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**VOLUME 2 ISSUE 1**

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# Comparing viability measurements on cell lines utilizing the CytoFLEX Flow Cytometer

By Nancy Dempsey, Senior Product Manager

## INTRODUCTION

Discriminating live cells from dead cells is important both for accurate flow cytometric analysis and for determining effects of cytotoxic drugs. Traditional methods for live/dead discrimination (7-AAD and PI) bind DNA and are not compatible with fixation and permeabilization. Zombie dyes act by binding to amine groups in the cytoplasm of dead cells while being excluded from live, membrane-intact cells<sup>1</sup>. Zombie dyes are available in multiple colors and are compatible with most permeabilization protocols. With four lasers and 13 colors, the CytoFlex is compatible with the use of all Zombie dyes and allows for live/dead discrimination along with surface and intracellular staining.

## METHODS

### CELL LINES AND DRUGS

Cultured P12 and U937 cell lines were grown to confluence. Two million cells/mL were plated into a 24-well tissue culture plate with or without 20 mg/mL of mitomycin-c for 48 hrs at 37°Celsius in complete-RPMI medium + 5% fetal calf serum.

### VIABILITY STAINING & VICELL COUNTING

Treated cells were washed in 10 times the volume of PBS, specifically chosen since it lacks protein, at 400g for 5 minutes. An aliquot of each cell line and treatment condition was counted on the ViCell. One million cells from each cell line and treatment condition were stained in 100 µL final volume with either 1 µL of Zombie Yellow, 1 µL of Zombie Aqua, or 20 µL of 7-AAD. All conditions were stained for 30 minutes. Then, all tubes were washed in 3 mL of growth media and spun at 400g for 5 minutes. Cell pellets were resuspended in PBS and acquired on the CytoFLEX.

Lasers	405 nm		488 nm	532nm
Filter	510	575	647	
Dye	Zombie Aqua	Zombie Yellow	7-AAD	

## RESULTS

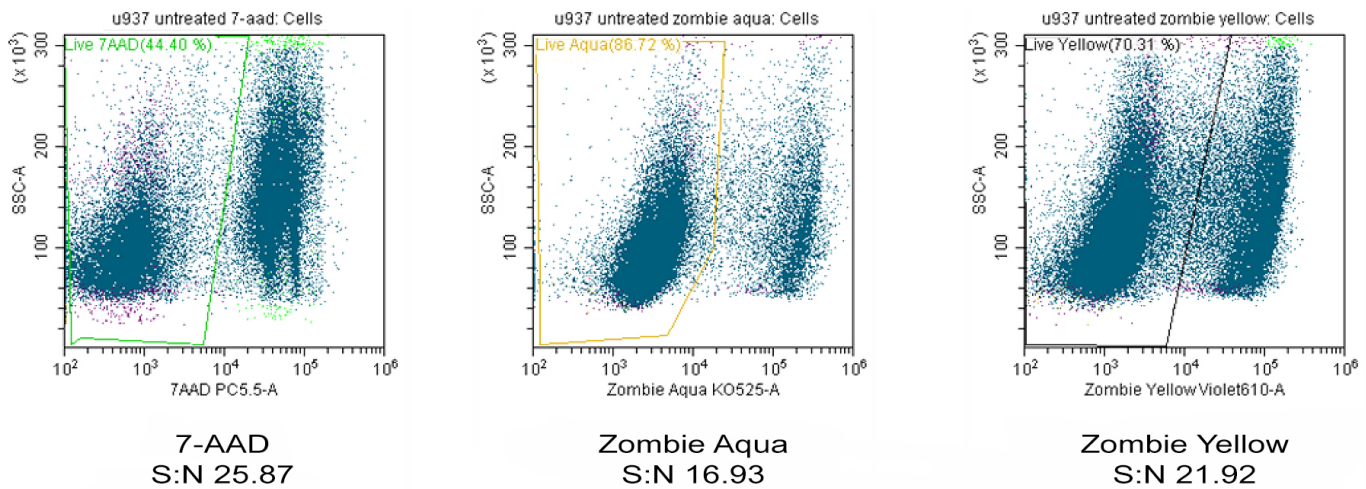
Of the three viability dyes tested, 7-AAD produced the highest signal to noise (S:N) ratio (Figure 1). Each cell line and treatment group showed similar trends in percentage viable cells with the addition of mitomycin-c or Ly-294. Additionally, each viability dye correlated to the results generated by the ViCell (Figure 2). Although the percentages of viable cells differed slightly between the viability dyes tested, it is possible that this is due to the altering mechanisms of actions of the viability dye binding. These data suggest that it is necessary to be consistent in individual experiments with a singular viability dye of choice.

