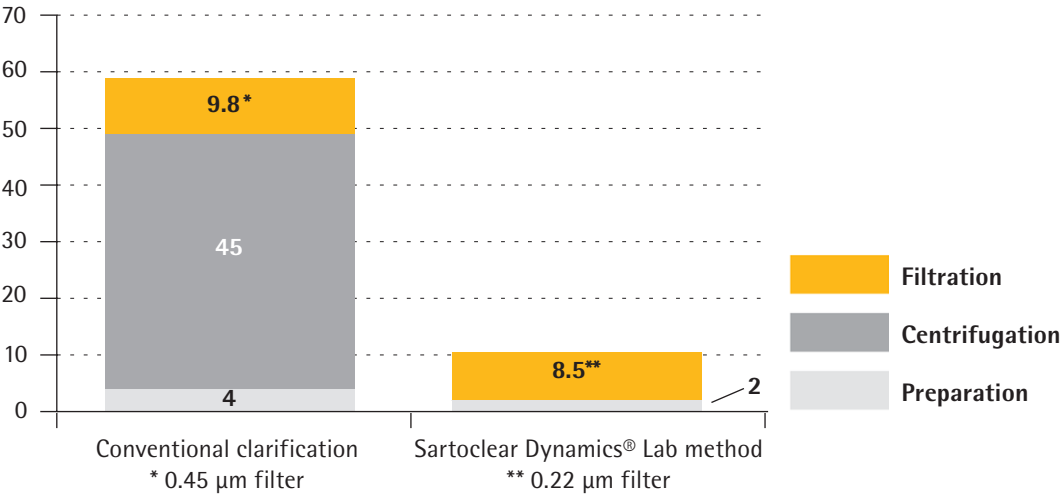
These ready-to-use-kits combine a vacuum filtration unit, a filter aid for clarification, and a 0.22 µm asymmetric polyethersulfone (PES) filter for sterile filtration so you can clarify and filter up to 1 L of mammalian cell culture in a single step.

Key Advantages:

- Fast: Get your results faster with high flow rates and a time-saving, single-step filtration, with no setup required
- Efficient: Save time—no lengthy centrifugation step needed
- Easy-to-use: A single filter clarifies and sterilizes mammalian cell supernatant

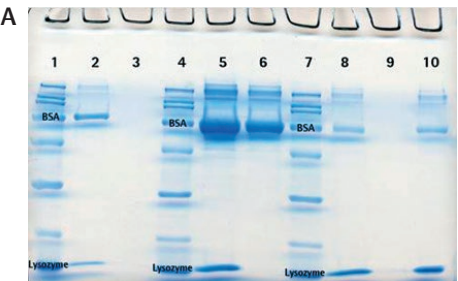


Handling time (minutes)



Suspension culture clarification can be accelerated. 1 L of mammalian cell culture with a density of 2.4 x 10⁶ cells/mL filtered and clarified using either preparation, centrifugation, and filtration with 0.45 µm (left) or preparation and filtration with 0.22 µm Sartoclear Dynamics Lab (right). Experimental time was reduced from 60 min to 10 min.

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



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%

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.

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

A modular design with plug in-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



Available in 5,000, 10,000, 30,000, and 100,000 kDa MWCOs. Visit www.sartorius.com for complete order information.

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		

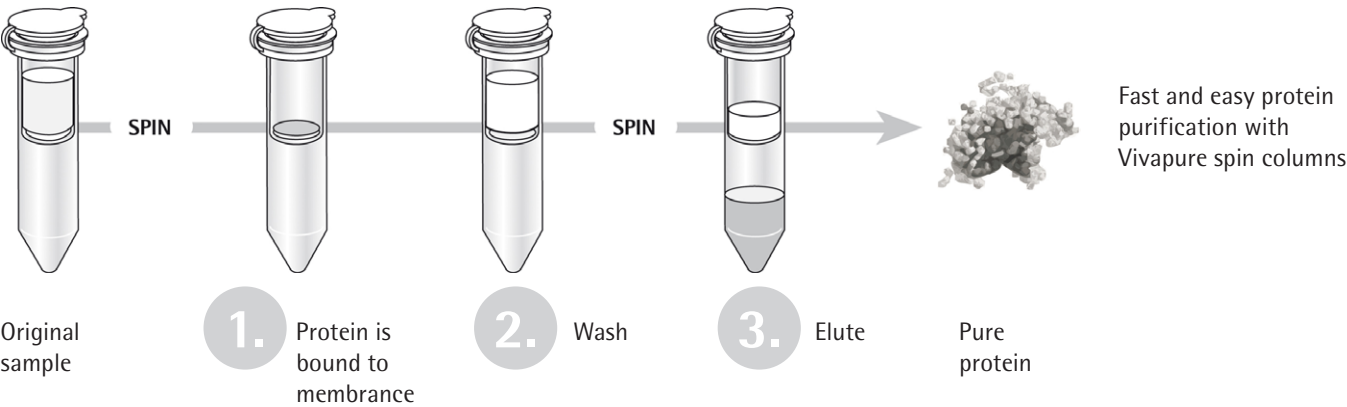
Vivaspin® Ultrafiltration Centrifugal Concentrators: the optimal solution for any concentration or buffer exchange application



