

Equipment & Instruments for Your Cell Culture Workflow

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CELL CULTURE WORKFLOW

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Electrical	Shaker Exterior Dimensions	Remote Exterior Dimensions (Overall)	Orbit Size	Cat. No.	Each
120V	30.1 x 35.6 x 15.4 cm (11.85 x 14 x 6.1")	13.5 x 35.6 x 11.6 cm (5.3 x 14 x 4.6")	19 mm (¾")	10159-960	3483.22

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cellIQ™ Multi-gas Incubators



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Description	Volume, cu. ft.	Sensor	Cat. No.	Each
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HEPA Filtration	6.5	TC	10810-744	7175.00
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Description	Electrical	Sash Opening	Cat. No.	Each
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3'	115V, 15A	8"	89413-126	10,493.90
3'	115V, 15A	10"	89413-124	10,493.90
4'	115V, 15A	8"	89413-130	11,822.05
4'	115V, 15A	10"	89413-128	11,822.05
5'	115V, 20A	8"	89413-134	13,170.40
5'	115V, 20A	10"	89413-132	13,170.40
6'	115V, 20A	8"	89413-138	14,569.25
6'	115V, 20A	10"	89413-136	14,569.25

All cabinets with base stand; for other options visit vwr.com



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Description	Maximum Capacity	Maximum RCF	Maximum Speed, RPM	Cat. No.	Each
Avanti JXN-26 High Performance Centrifuge	115V, 15A	81,770 g	26,000	10119-926	45,183.58



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- Perfect for supporting GMP environment and shared labs. Password protection allows appropriate security levels.
- Versatility across applications with an extensive rotor library and consumables. Plus backward compatibility with the existing Avanti rotor library.**

Description	Cat. No.
Avanti JXN-30, IVD,* 200 – 240 V, 50/60 Hz, 24A	10210-212
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 - Powerful refrigeration system pre-cools from ambient to 4°C in less than 4 min.
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Cell Culture Application Package	Description	Max. Tube Cap. (15 mL/50 mL)	Cat. No. (Constant Temp.)	Cat. No. (Refrig.)
Includes centrifuge, swinging bucket (SW) rotor, 15 mL conical adapters (qty. 4) and 50 mL conical adapters (qty. 4)	X-14/X-14R, IVD, 120 V, 60 Hz, w/4 x 750 mL SW Rotor	56 / 28	BKB08860	BKB08861
	X-14/X-14R, IVD, 120 V, 60 Hz, w/ARIES 4 x 750 mL SW Rotor	56 / 28	BKB08862	BKB08863

ALLEGRA X-30 SERIES – Benchtop Centrifuges

- Space-saving footprint – only 18.1 in. wide
- Offered in ambient and refrigerated models
- SX4400 swinging bucket rotors accepts samples from 0.5 mL to 400 mL



Cell Culture Application Package	Description	Max. Tube Cap. (15 mL / 50 mL)	Cat. No. (Ambient)	Cat. No. (Refrig.)
Includes centrifuge, swinging bucket (SW) rotor, 15 mL conical adapters (2 sets of 2) and 50 mL conical adapters (2 sets of 2)	X-30/X-30R, IVD, 120 V, 60 Hz	20 / 12	BKB08536	BKB08540

*IVD: For In Vitro Diagnostic Use.

**Please refer to the Avanti JXN Series User Guide for the list of compatible rotors.

†BioSafe and BioSafety are terms intended to describe the enhanced biocontainment features of our products.

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Model	Overall Dimensions, in.	Resolution	Cat. No.	Each
UV5 Excellence UV/VIS Spectrophotometer	8.19 x 10.04 x 9.98	>1.5 (Toluene in Hexane)	10811-200	9000.00



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- Configurable to each user's unique needs
- VWR Three-Year Limited Warranty

Description	Includes	Cat. No.	Each
B10P Benchtop pH Meter with pH Probe	B10P Meter (89231-662) and Refillable Glass pH Electrode (89231-580)	89231-664	928.13

SpectraMax® i3x Multi-Mode Detection Platform



The SpectraMax i3x Multi-Mode Detection Platform measures spectral-based absorbance, fluorescence, and luminescence with the added functionality of modular upgrades for western blot, imaging, and fast kinetics with injectors. The unit allows users to unravel the mysteries of science by exploring cellular pathways and protein activation and expression in one system.

It is engineered for performance with Spectral Fusion™ illumination for increased sensitivity across the entire excitation range. The SpectraMax i3x also features a cooled photomultiplier tube (PMT) for improved detection in extremely low light. These features enable users to generate more data points without the need to dilute.

The SpectraMax i3x Multi-Mode Detection Platform is one complete solution. With available options such as the SpectraMax MiniMax™ 300 Imaging Cytometer, ScanLater™ Western Blot cartridge, reagents optimized for high performance, and the industry-leading data acquisition and analysis tool SoftMax Pro, the SpectraMax i3x Multi-Mode Detection Platform is the total solution for all research needs.



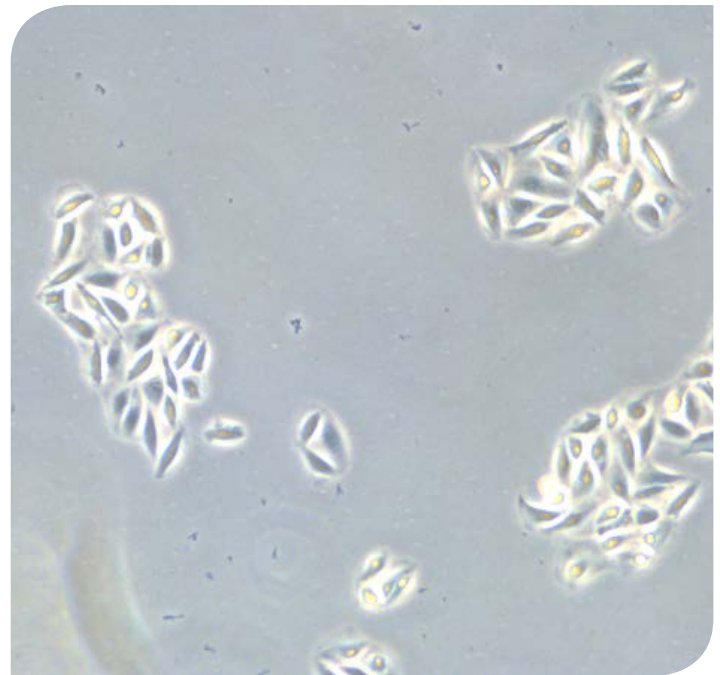
Description	Cat No.	Each
SpectraMax i3x Multi-Mode Detection Platform	10014-924	63,178.21

How to do a Proper Cell Culture Quick Check Workflow for Subculture of Adherent Cells

Authors: Dr. Tamara Straube, Leica Microsystems and Claudia Müller, Leica Microsystems

Many fields of biomedical research, like cancer research, drug development and tissue engineering, require the use of living cells to perform a variety of assays. Mammalian cell cultures are an essential tool in biology because they allow rapid growth and proliferation of different cell types for experimental analysis.

In order to successfully work with mammalian cell lines, they must be grown under controlled conditions and require their own specific growth medium. In addition, to guarantee consistency their growth must be monitored at regular intervals. When a cell line reaches about 80% confluence, the cells must be subcultured to ensure proper growth and health of the cells. 80% confluency means when 80% of the surface of a culture vessel is covered with cells. This article describes a typical workflow for subculturing an adherent cell line with detailed illustrations of all of the necessary steps.



Why do I need to split my cells?