## REFERENCES

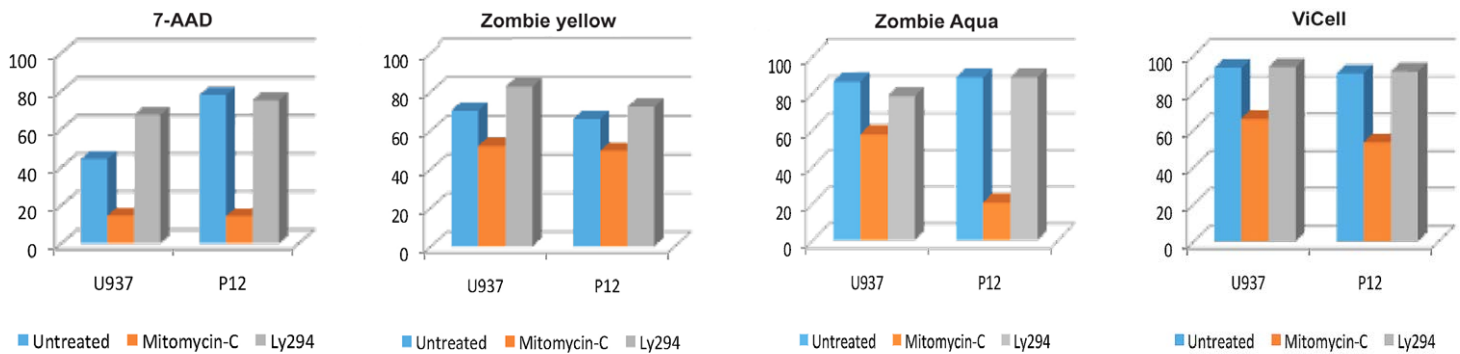
- 1 Perfetto SP, Chattopadhyay PK, Lamoreaux L, Nguyen R, Ambrozak D, Roup RA, Roederer M. Amine-reactive dyes for dead cell discrimination in fixed samples. *Curr. Protoc. Cytom.* Chapter 9: Unit 9.34, 2010.

## NOTES

The results demonstrated in this application sheet represent those generated on the Beckman Coulter CytoFLEX Flow Cytometer. As differences exist in the performance between analyzers, the author cannot guarantee a similar appearance with the use of other flow cytometers.



**FIGURE 1. Viability of U937 Myeloid Cells Measured by Multiple Dyes.**  
 U937 cells were stained with either 7-AAD (left), Zombie Aqua (middle), or Zombie Yellow (right) and acquired on a CytoFLEX. Ly-293 treatment results not shown.



**FIGURE 2. Viability of U937 and P12 Cell Lines.**  
 U937 and P12 cell lines were incubated for 48 hours with or without mitomycin-c or Ly294. After washing, cells were stained with 7-AAD (A), Zombie Aqua (B), Zombie Yellow (C), or counted on the ViCell. Percentage of viable cells from untreated (blue), mitomycin-c treated (orange), or Ly294 treated (gray) is graphed.