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:**
- Fast: High-speed concentration with high recovery rate due to the vertical membrane design and thin channel filtration chamber
 - Flexible: Find your ideal concentrator for highest flow-through speed and maximum retention with a broad range of Vivaspin volume capacities and MWCOs

Available in 3,000, 5,000, 10,000, 30,000, 50,000, and 100,000 kDa MWCOs. Visit www.sartorius.com for complete order information.



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 Sartorbind Membrane Adsorber
 - Ease-of-use: Ensure consistency of your results with these ready-to-use columns

All Vivapure kits also available in Maxi (up to 20 mL sample), 8/pk. Visit www.sartorius.com for complete order information.

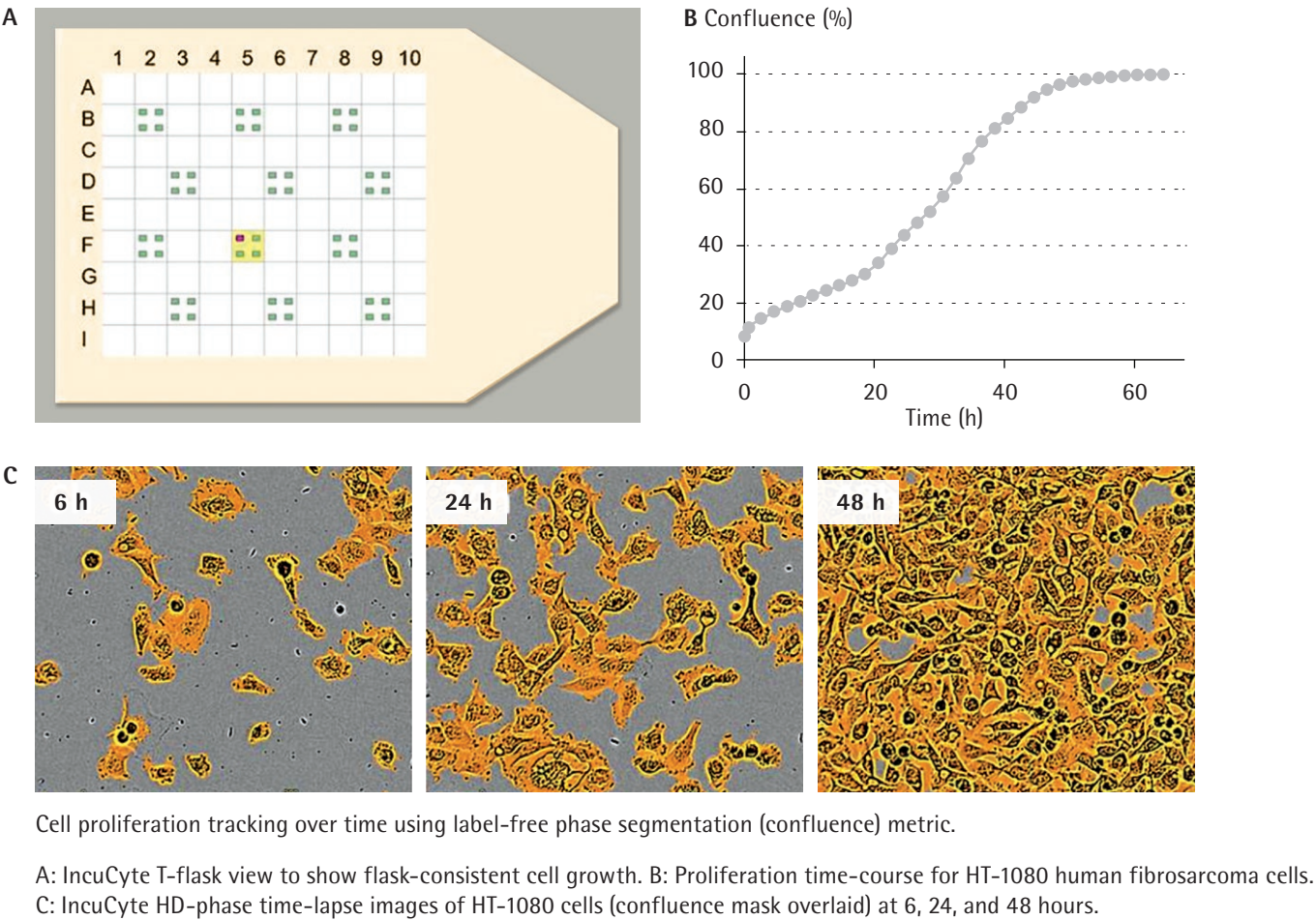
Get pure protein from your sample in three easy steps.