Once a cell culture has been started, it cannot be grown indefinitely due to the increase in cell number, consumption of nutrients and increase in toxic metabolites which eventually results in cell death. Moreover researchers usually want to perform experiments on their cells several times, and therefore do not want to use up all of the cells at once. Sub-culturing, or splitting the cells, produces new cultures with lower cell density than the original culture. By removing the medium and transferring the cells into fresh growth medium, the cells are given fresh nutrients and toxic metabolites are removed, allowing long-term maintenance of the culture.

After initially seeding the cells, growth starts with a lag phase and proceeds to a log phase, where the cells proliferate exponentially followed by a stationary phase where growth rate and death rate are equal (Fig. 1). In the death phase, cells die due to lack of nutrients and inadequate living conditions.

In order to keep cells healthy and actively growing it is necessary to renew the growth medium and to subculture them at regular intervals. Change of culture medium can take place several times in the log phase dependent on the cell type. The best time to subculture cells is between the log phase and the stationary phase, before the cells reach confluence.

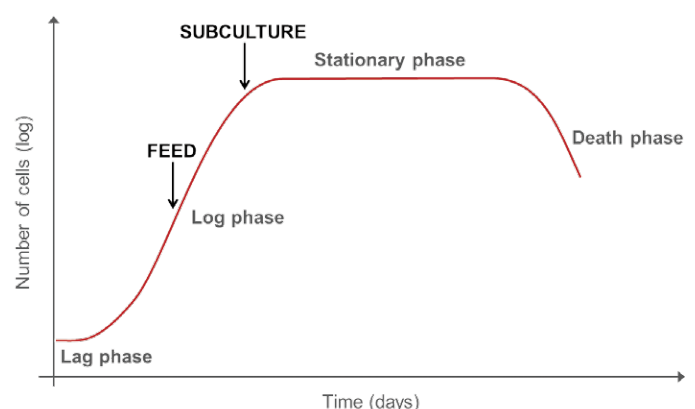


Fig. 1: Growth curve of cells: The growth curve of cells in culture is made up of four phases: the latent phase before growths begins (lag phase), the exponential growth phase (log phase), the stationary phase in which the rapid increase in cell numbers gradually slows and the death phase in which cells die, because of lack of nutrients and wrong living conditions. The culture medium should be changed during the log phase and cells should be passaged before they reach the stationary phase.

Why do I need to examine my cells?

It is important to examine the cell culture every day and immediately prior to subculturing to monitor cell health, check for contamination and determine when to split the cells. A first examination of the culture for fungal contamination, turbidity and particles in the medium as well as unexpected pH shifts, indicated by color change of the medium, can be done at the macroscopic level, by eye. After this, a closer check of the general cellular morphology and growth patterns should be examined using an inverted microscope. The optics of an inverted microscope are located below the specimen. Since the cells are attached to the bottom of the dish, they can be viewed easily from this perspective. Observation should take place with a total magnification of 100 – 200x and with phase contrast, because most cells are difficult to observe in normal bright field illumination.

There are many variations in mammalian cell morphology, but most mammalian cells in culture can be divided into three categories: fibroblastic cells Chinese Hamster Ovary cells (CHO)), epithelial-cell-like (human cervix cells (HeLa)) and lymphoblast-like cells (human leukaemia cells (HL60)). In addition to this certain cell lines can have specific morphological characteristics, e.g. neurons (SH-SY5Y) which have very long dendritic processes. Cell morphology is also affected by events in the cell lifecycle. During mitosis many cells round up, forming very refractile bright spheres that may float around in the medium. Dead cells often round up and become detached also but are usually not bright and refractile. Various cell lines not only differ in size and shape, they also differ in their growth behaviour. They either growing adherent (fibro-blastic and epithelial cells) or in suspension (lymphoblast-like cells). Most adherent cell lines grow as a single cell layer (monolayer) attached to glass or treated plastic substrates (coated with poly-lysine, fibronectin, collagen or gelatine).

How can I subculture my cells?

The most common method to prepare cells for subculture is by breaking the intercellular and cell-to-substrate connections with proteolytic enzymes like trypsin. Trypsin in combination with Ethylenediaminetetraacetic acid (EDTA) causes cells to detach from the growth surface. Trypsin cuts away the focal adhesions that anchor the cell to the culture dish and EDTA acts as a calcium chelator. By removing calcium, cadherins which are involved in cell-cell interactions, are broken and cells separate from one another. Once separated from the growth surface and the surrounding cells, they can be easily separated and grown in new cell culture dishes. Cell culture conditions and subculture methods vary for each cell type. Figure 2 describes the basic steps in the subculture workflow. During the whole subculture process it is important to work in a contamination-free environment. Examination of the cells at the beginning, during trypsination, cell counting, and after splitting is essential. For consistent results, maintaining good records and documentation is also important.

The following protocol describes the basic principles of the subculture routine for Madin Darby Canine Kidney Cells (MDCK cells) grown in a 90 mm Petri dish. These are epithelial cells isolated from the distal tubules of a dog. In culture, they grow adherently and form a monolayer of polygonal cells after they have reached confluence. The following material and equipment is needed for subculture: Materials:

- Pre-warmed medium to 37° C (for MDCK cells: MEM with 5% FCS, 2 mM Glutamine, 100 U/mL Penicillin, 100 mg/mL Streptomycin)
- Pre-warmed PBS without Ca²⁺ /Mg²⁺
- Pre-warmed 0.05% Trypsin, 0.02% EDTA in D-PBS
- Trypan Blue (vital stain)
- 70% ethanol or isopropanol for disinfection
- Cell counting chamber
- Pipette/ micropipette with disposable tips
- Phase contrast capable inverted microscope (Leica DMI1, for example)
- Personal protective equipment
- Water bath set to appropriate temperature
- Incubator at 37°C with 5% CO₂ and high humidity
- Centrifuge
- Pre-labelled dishes
- The splitting ratio is 1:10.

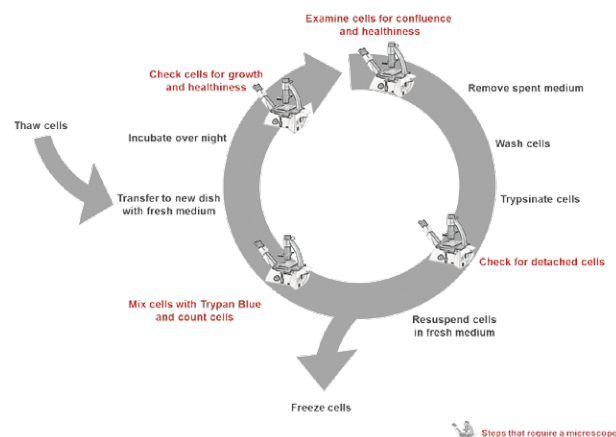


Fig. 2: Subculture workflow; red indicates steps which need a check with the microscope.

4-Step Workflow for Subculture of Adherent Cells as Conducted with the Leica DMI1

Step 1: Cell Examination



Fig. 3: Take cells out of the incubator and put them under the microscope for quick cell check. Cells should be checked microscopically every day to ensure they are healthy (no contamination, few dead cells) and growing as expected.

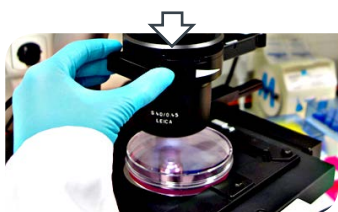


Fig. 4: Cells should be mainly attached to the bottom of the dish or flask and the media should be pink-orange in color. The pH indicator phenol red turns yellow upon acidification as a result of metabolism products from the cells (or contaminations!) in the media. MDCK cells are polygonal in shape when in the log phase and grow as a monolayer. They are difficult to see with normal brightfield illumination. By switching to phase contrast the cells can be identified more easily. On the Leica DMI1 this can be done by simply moving the slider housing the condenser annulus, as shown.