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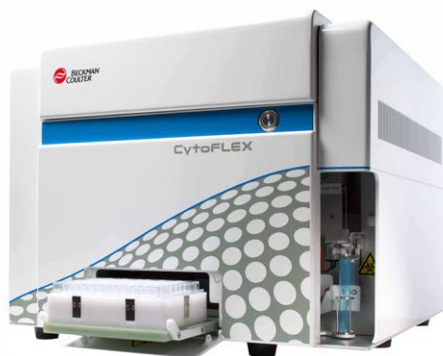
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Description	Cat. No.
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Description	Cat. No.
CytoFLEX System B4-RO-VO	76330-530
CytoFLEX System B3-R1-VO	76330-090
CytoFLEX System B2-RO-V2	76330-092
CytoFLEX System B2-R2-VO	76330-094



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Description	Dimensions	Maximum RCF	Maximum Speed	Cat. No.
<b>Refrigerated Benchtop Centrifuges</b>				
Allegra® X-30R Refrigerated Benchtop Centrifuge, Cell Culture Application Package	46W x 70.7D x 37H cm, (18 <sup>1</sup> / <sub>8</sub> x 27 <sup>4</sup> / <sub>8</sub> x 14 <sup>3</sup> / <sub>8</sub> ")	4,255 g (Swinging-bucket), 29,756 g (Fixed-angle)	4,700 rpm (Swinging-bucket), 18,000 rpm (Fixed-angle)	<b>BKB08540</b>

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Description	Water Quality	Cat. No.
PURELAB® flex 3 Water Purification System with Starter Kit	Type I / >III	<b>89221-842</b>
PURELAB® flex 4 Water Purification System with Starter Kit	Type I	<b>89221-844</b>



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Inverted Tissue Culture Microscope, 4 Phase Slider, field of view: 20 mm	80 mm, S80	3 Objectives (5x N Plan 5X PH0,10X PH1,20X PH1)	10752-394



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Description	Cat. No.
GenePix 4300 Microarray Scanner with GenePix Pro	10192-224



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High-Quality Phase Contrast Unit	High-Quality Phase Contrast Unit	19000-068



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Description	Capacity	Cat. No.
CryoPro® BR-1 Rack System Promotion Package	875 Vials (2 mL), In a Manual Fill Tank	10027-588



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Refrigerated Centrifuge, PCR Bundle	6 x 8 PCR Strips	14,000 rpm	18,845 g	PCR Strip Tube Rotor	10830-776



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Description	Electrical	Volume	Exterior Dimensions	Amps/Breaker	Cat. No.
VWR® Ultra-Low Freezers, 400-Box Capacity	115V, 60Hz	19.4 cu.ft. (Interior)	32.3W×38.4D×78"H	13/20	76307-948
VWR® Ultra-Low Freezers, 600-Box Capacity	115V, 60Hz	14.9 cu.ft. (Interior)	27W×38.4D×78"H	12.6/20	76307-960



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Units are equipped with low E, double-pane, thermal insulated glass doors for energy efficiency.

Electrical	Volume	Dimensions	Color	Compressor	Door Type	No. of Shelves	Temperature Range	Weight	Cat. No.
<b>White Interior</b>									
115 V, 60 Hz, 8.5 A	1330.9 L (47 cu. ft.)	137.5W×75.3D×199.8H cm (54 <sup>7</sup> / <sub>8</sub> ×29 <sup>5</sup> / <sub>8</sub> ×78 <sup>5</sup> / <sub>8</sub> "	White	½ hp	2 Doors, Sliding Glass	8	2 to 8°C (35.6 to 46.4°F)	220 kg (485 lbs.)	75871-650



**HETTICH MIKRO 220 MICROLITER CENTRIFUGES, HETTICH LAB TECHNOLOGY OFFERS LARGE CAPACITIES AND HIGH-PERFORMANCE FOR HIGH-THROUGHPUT LABORATORIES**

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- Max RPM/RCF-18,000/31,514
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Description	Tube Capacity	For Tube Volume	Maximum Speed	Includes	Tube Size	Cat. No.
Hettich MIKRO 220 R Microliter Tube Package 48, Refrigerated, Bio lid	48 (max.)	1.5 – 2.0 ml (max.)	14,000/18,845 (RPM/RCF)	(1) Centrifuge, (1) Fixed-angle Rotor, (48) Adapters 1.5 mL, (1) Bio-containment Lid	11×38 mm (max.)	10813-182



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- Max RPM/RCF – 15,000/21,382
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- For DNA, RNA and temperature-sensitive samples

Holds up to 30 tubes per run at an RCF of up to 21,382 x G.