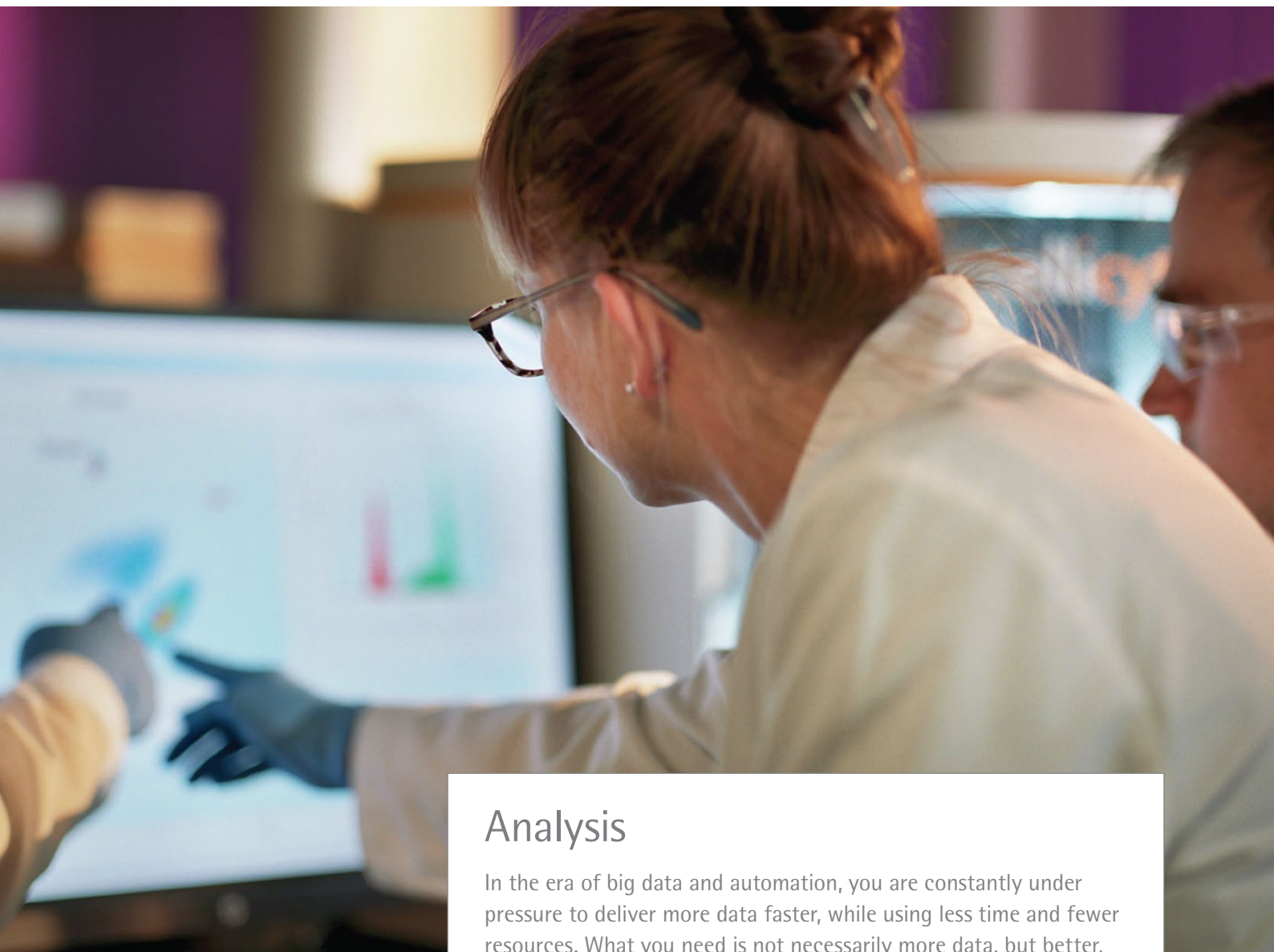
Cell Characterization Solutions

IncuCyte® S3 Live-Cell Analysis System: automatic, deep, physiologically relevant information

Automatically acquire and analyze images around the clock. Whether assaying cell health or investigating cellular behavior, see what happened and when—without ever removing your cells from the incubator.