Fig. 5: Documentation of the cell status is very important to ensure uniform results across experiments. The Leica DMI1 can be equipped with a camera and screen which allows easy imaging and saving via remote control.

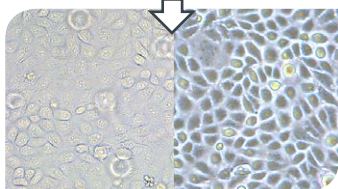


Fig. 6: Comparison of brightfield and phase contrast images of MDCK cells. The phase contrast image gives a better overview and makes inspection of the cell morphology and cell counting easier.

Step 2: Cell Harvesting



Fig. 7: Pipet off the medium from cells into a waste container.



Fig. 8: Carefully wash cells up to three times with 5 ml pre-warmed PBS without calcium and magnesium to get rid of the fetal bovine serum (FBS) in residual culture media. FBS will inhibit the trypsin. Add 3 ml pre-warmed Trypsin/EDTA and swirl gently to cover all cells at the bottom of the dish. Incubate cells for a few minutes at 37°C to detach them.



Fig. 9: Different cell lines require different trypsin incubation times. To avoid over-trypsinization which can damage the cells, check them every few minutes under the microscope.



Fig. 10: Gently rinse plate and transfer cell suspension into a 50 ml tube and spin them down for 5 min at 800 rpm. Aspirate the supernatant and resuspend the cells in 10 ml fresh medium to fully remove the trypsin

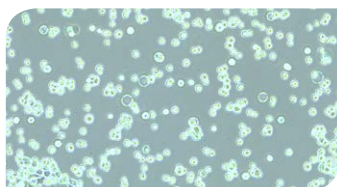


Fig. 11: Detached cells should be round shaped and free floating in the trypsin solution. As soon as cells have detached, add 5 ml culture medium to the dish to inactivate the trypsin.

Step 3: Cell Counting



Fig. 12: Mix 100 µl cell suspension with an equal amount of 0.4% Trypan Blue solution. Trypan Blue selectively penetrates cell membranes of dead cells and stains them blue, but is not absorbed by living cells. Prepare the haemocytometer by placing the coverslip over the counting surface.



Fig. 13: Load the counting chamber with the cell suspension (~ 4 µl per counting area) by placing the pipette tip at the edge of the cover slip and gently expel the cell suspension. The area under the cover slip fills by capillary action. In most cases the chamber has two counting areas that can be loaded independently.

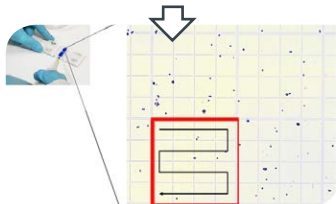


Fig. 14: Place the chamber on the microscope stage and focus the cells. The square pattern of the counting grid differs depending on the chamber type. The Fuchs-Rosenthal counting chamber you can see here has a pattern of 16 areas of one square millimeter each bordered by triple lines. Each square is subdivided into 16 smaller squares. Count all the cells in one 16 square region, as shown in the figure. To avoid counting cells twice at the edges of the area, count only those cells on the lines of two sides of a square. In this example, the cells touching the upper and left limits should be counted (thicker red lines). Cells touching the lower and right limits should be not taken into account. Count the live and dead cells in 5 one square millimeter rectangles of the counting chamber. For calculation, you will need to combine the counting results from all 5 squares. For greater accuracy in the measurement, additional squares of the counting chamber can also be counted.

The cell concentration can be calculated by the following formula:

$$\text{Total cells/mL} = \frac{\text{Total cells counted} \times \text{dilution factor} \times 10,000 \text{ cells/mL}}{\# \text{ of counted squares}}$$

Step 4: Plating

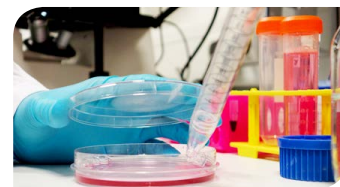


Fig. 15: Pipette the required volume of cells (appropriate number of cells) into new dishes at the required split ratio (here 1:10) and top up with culture medium to the required final volume in each dish (10 ml). Note cell type, day of cell splitting and passage number on the lid of the dish. Place cells back in the incubator at 37° C.



Fig. 16: Leave cells overnight to recover and settle. Check cells 24 hours later under the microscope for shape, adhesion and contamination.

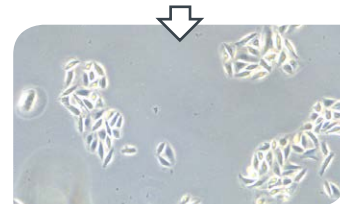


Fig. 17: Cells should be attached to the bottom of the dish and starting to grow and divide. Change the media to get rid of any residual trypsin. Grow cells until they are confluent and ready for your experiment or next subculture.

From Eye to Insight



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Description	Cat. No.	Each
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Description	Sensor	Capacity, cu.ft.	Cat. No.
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Single Unit	TC	1.4	10810-742
Single Unit, Basic	TC	5.3	10810-888
Single Unit	IR	6.5	10810-944
Single Unit	TC	6.5	10810-902
Dual-Stacked	IR	2 x 6.5	10811-004
Dual-Stacked	TC	2 x 6.5	10811-002
Water-Jacketed CO₂ Incubator			
Single Unit	IR	6.5	10810-878
Single Unit	TC	6.5	10810-744
Dual-Stacked	IR	2 x 6.5	10810-886
Dual-Stacked	TC	2 x 6.5	10810-884

PROMO CODE 4287

VWR® Ultra-Low Temperature Freezers

SPECIAL LIMITED TIME OFFER – ACT TODAY!

Choose from one of the following packages:

1. Freezer with two shelves of racks
2. Freezer with chart recorder and two shelves of racks
3. Freezer with LN₂ back-up and two shelves of racks
4. Freezer with CO₂ back-up and two shelves of racks

ASK YOUR VWR SALES REPRESENTATIVE ABOUT AN EXTENDED WARRANTY FOR YOUR ULTRA-LOW FREEZER



PROMO CODE 4293

Comprehensive Solutions for Benchtop Lab Equipment

Purchase a VWR® Shaker and receive a FREE stainless steel Universal Platform with a value up to \$1,050

VWR Shakers

- Microprocessor control with independent digital displays
- Exclusive Accu-Drive shaking system
- Triple eccentric drive with brushless motor

Stainless Steel Universal Platform

- Constructed of 304 stainless steel
- Allows for mounting of flask clamps, test tube racks, and bottle clamps
- Platform slides over top of tray and is tightened with screws
- One FREE platform for every shaker purchased



PROMO CODE 4546

Beckman Coulter Allegra X-30R Promotional Bundle

Purchase an Allegra X-30R Cell Culture application package and get a \$6096 microplate rotor at 50% off and a FREE Microfuge 16 with FX241.5P rotor.



PROMO CODE 4198

Beckman Coulter Allegra X-14R Promotional Bundle

Purchase an Allegra X-14R Cell Culture Application Package and get four FREE microplate carriers for the SX4750 or SX4750A rotor plus a FREE Microfuge 16 with FX241.5P rotor.