Description	Tube Capacity	For Tube Volume	Maximum Speed	Includes	Tube Size	Cat. No.
Hettich MIKRO 200		1.5 – 2.0	15,000/21,382	(1) Centrifuge, (1) Fixed-angle	11 x 38 mm	
Microliter Tube Package 24	24 (max.)	mL (max.)	(RPM/RCF)	Rotor, (24) Adapters 1.5mL	(max.)	<b>10813-140</b>



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Description	Capacity	O.D.xH	Neck Diameter	Static Evaporation Rate	Weight Empty	Weight Full	Cat. No.
		43.2 x 61.1 cm					
L-30 Liquid Dewar	32 L (8.45 gal.)	(17 x 24")	6.4 cm (2½")	0.22 L/Day	12 kg (26.4 lbs.)	38 kg (83.8 lbs.)	<b>55709-240</b>

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Capacity (Liters)	Overall Dimensions (L x W x H, cm)	Working Access (cm)	Cat. No.
2	22.9×30.5×34.3	9.9 x 10.9 x 15.2	76308-830
5	36.8×30.5×34.5	12.7 x 27.4 x 15.2	76308-834
10	39.3×43.2×39.3	26.9 x 29.5 x 15.2	76308-896
20	57.2×44.5×39.3	24.1 x 43.2 x 15.2	76308-900
28	57.2×44.5×45.7	24.1 x 43.2 x 20.3	76308-904

Electrical: 120V, 60Hz

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Description	Cat. No.
Corning Cell Counter	76200-994



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Gas	Gas	Delivery Pressure Gauge	Flow Capacity Standard	Inlet CGA	Cat. No.
Argon, Nitrogen, Helium	Argon, Nitrogen, Helium	1-50 psig	1020 CFH/1220 CFH/3200 CFH	580	55850-600



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- Ultra-smooth interior surface for uniform flow and bacteria resistance

Extremely flexible tubing is specially formulated to withstand repeated compression and release for consistent, reliable performance in peristaltic pumps.

I.D. x O.D.	Wall Thickness	Quantity	Cat. No.
0.375 x 0.625"	0.125"	Ea.	89068-444

# Automated reproducible dendritic cell production

By Jamie N. Clark, Product Line Manager, Bioprocess

Antigen-presenting dendritic cells (DCs) act as messengers between the innate and the adaptive immune systems. Present in tissues that are in contact with the external environment, such as the skin, the inner lining of the nose, lungs, stomach and intestines, DCs can also be found in an immature state in the blood in very low concentrations (<1%). For *in vitro* studies, they are typically generated from monocytes.

DCs are indispensable in immunology and immunotherapy research on cancer and infectious diseases as well as autoimmune disease and transplant rejection. As key elements of personalized vaccines for cancer and infectious diseases, they advantageously generate immunological memory and allow for autologous or allogeneic therapies, which have demonstrated promising results in the clinic.

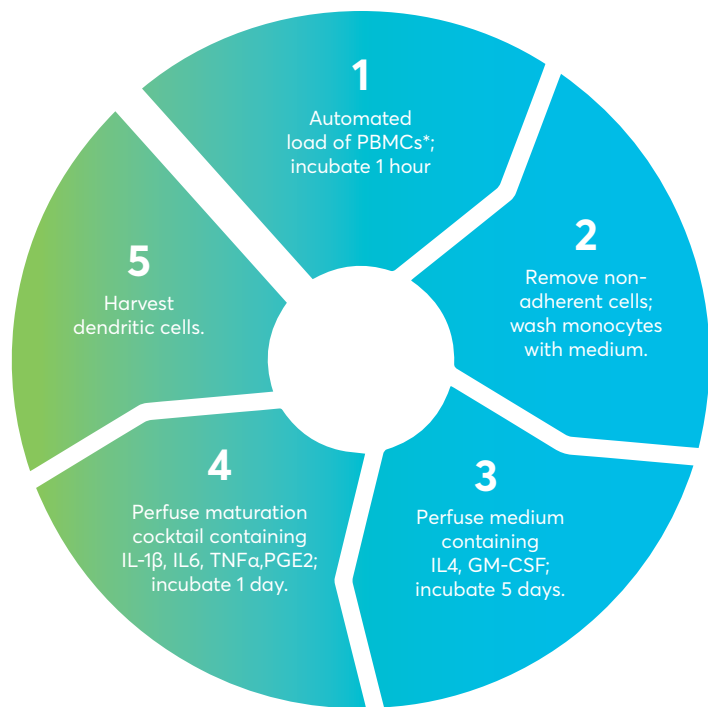
Despite heavy investment in R&D involving DCs, under-developed and inefficient manual protocols for DC generation lead to batch-to-batch variability and inconsistencies and contribute to increased costs and research slowdowns.