- Key Advantages:**
- Efficient: Track cell growth, including morphology and confluence with label-free phase segmentation
 - High-content: Ensure consistency and reduce variability by quickly optimizing using whole-well imaging and detection of spatial variation in the overall monolayer





Analysis

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. What you need is not necessarily more data, but better, higher-quality data and analytical processes. Algorithms that can, for instance, distinguish between cell types, track changes over time, and allow for complex benchmarking dynamically between multiple wells and between plates are vital. These developments will allow for a streamlined, fast discovery process by crunching through mountains of data in a more meaningful way to help you answer scientific questions more easily and reliably.

Accelerate your collection and processing of meaningful data with Sartorius data analysis solutions.

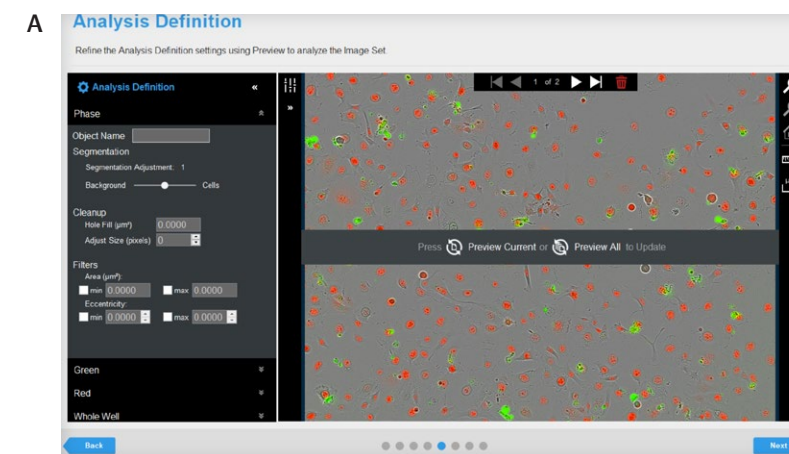
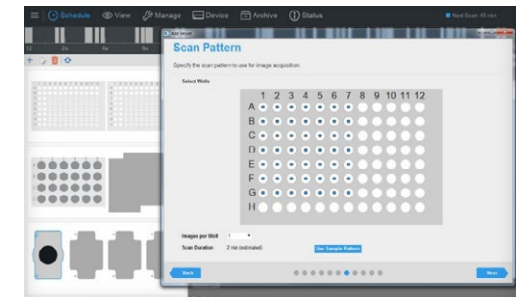
Analyzing Image Data at Throughput

IncuCyte® S3 Live-Cell Analysis System Software: never miss powerful insights again

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:

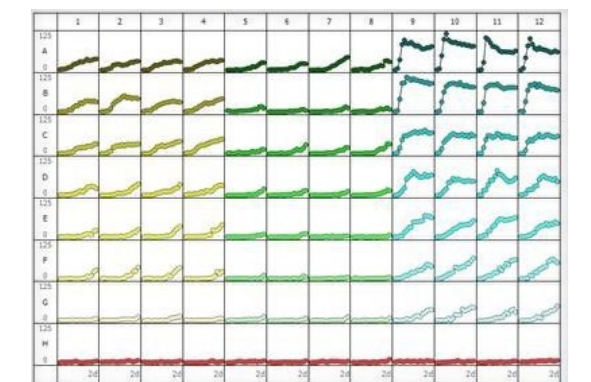
- Intuitive: The Analysis Wizard allows for a quick setup of analysis parameters (scan time, wells/image channels)
- Powerful: Image visualization and analysis tools enable real-time decision-making
- Advanced: Graphing options enable analysis of thousands of images, quickly and with minimal effort



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.

B NuLight Red HT-1080 Caspase-3/7 mean vs time
Caspase-3/7 count (1/image) over 2 days



Take Your Research from the Bench to Breakthroughs

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 the bench to breakthroughs 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

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