Description	Cat. No.
Allegra X-30R Cell Culture Promotional Bundle	MPB42202

Description	Cat. No.
Allegra X-14R Cell Culture Promotional Bundle	MPB42200
Allegra X-14R ARIES Cell Culture Promotional Bundle	MPB42201

Promotional part number is available for a limited time, must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on vwr.com. (Promotional part numbers cannot be found via Search on vwr.com.) For assistance with ordering, please contact VWR Customer Service at 1.800.932.5000.

Promotional part numbers are available for a limited time, must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on vwr.com. (Promotional part numbers cannot be found via Search on vwr.com.) For assistance with ordering, please contact VWR Customer Service at 1.800.932.5000.

PROMO CODE 3466

Trade in your old METTLER TOLEDO (or competitor) balance and receive a 15% Total Cash Back on your new METTLER TOLEDO balance purchase through VWR.

For promotion details and to redeem your rebate, have your VWR proof of purchase (VWR invoice or packing slip) and visit vwr.com/promotions.

Enter Promo Code 3466 in the search field and fill out the online redemption form. Be sure to enter the serial number of the model purchased. Valid on XPE/XSE, XP/XS and MS balances 15% Cash Back based on final purchase price Rebate may not exceed \$1,000.



PROMO CODE 4011

Cash In On Excellence

Purchase a balance or analytical instrument through VWR and receive a rebate from METTLER TOLEDO. Visit vwr.com for a complete listing of METTLER TOLEDO products.

\$400 Rebate

- Excellence Plus Balances (XPE)
- Entry Level Titrators (V20/C20/G20)
- Benchtop Density Meters & Refractometers
- Melting Point Excellence (MP50)

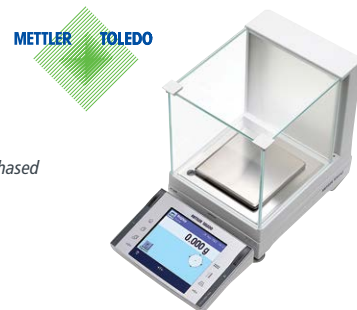
\$300 Rebate

- Excellence Balances (XSE/XS)

\$200 Rebate

- New Classic Balances (MS-TS)
- EasyPlus Titrators

To redeem your rebate: Be sure to enter the serial number of the model purchased on the online form.



PROMO CODE 4677

Molecular Devices SpectraMax Drop Promotion

Get a SpectraMax DROP UV Vis Microplate Reader AND a SpectraDrop Micro Volume Microplate for under \$11,500, valued at \$28,108.

Offer valid now through 12/31/2016.



Description

SpectraMax® DROP UV/VIS Absorbance Reader with SpectraDrop™ Micro Volume Starter Kit and SoftMax Pro Software

Cat. No.

MP89230-746

Promotional part numbers are available for a limited time, must be used at the time of purchase, and may be ordered via the "ORDER ENTRY" link on vwr.com. (Promotional part numbers cannot be found via Search on vwr.com) For assistance with ordering, please contact VWR Customer Service at 1.800.932.5000.

PROMO CODE 4214

VWR® CryoPro® RACK SYSTEMS, BR SERIES BUNDLES

Bundle includes rollerbase, one pair of cryogenic gloves, and the full capacity of fiberboard boxes.

Description	Capacity, 2mL Vials	No. 100-Cell Boxes	No. 25-Cell Boxes	Cat. No.
BR-1 Rack System	875	—	35	10027-588
BR-2 Rack System	2,500	25	—	10027-590
BR-3 Rack System	5,000	50	—	10027-530
BR-4 Rack System	7,000	70	—	10027-532

Offer expires December 31, 2016. No redemption necessary. Simply order using the Cat. Nos. listed above to receive these specially-priced bundles.



PROMO CODE 4288

Pipettor Trade-In

Save Money and Support Global Science

Save up to 40% off VWR List Price!

Here's how...

1. Purchase a VWR pipettor listed on the flyer for Promo Code 4288 on vwr.com and save up to 40% off the standard list price!
2. Send your old pipettor and decontamination form to the address listed on the back of that flyer. Important: mark on the pipettor if it is in working order. A simple "good" or "bad" will do.
3. Pipettors that are not in working order will be RECYCLED!
4. Working pipettors will be donated to scientists and educators in developing countries.

Seeding Labs will send your donated pipettor to scientists who are working on life-changing research such as:

- Agricultural productivity
- Helping communities adapt to changing climates
- Strengthening health systems
- Reducing hunger and malnutrition
- Regulating clean drinking water
- Academic research



Cell Migration & Heat Shock Studies Using New StainFree Cell Detection Technology



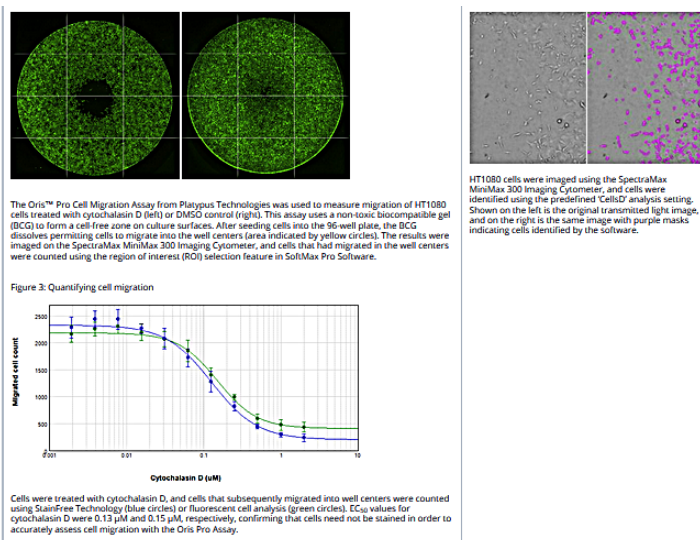
By Cathy Olsen, Ph.D.

In these application briefs, we show how a new technology enables the measurement of cell migration and cellular response to heat shock without the need for fluorescent staining.

Cell migration analysis: HT1080 Cells

The fibrosarcoma cell line HT1080 was generated in 1972 from tumor biopsy tissue. Interestingly, the patient had not been treated with radiation or chemotherapy at the time of biopsy, so the cells lack the sort of unwanted mutations that are commonly caused by these treatments¹. Because HT1080 cells are highly invasive, they are often used as models for cell invasion and migration. Researchers have been able to identify a number of potential therapeutic agents for cancer on the basis of their ability to inhibit the invasive behavior of HT1080 cells.

This study focuses on visualization and analysis of cell migration using the Oris™ Pro Cell Migration Assay from Platypus Technologies on the SpectraMax® i3 Multi-Mode Microplate Reader. This assay utilizes a non-toxic biocompatible gel that dissolves and creates a cell-free detection zone in the center of each well, allowing for the study of the cell migration mechanisms involved as cells move into the detection zone. For more information, see the “Wells to Westerns: Investigating the cellular heat shock response” application note at vwr.com/molecular-devices.