The current gold-standard method for generating DCs from monocytes has 11 laborious manual steps involving 15 hours of technician time. Steps include static culture and stimulation with cytokines contained in culture media using multiple t-flasks or well plates.

To address this manufacturing dilemma, market-leading Corning entered into an agreement with Flaskworks to commercialize MicroDEN, an automated fluidic system that allows for differentiation of monocytes into DCs utilizing continuous perfusion of differentiation media.

"Using an automated, perfusion-based process such as MicroDEN for dendritic cell production it eliminates six manual steps, reduces the risk of contamination, and efficiently produces repeatable results in less time," said Jamie Clark, Product Line Manager, Bioprocess, at Corning Life Sciences. "It also eliminates the variability that can result from different levels of technician proficiency."

The closed system provides consistent yields and requires only three hours of technician time during the week-long process (see figure below). MicroDEN leverages the benefits of a polystyrene



\*Peripheral Blood Mononuclear Cells

Automated, Perfusion-based, Closed System Solution

culture surface, similar to the manual method, to provide for removal of non-adherent cells. Up to 25 million DCs can be reproducibly generated per unit, an equivalent or greater yield than manual production.

Benchmark phenotyping along with allogeneic T-cell proliferation and syngeneic antigen-specific functional assays demonstrated no phenotypic or functional differences based on manufacturing methodology.<sup>1</sup> The same conventional phenotypes also resulted using culture medium containing either FBS or human serum, and when using serum-free medium.

In fact, in an allogeneic functional assay with immature DCs co-cultured with allogeneic CD3+ T cells for five days, MicroDEN-generated DCs proved better than manually-generated cells at inducing T-cell proliferation. Proliferation was analyzed using CellTrace™ Far Red.

The RUO system will quickly demonstrate its superior approach to generation of DCs in routinely-performed workflows and assays. Applications for MicroDEN-generated DCs include tumor infiltrating lymphocytes (TIL) workflows that require a screening step, typically performed with autologous, manually-produced, monocyte-derived DCs, for selection of appropriate sub-types and validation of neoantigen-specific T-cell receptors (TCRs).

To illustrate another example, a reliable supply of DCs is also needed for Mixed Lymphocyte Reactions (MLR) and Antibody Dependent Cellular Cytotoxicity (ADCC) assays that are widely used in screening of biologic and small molecule drugs. Higher T-cell proliferation and production of relevant cytokines are screens for anti-tumor potential.

It is no longer necessary to invest months to train technicians to manufacture DCs and still receive inconsistent results that vary batch to batch. The innovative MicroDEN perfusion system



eliminates 55% of the manual steps, produces reproducible results in less time while greatly reducing contamination risk. Now, Corning and Flaskworks have shown that there is indeed a better way to manufacture DCs.

#### REFERENCE

1. Automated generation of immature dendritic cells in a single-use system, Kozbial A. et al., J Immunol Methods, 2018 June ; 457: 53–65. doi:10.1016/j.jim.2018.03.010.



**VWR® POWER SUPPLY**

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- Compact footprint, takes up minimal lab space
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- 300 V/2000 mA, 300 W maximum output
- Ideally suited for horizontal DNA gels, vertical protein gels

The color touchscreen control panel is easy to use, allowing setting of voltage, amperage and run time. Four sets of output jacks allow connection of multiple electrophoresis tanks.

Description	Voltage	Cat. No.
<b>115 VAC Unit</b>		
VWR® Power Supply	10 - 500 V	76196-454



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**SMALLEST OF THE VWR ELECTROPHORESIS SYSTEMS, THE MINI S CAN BE USED FOR UP TO 24 SAMPLES ENABLING SHORT AND RAPID SAMPLE SEPARATIONS.**

- Direct gel casting in the chamber
- Fluorescent ruler silk screened onto the gel tray
- Complete with UVT gel tray

All VWR horizontal Mini gel systems include a UV-transmissible gel tray, which has a minimum of two comb positions, allowing the user to run from 2 - 12 (depending on the size of the unit) sets of samples for equal distances simultaneously and a fluorescent ruler (silk-screened onto the tray) that aids in the precise photo documentation of each gel run.

Description	Buffer Volume	Cat. No.
VWR Horizontal Mini S Electrophoresis System	400 ml	76314-718



**INGENIO® EZPORATOR® ELECTROPORATION SYSTEM, MIRUS BIO**

**THIS SYSTEM IS DESIGNED TO BE USED WITH THE INGENIO® ELECTROPORATION SOLUTION TO PROVIDE A COST-EFFECTIVE, ROBUST AND OPEN TRANSFECTION SYSTEM FOR MANY HARD-TO-TRANSFECT CELL TYPES**

- Performance: deliver any nucleic acid to hard-to-transfect, stem and primary cells
- Simplicity: use a single, universal electroporation solution across all cell types
- Flexibility: easily optimize electroporation parameters for each cell type

The Ingenio® EZporator® Electroporation System is designed to be used with the Ingenio® Electroporation Solution which is ideal for mammalian and insect cell transfection. Electroporation is the method of choice for many hard-to-transfect cell types, and the Ingenio® EZporator® Electroporation System is a cost-effective, straightforward, open system that is perfect for any lab seeking performance without breaking the bank.

Cat. No.
76304-532

This specific product is not available in Canada. Please contact your VWR Sales Representative to learn about easy access to similar options available in your region.





### ENGEN® SGRNA SYNTHESIS KIT, *S. PYOGENES*, NEW ENGLAND BIOLABS

#### IN NATURE, *S. PYOGENES* CAS9 IS PROGRAMMED WITH TWO SEPARATE RNAs, THE CRRNA AND TRACRRNA

- Programmed with two RNAs
- Contains approximately 20 nucleotides
- Adapted for use in the lab
- Create double-stranded DNA for transcription

The crRNA, or CRISPR RNA sequence contains approximately 20 nucleotides of homology complementary to the strand of DNA opposite and upstream of a PAM (Protospacer Adjacent Motif) (NGG) sequence.

Description	Size	Cat. No.
EnGen sgRNA Synthesis Kit, <i>S. pyogenes</i>	20 Reactions	103218-922

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Description	Cat. No.
<b>Purchase a Block Heater...</b>	
1 Block Digital Dry Block Heater	75838-270
2 Block Digital Dry Block Heater	75838-282
4 Block Digital Dry Block Heater	75838-294
6 Block Digital Dry Block Heater	75838-306
2 Block Digital Dry Block Heater w/Heated Lid	75838-278
1 Block Analog Dry Block Heater	75838-318
2 Block Analog Dry Block Heater	75838-286
4 Block Analog Dry Block Heater	75838-298
6 Block Analog Dry Block Heater	75838-310



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PROMO  
CODE  
5093

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Modular Block for 20 x 1.5mL Eppendorf Tubes 1	13259-002
Modular Block for 20 x 1.5mL Microtubes	13259-286
Modular Block for 20 x 2.0mL Eppendorf Microtubes	12985-048
Modular Block for 20 x 12/ 13mm Test Tubes	13259-130
Modular Block for 12 x 15/ 16mm Test Tubes	13259-162

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- High-speed shaking ability
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- Operational data can be exported via USB
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- Now with best-in-class, exclusive five-year warranty
- Available with an NIST Traceable, ISO/IEC 17025 Accredited Calibration Certificate from Troemner

Description	Electrical	Cat. No.	Each
Thermal Shake Touch with 1.5 mL Block	120V, 1.8A, 215W	89232-908	2690.00
Cooling Thermal Shake Touch with 1.5 mL Block	120V, 1.8A, 215W	89232-904	3182.70
Cooling Thermal Shake Touch with 1.5 mL Block	230V, 0.9A, 210WW	89232-906	3182.70