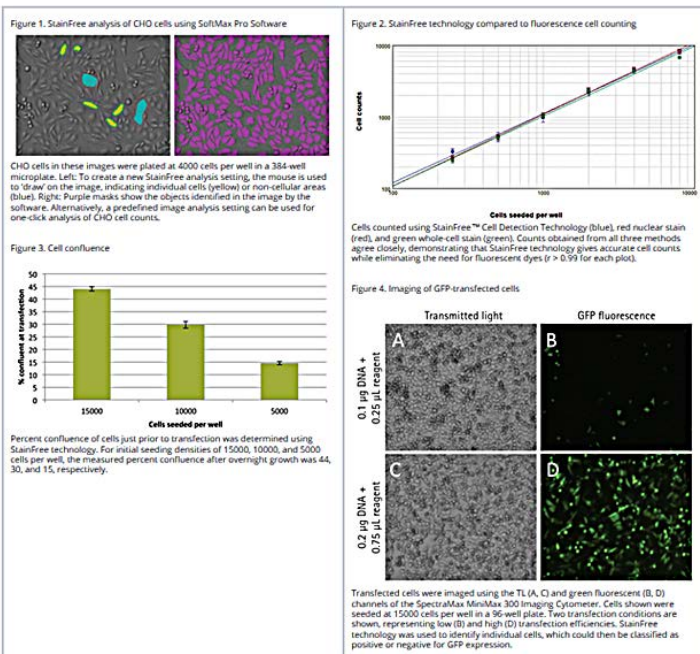


Investigating the cellular heat shock response: CHO Cells

Researching a cellular response can involve multiple approaches to gathering information—imaging, cell-based viability and proliferation assays, western blots to look at changes in protein expression, and more. Often multiple instrument platforms are needed to glean the necessary results, and several software packages may need to be learned in the process.

In this study, we used Chinese Hamster Ovary (CHO) cells – an epithelial-like cell line commonly used in biological and medical research. Developed over 50 years ago, they have been used in innumerable studies ranging from genetics to cytotoxicity. They are highly amenable to transfection and have become the most popular cell line for manufacturing recombinant proteins, including therapeutics.

Exposure of cells to higher than normal temperatures is known to activate the apoptosis pathway, as well as increase expression of the heat shock protein HSP70. CHO-K1 cells under two different growth conditions, healthy or stressed, were exposed to heat shock then assayed for proliferation, viability, and apoptosis using the imaging capability of the SpectraMax i3 system. Expression of HSP70, which is upregulated in response to heat shock, was analyzed using the ScanLater™ Western Blot Detection System.



¹ Rasheed S, Nelson-Rees WA, Toth EM, Arnstein P, Gardner MB (1974). "Characterization of a newly derived human sarcoma cell line (HT-1080)". *Cancer*. 33 (4): 1027-33



VWR® Ultra-Low Temperature Upright Freezers

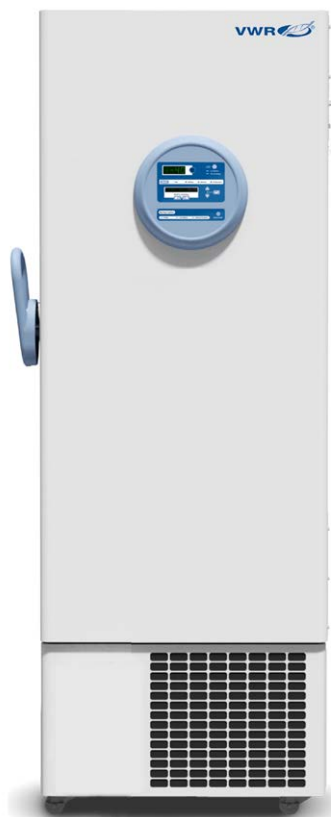
VWR Collection Ultra-Low Temperature (ULT) Upright Freezers are designed and constructed for long-term performance, and they represent the leading choice of laboratory professionals for applications where temperature control is critical.

- Microprocessor temperature control system
- Advanced monitor/alarm system
- Automatic voltage compensator
- Cascade refrigeration system
- Non-CFC, Non-HFCF, Nonflammable refrigerants
- VWR Two-year limited parts and labor warranty
- Temperature Range: -86 to 50°C (-123 to 58°F)

The VWR Collection line of ultra-low temperature freezers offers a microprocessor temperature control system that maintains constant freezer temperature, along with a sophisticated microprocessor monitor/alarm system.

The automatic voltage compensator detects line frequency, monitors incoming voltage, and adjusts compressor voltage to reduce wear and tear on the compressors.

Modern design includes an easy-to-grasp handle for one-handed operation. Dual wheel, locking swivel casters allow mobility as well as secure positioning



Volume, L (cu.ft.)	Electrical	Exterior Dimensions (H x W x D cm)	Amps/Breaker	Cat. No.	Each
368 (13)	120V, 60Hz	197.8 x 83.4 x 84.5	16/20	10160-724	14,389.79
369 (13)	208/230V, 60Hz	197.8 x 83.4 x 84.5	12/15	10160-726	14,389.79
490 (17.3)	120V, 60Hz	197.8 x 98.8 x 84.5	16/20	10160-728	14,565.89
490 (17.3)	208/230V, 60Hz	197.8 x 98.8 x 84.5	12/15	10160-730	14,565.89
651 (23)	120V, 60Hz	197.8 x 98.8 x 103.5	16/20	10160-732	14,889.67
652 (23)	208/230V, 60Hz	197.8 x 98.8 x 103.5	12/15	10160-734	14,889.67
793 (28)	208/230V, 60Hz	197.8 x 98.7 x 118.7	12/15	10160-736	15,532.89

VWR® CryoPro® Rack Systems, BR Series Promotion Packages



Combining the convenience of box vial storage with the economy of a low nitrogen loss design, the BR Series provides the perfect solution for medium to large storage needs.

- Convenient box vial storage
- Low nitrogen loss

Vial storage in boxes allows for quick and accurate inventorying and recovery of specimens. The BR-1 model can hold 25-cell cardboard or plastic boxes. The BR-2, BR-3, and BR-4 models can hold 100-cell cardboard or plastic boxes.

Ordering Information: Supplied with rollerbase, full capacity of fiberboard storage boxes and 1 pair of cryogenic gloves.

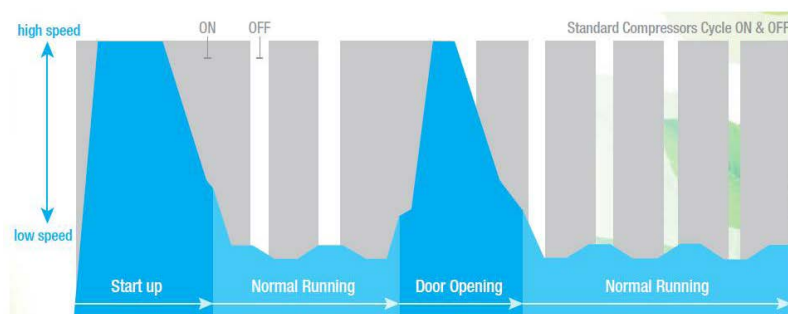
CryoPro System Promotion Package	Capacity	Cat. No.	Each
BR-1 Rack	875 Vials (2 mL), In a Manual Fill Tank	10027-588	3776.57
BR-2 Rack	2500 Vials (2 mL), In a Manual Fill Tank	10027-590	6469.10
BR-3 Rack	5000 Vials (2 mL), In a Manual Fill Tank	10027-530	7435.69
BR-4 Rack	7000 Vials (2 mL), In a Manual Fill Tank	10027-532	8488.61



Save More Energy with a Thermo Scientific TSX Series Ultra-Low Freezer at -70°C Setpoint

thermoscientific

The Thermo Scientific TSX Series of ultra-low freezers was designed to offer substantial energy savings without compromising sample protection. While conventional-refrigerant ultra-low freezers use single speed compressors that continually cycle on and off, the TSX Series' V-drive runs at variable speeds. This variable speed technology adjusts cooling performance to the conditions inside and outside the freezer. When conditions are stable, such as overnight or on weekends, the V-drive runs at a low speed, reducing energy consumption, while maintaining a stable temperature for sample storage. When there are frequent door openings, or samples are added to the freezer (introducing ambient conditions), the V-drive detects this activity and increases the drive speed to bring temperatures back to the setpoint quickly.



As shown in the above graphic, the TSX's V-drive, unlike standard compressors that cycle on and off, adjusts to factors such as start-up and door openings, when a higher compressor speed is needed. During normal running time when the door is closed, the V-drive runs at a lower speed to maintain the setpoint.

Save additional energy at -70°C setpoint

While conventional refrigerant ultra-low freezers can run up to 18 kWh/day in energy usage, TSX Series freezers offer savings of up to 50%. And, by switching from a -80°C to a -70°C setpoint, you can save an additional 10-18% in energy.¹ As noted in the following chart switching to a -70°C setpoint from -80°C on a TSX600 results in a kWh/day of 7.8 – an additional savings of 10%. When making that same switch on a TSX400, the reduction is 18% with a 6.5 kWh/day.

Is it safe to run at -70°C?

As recently as 15 years ago, virtually all ultra-low freezers were set to -65°C or -70°C². While many such freezers today can achieve -80°C and even below, -70°C in most situations is an acceptable setpoint. Nucleic acids for example can be safely stored at -20°C or -70°C, depending on the duration of the storage. Likewise, bacteria, viruses and most proteins can also be safely stored at -70°C. In fact, labs today at the Centers for Disease Control (CDC) are running ultra-low freezers at -70°C to store samples ranging from DNA/RNA, to bacterial, purified proteins, enzymes and more.³

¹ Internal performance data, data on file. June, 2016

² <http://www.mygreenlab.org/-70-is-the-new--80.html>. Accessed June, 2016

³ Ibid.

Energy Usage and Savings: Thermo Scientific TSX400

	Conventional Ultra-Low Freezer*		Conventional Ultra-Low Freezer*		Cost/ kWh**	Annual Cost Savings/ Freezer	10 Year Savings	Metric Tons of CO ₂ Reduced Per Year***
	Energy Usage (kWh/day)	Annual Energy Usage (kWh)	Energy Usage (kWh/day)	Annual Energy Usage (kWh)				
U.S. Average	18.5	6753	6.5 (-70°C) 7.9 (-80°C)	2884	\$0.11	\$425.59	\$4225.9	2.29

** Thermo Scientific TSU400D

** Calculated using data from the U.S. Energy Information Administration Retail Sales of Electricity to Ultimate Customers published electricity and natural gas price statistics. <http://www.eia.gov/electricity>. Accessed October, 2015.

*** metric tonnes/kWh - 0.0005925"

Energy Usage and Savings: Thermo Scientific TSX600

	Conventional Ultra-Low Freezer*		Conventional Ultra-Low Freezer*		Cost/ kWh**	Annual Cost Savings/ Freezer	10 Year Savings	Metric Tons of CO ₂ Reduced Per Year***
	Energy Usage (kWh/day)	Annual Energy Usage (kWh)	Energy Usage (kWh/day)	Annual Energy Usage (kWh)				
U.S. Average	18	6570	7.8 (-70°C) 8.7 (-80°C)	3175.5	\$0.11	\$358.12	\$3,581.20	2.01

** Thermo Scientific TSU600D

** Calculated using data from the U.S. Energy Information Administration Retail Sales of Electricity to Ultimate Customers published electricity and natural gas price statistics. <http://www.eia.gov/electricity>. Accessed October, 2015.

*** metric tonnes/kWh - 0.0005925"

Thermo Scientific TSX Series Ultra-Low Freezers

thermo scientific



**NEW: TSX Series
ultra-low freezers
with racks, boxes,
back-up systems
and chart
recorders.**

Designed to save up without compromising sample protection

- Two capacities: Choose 600 box or new 400 box capacity
- Save more energy at -70°C setpoint: 6.5 kWh/day (TSX400), 7.8 kWh/day (TSX600)
- Maximized storage in a minimal footprint: 11.38 sq. ft. (TSX600), 8.46 sq. ft. (TSX400)
- Sustainable design features: natural refrigerants and water-blown foam
- Whisper quiet: 45.5 dBA (TSX600), 47.5 dBA (TSX400)
- Electrical: 208-230V, 60Hz

Description	Cat. No.	Each
TSX600D Freezer with 2-shelves of racks and boxes	10770-478	23,921.45
TSX600D Freezer with LN ₂ back-up and 2-shelves of racks and boxes	10770-482	26,289.20
TSX600D Freezer with CO ₂ back-up and 2-shelves of racks and boxes	10770-484	26,289.20
TSX600D Freezer with chart recorder and 2-shelves of racks and boxes	10770-480	25,532.75
TSX400D Freezer with 2-shelves of racks and boxes	10863-300	20,130.00
TSX400D Freezer with LN ₂ back-up and 2-shelves of racks and boxes	10863-304	21,684.00
TSX400D Freezer with CO ₂ back-up and 2-shelves of racks and boxes	10863-306	21,684.00
TSX400D Freezer with chart recorder and 2-shelves of racks and boxes	10863-302	20,958.00

Thermo Scientific CryoPlus Auto-Fill LN2 Storage

thermo scientific

Simplified LN2 storage and retrieval

- Two package sizes to meet your storage capacity needs. Package includes box racks, hot gas bypass, and riser intended for vapor-phase storage
- Easy to use auto-fill for convenience and visual identification of LN2 levels
- Hot gas bypass protects samples by diverting warm gas from the fill hose to the atmosphere at the beginning of the filling cycle



Description	Cat. No.	Each
CryoPlus 1, 120V with four 2" box racks	10159-938	11,102.80
CryoPlus 2, 120V with ten 2" box racks	10159-940	15,317.60

VWR
COLLECTION



VWR® Manual Defrost Laboratory Freezers

The VWR Manual Defrost Laboratory Freezers are purpose built for scientific and medical applications.

- Features a digital microprocessor temperature controller allowing for the precise temperature management necessary for critical samples and supplies
- Manual defrost design prevents product damaging temperature spikes from defrost cycles

The all new TempTech-100 temperature display and alarm module offers industry leading product security with a monitoring and alarm system that is 100% independent of the temperature controller. Real time sample simulated temperatures are constantly displayed and supported by audible/visual high and low temperature alarms, along with power outage and sensor error alarms.

Volume, L (cu. ft.)	Exterior Dimensions, W x D x H, cm	No. of Fixed Shelves	Cat. No.	Each
396 (14)	75.5 x 82.2 x 158.7 (29 ³ / ₄ x 32 ³ / ₈ x 62 ¹ / ₂ ")	3	10819-384	6066.90
481 (17)	86.4 x 77.3 x 172 (34 x 30 ⁷ / ₁₆ x 67 ³ / ₄ ")	4	10819-386	6351.52
566 (20)	86.4 x 82.7 x 186 (34 x 32 ³ / ₁₆ x 73 ¹ / ₄ ")	4	10819-388	6336.54
850 (30)	90.8 x 87 x 184 (35 ³ / ₄ x 34 ¹ / ₄ x 72 ¹ / ₂ ")	4	10819-406	9199.86

VWR® Performance Glass Door Laboratory Refrigerators with Natural Refrigerants



- Adjustable Operating Temperature Range: 1 to 10°C (33.8 to 50°F)
- Password-protected Control Panel
- Sample simulated digital temperature display

VWR Performance Glass Door Laboratory Refrigerators are purpose built for scientific and medical applications. Units feature a digital microprocessor temperature controller allowing for the precise temperature management necessary for critical samples and supplies. A forced air directional refrigeration system provides superior temperature uniformity and recovery after door openings. An automatic cycle-defrost design prevents product damaging temperature spikes.

The all-new TempData-2000 Touch Screen temperature display and alarm module offers the latest in advanced temperature control and data logging. This feature provides industry leading product security with a monitoring and alarm system that is 100% independent of the temperature controller. Real time sample simulated temperatures are constantly displayed, logged, and supported by audible/visual high and low temperature alarms. Additional safety features include power outage alarm, sensor error alarm, and door ajar alarm. Remote alarm dry contacts, a 4-20mA output and an access port are provided to simplify connections to existing facility monitoring systems. A USB port is provided for easy transfer as well as software updates. Height does not include 10.2cm (4") for casters.

Environmentally friendly, natural hydrocarbon (HC) refrigerants (not containing hydrofluorocarbons) vastly reduce global-warming potential (GWP) while meeting new EPA/SNAP mandates and UL, ASHRAE compliance guidelines.



Volume	Electrical	Exterior Dimensions	Door Type	No. of Shelves	Cat. No.	Each
736 L (26 cu. ft.)	115V, 60Hz, 5.4A	76.2W x 79.7D x 200H cm (30 x 31 3/8 x 78 5/8")	1 Swing Glass	4 Adjustable	10819-534	7143.32
1338 L (49 cu. ft.)	115V, 60Hz, 8.5A	137.5W x 79.7D x 200H cm (54 1/8 x 31 3/8 x 78 5/8")	2 Swing Glass	8 Adjustable	10819-538	10,312.66
2039 L (72 cu. ft.)	115V, 60Hz, 8.5A	198.4W x 84.1D x 200H cm (78 1/8 x 33 1/8 x 78 5/8")	3 Swing Glass	12 Adjustable	10819-542	13,696.00

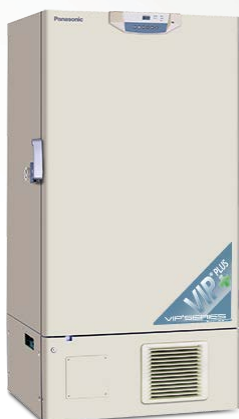
Panasonic

Life Science
Life Science

What are your SAMPLES worth?

VIP® Series
-86°C ULT Freezers

TwinGuard®
-86°C ULT Freezers



Minimize risk with -86°C reliability you can count on.

TwinGuard® Series

Dual Independent Compressor Technology:

Two independent cooling systems allow the unit to run continuously at ultra-low temperature in the unlikely case of a service event.

Patented VIP® PLUS Vacuum Insulation Panel:

TwinGuard® Series provide uniform temperatures with energy and space efficient refrigeration. Ideal for secure storage of high value biological samples, tissue and rare specimens.

VIP® Series

Proven Reliability:

VIP® Series has an operational success rate greater than 99%*, making them one of the most reliable ultra-low temperature freezers in the industry to store priceless biological and scientific samples.

Optimum Performance:

Increased reserve cooling capacity improves temperature recovery after door openings.

Volume, L (cu. ft.)	Electrical	Exterior Dimensions, cm	Cat. No.	Each
333 (11.8)	115V, AC, 20A	67 x 86.7 x 186	10046-908	16,832.64
519 (18.3)	115V, AC, 15A	77 x 86.7 x 199	10046-910	19,036.28
526 (18.6)	208/230V, AC, 15A	77 x 87 x 199	10046-912	19,036.28
728 (25.7)	115V, AC, 20A (VA Models)	101 x 87 x 199	10046-914	22,082.10
728 (25.7)	208/230V, AC, 15A (VC Models)	101 x 87 x 199	10046-916	22,484.13

* Based on actual repair data compiled by Panasonic.

Available through VWR. Contact your VWR Sales Representative for more information.



VWR® Inverted Microscope

The VWR® Inverted Microscope is the ideal device for live cell and advanced applications, as well as routine laboratory, research, and educational needs.

- Ideal for live cell and advanced applications
- Trinocular Siedentopf tube with 45° inclination
- One-year warranty on electrical parts
- Five-year warranty on mechanical parts and optics

The VWR® Inverted Microscope features a Trinocular Siedentopf trinocular tube with 45° inclination (Light Split = 20/80), Wide Focus PL 10x/22mm high eyepoint eyepiece, side facing quintuple nosepiece, CCIS planachromatic objective PL4X, CCIS planachromatic phase objective Ph10x, LWD PL Ph20x, LWD PL Ph40x, ELWD N.A. 0.30 condenser, centrable phase slider with PH1, PH3, and bright field, phase centering telescope, plain stage with attachable mechanical stage with well plate holders (128x86mm), glass and metal stage inserts, 32mm, 54mm, 65mm Petric dish holder, externally mounted centerable 6V/30W Koehler illumination with intensity control, 45mm blue ground glass and green interference filter, power cord, allen hexagonal key, vinyl dust cover, and universal power supply (100–240V).

Description	Cat. No.	Each
VWR® Inverted Microscope	89404-462	5121.90

VWR® Traceable® Excursion-Trac™ Datalogging ULT Freezer Thermometer



Datalogging thermometer with user-defined timing intervals

- Ideal for monitoring ultra-low temperature freezers and includes a PTFE cable
- Triple display simultaneously displays Minimum, Maximum and Current Temperatures, °F/°C switchable
- Rolling memory structure, maintains the most recent 525,600 temperature observations and 10 unique alarm events
- Recorded data (CSV file) may be transferred from thermometer to PC or Mac using a USB flash drive – no additional software is needed
- Memory can be cleared on unit after downloading data to USB stick
- Smart-Alarm™ features a visual/audible alarm that continues to alarm even if the unit returns to non-alarm conditions
- Status indicators – low battery, memory full, USB data transfer, active alarm state
- Thermometer is calibrated at multiple points (-80°C, -40°C, 0°C, 100°C) and comes standard with an individually serialized, and certified Traceable calibration certificate from an ISO/IEC 17025 calibration laboratory accredited by A2LA
- Supplied with: stand, batteries, Velcro®, magnetic strips, wall mount, Traceable Certificate



Unit Range	Resolution	Accuracy	Probe	Cat. No.	Each
-90.00 to 105.00°C	0.01°	±0.1°C	Platinum RTD Sensor, 1 Stainless Steel 316 Probe	75784-088	190.00
-90.00 to 105.00°C	0.01°	±0.1°C	Platinum RTD Sensor, 2 Stainless Steel 316 Probes	75784-090	246.00

OMNI Bead Ruptor 24 Bead Mill Homogenizer



- Homogenize any sample in seconds
- No cool down required between runs, process hundreds of samples per day
- Convenient front loading design, 99 programmable memory settings, and multilingual user interface
- Wide selection of beads & tubes for ultimate versatility

DESCRIPTION	CAT. NO.	EACH
Bead Ruptor	10032-376	11,122.53
<i>Choose a tube carriage (not included)</i>		
1.5 mL Tube Carriage Kit	10032-380	1922.33
2 mL Tube Carriage Kit	10809-030	1495.00
7 mL Tube Carriage Kit	10032-384	2179.49
30 mL Tube Carriage Kit	10015-250	1695.00



Call your VWR Sales Representative or go to VWR.com for more information

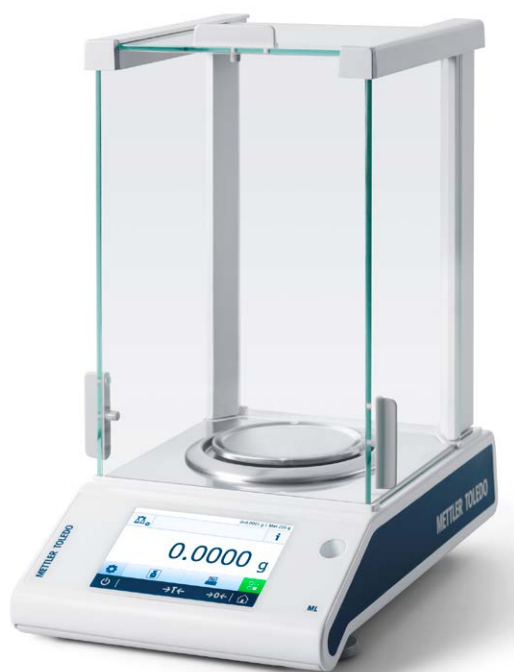


ML-T Series Analytical and Precision Balances

Big features go compact with Mettler Toledo® ML-T series balances. Built-in applications and a straight-forward user interface combine to ensure ML-T balances are easy to use. The weighing-in guide helps users dose within tolerances. The large color touchscreen is easy to read and any warnings are clearly indicated in red. With the smallest in-class footprint and larger than average weighing pans, ML-T series balances provide the room needed to carry out daily tasks efficiently.

The compact size and battery operation make it easy to take ML-T balances anywhere needed for weighing applications. The renowned MonoBloc weighing cell, with FACT automatic internal adjustment, delivers consistently reliable results. Once finished with weighing tasks, ML-T series balances are quick to clean and easy to take care of. Built-in overload protection and a metal bottom housing ensure a long balance lifetime.

Capacity	Readability	Repeatability (Std. Dev.)	Pan Size	Cat. No.	Each
1620 g	0.01 g	0.01 g (@5% load)	170 x 90 mm	10796-918	2510.68
4200 g	0.01 g	0.01 g (@5% load)	170 x 90 mm	10796-922	3109.93
220 g	1 mg	1 mg (@ 5% load)	90 mm	10796-938	2655.32
3200 g	0.01 g	0.01 g (@5% load)	170 x 90 mm	10796-912	2438.35
3200 g	0.01 g	0.01 g (@5% load)	170 x 90 mm	10796-920	2944.62



VWR® A-Series Balances



VWR A-Series Balances provide repeatable and precise weighing with advanced technological features.

- Worry-free five-year warranty
- Internal calibration (automatic, time- or temperature-activated)
- Multiple weigh modes

In addition to forced-compensation weighing technology, VWR A-Series balances incorporate state-of-the-art features for advanced weighing applications and documentation. These economical balances offer a variety of standard features, such as internal calibration, menu-driven operation, multiple weigh modes, advanced communication features, and varied application modes.



Specifications	
Interfaces	RS232 (2), USB-A, and USB-B
Operating Temperature	10 to 40°C (50 to 104°F)
Power Requirements	Input: 100–240VAC, 50/60Hz, 0.6A

Capacity	Readability	Repeatability (Std. Dev.)	Pan Size	Cat. No.	Each
60 g/220 g	.01 mg/0.1 mg	0.1 mg	70 mm (2.76 in)	10205-026	4963.00
160 g	0.1 mg	0.1 mg	85 mm (3.35 in)	10204-960	2070.49
220 g	0.1 mg	0.1 mg	85 mm (3.35 in)	10204-962	2367.49
310 g	0.1 mg	0.1 mg	85 mm (3.35 in)	10204-964	2590.60
360 g	0.001g	0.001 g	128 x 128 mm (5.04 x 5.04 in)	10204-966	1731.58
4500 g	0.01 g	0.01 g	195 x 195 mm (7.68 x 7.68 in)	10204-968	1784.73
6000 g	0.01 g	0.01 g	195 x 195 mm (7.68 x 7.68 in)	10204-970	1990.00



VWR® B-Series Balances

VWR B-Series Balances combine advanced weighing with intuitive operation.

- Worry-free five-year warranty
- Reliable results
- Large LCD display
- Externally Calibrated

VWR B-Series balances incorporate state-of-the-art features for advanced weighing applications. These economical balances offer a variety of modes which include parts counting, animal weighing, under-pan weighing, and many more!



Capacity	Readability	Repeatability (Std. Dev.)	Pan Size	Cat. No.	Each
120 g	0.1 mg	0.1 mg	90 mm (3.5 in)	10204-974	1845.60
210 g	0.1 mg	0.1 mg	90 mm (3.5 in)	10204-976	2265.00
200 g	0.001 g	0.001 g	90 mm (3.5 in)	10204-978	1249.00
400 g	0.001 g	0.001 g	90 mm (3.5 in)	10205-028	1548.00
500 g	0.001 g	0.001 g	90 mm (3.5 in)	10205-030	1795.00

VWR® Electronic Pipettors, Variable Volume



VWR Electronic Pipettors offer outstanding performance in all pipetting modes. These pipettors require virtually no force to aspirate and dispense samples, and they significantly reduce RSI (Repetitive Strain Injury) associated with routine work. Pipettors combine superior accuracy, precision, and robustness with an advanced ergonomic design.

- Ease-of-use: Only 2 buttons and 5 pipetting modes, including the CUSTOM Mode which creates pipetting protocols easily and rapidly
- Advanced Ergonomics: Lightweight and perfectly balanced, it requires virtually no force to significantly reduce RSI
- Fully Motorized Piston Drive: For an even and regular sample delivery across each channel



Description	Volume	Accuracy	Color	Increments	Precision	Cat. No.	Each
VWR Single Channel Electronic Pipettor	0.5–10 µL	±2.75% at 1 µL / ±0.88% at 10 µL	Red	0.01 µL	≤1.32% at 1 µL / ≤0.28% at 10 µL	10827-884	525.00
VWR Single Channel Electronic Pipettor	2–20 µL	±4.13% at 2 µL / ±0.83% at 20 µL	Pale Yellow	0.01 µL	≤1.38% at 2 µL / ≤0.28% at 20 µL	10827-918	525.00
VWR Single Channel Electronic Pipettor	20–300 µL	±2.57% at 30 µL / ±0.39% at 300 µL	Green	0.1 µL	≤0.73% at 30 µL / ≤0.11% at 300 µL	10827-920	525.00
VWR Single Channel Electronic Pipettor	100–1200 µL	±2.20% at 120 µL / ±0.55% at 1200 µL	Blue	1 µL	≤0.37% at 120 µL / ≤0.11% at 1200 µL	10827-922	525.00

Multi-channel and pre-calibrated pipettors available on vwr.com

VWR® Bench Selector

Create Your Own Lab Workstation



The New VWR 3D Configurator allows you to easily design a lab workstation complete with accessories. Follow four easy steps - the configurator walks you through the simple process of selecting a VWR bench and adding accessories to build a lab workstation that best meets your needs. It has never been easier to design and quote a lab workstation!

- Many possible options, components, and adjustments
- Ergonomically designed and adaptable to unique workspace processes and requirements
- Height adjustable in manual, motorized, or hand crank versions

To get started, visit vwr.com/benchselector.



SevenCompact S210 pH Meters



Starting a measurement or calibration requires only a single keypress. Menu settings are intuitive, consisting of full sentences in 12 languages.

- Truly intuitive operation
- High-resolution color display
- Automatic buffer recognition
- All-round productivity from the start

Description	Includes	Cat. No.	Each
SevenCompact S210-Kit	InLab Expert Pro ISM electrode	75801-398	1050.00

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