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- Two modes of operation
- Best-in-class five-year warranty



PROMO CODE 5092



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Description	Cat. No.
Fixed Speed Vortex Mixer	10153-834
Analog Vortex Mixer	10153-838
Digital Vortex Mixer	10153-842
Pulsing Vortex Mixer	10153-812

Free item is to be OF EQUAL OR LESSER VALUE than purchased product. Promotional items will be shipped separately - not included with your order. Products, specifications and product numbers may change during the promotion period. This promotion cannot be used in conjunction with any other Greiner Bio-One or Distributor promotion. Contact your VWR Sales Representative or Customer Service for exact pricing. Quantity limits and participant qualifications for all promotions are determined by VWR. Offers are void where prohibited by law or organization/company policy. One redemption per laboratory.

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- Exclusive accu-drive shaking system
- Triple eccentric drive with brushless motor

Use with temperature probes, thermometers, or other glass tubes. Includes 18" (45.7 cm) stainless steel support rod, thermometer/temperature probe extension clamp, three-prong medium swivel clamp, and hook connector.



PROMO CODE 5095



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VWR Advanced Hotplate Stirrers deliver accurate and repeatable results. Temperature range from ambient +5° to 500°C, speed range from 60 to 1600rpm. Control panel features easy to use controls which allow user to dial in adjustments. Recall last set temperature with the touch of a button, even after unit has been turned off. Rear housing features an offcentered integral support rod holder with locking knob that works with the optional support rod kit.



\$165 VALUE



Description	Cat. No.
<b>3500 Models</b>	
Standard, with free 13" x 13" Platform	MP980301P1
Standard, with free 18" x 18" Platform	MP980301P2
Standard, with free 18" x 24" Platform	MP980301P3
Advanced, with free 13" x 13" Platform	MP980303P1
Advanced, with free 18" x 18" Platform	MP980303P2
Incubating Orbital Shaker, with free 11" x 13" Platform	MP980153P7
<b>3750 Models</b>	
Reciprocating, with free 13" x 13" Platform	MP980307P1
Reciprocating, with free 18" x 18" Platform	MP980307P2
Reciprocating, with free 18" x 24" Platform	MP980307P3
<b>5000 Models</b>	
Standard, with free 18" x 24" Platform	MP980310P3
Standard, with free 18" x 30" Platform	MP980310P5
Advanced, with free 18" x 24" Platform	MP980312P3
Advanced, with free 18" x 30" Platform	MP980312P5
5000I Incubating, with free 18" x 18" Platform	MP980330P2
5000IR Incubating/Refrigerating, with free 18" x 18" Platform	MP980332P2
<b>10000 Models</b>	
10000-1 Advanced, with free 24" x 24" Platform	MP980320P4
10000-2 Advanced, with free 24" x 24" Platform	MP980322P4
<b>15000 Models</b>	
15000-1 Advanced, with free 24" x 36" Platform	MP980324P6
15000-2 Advanced, with free 24" x 36" Platform	MP980326P6
<b>Dura-Shaker Models</b>	
Dura-Shaker, with free 13 x 13" Platform	MP980303CO2P1
Dura-Shaker, with free 18 x 18" Platform	MP980303CO2P2
Dura-Shaker, with free 18 x 24" Platform	MP980303CO2P3

Electrical	Top Plate Dimensions, cm	Maximum Capacity	Top Plate Material	Cat. No.
120V, 400W, 3.3A	10.2 x 10.2	600 mL	Aluminum	97042-606
120V, 400W, 3.3A	10.2 x 10.2	600 mL	Ceramic	97042-602
120V, 1000W, 8.3A	17.8 x 17.8	2500 mL	Aluminum	97042-646
120V, 1000W, 8.3A	17.8 x 17.8	2500 mL	Ceramic	97042-642
120V, 1550W, 12.9A	25.4 x 25.4	6000 mL	Aluminum	97042-686
120V, 1550W, 12.9A	25.4 x 25.4	6000 mL	Ceramic	97042-682

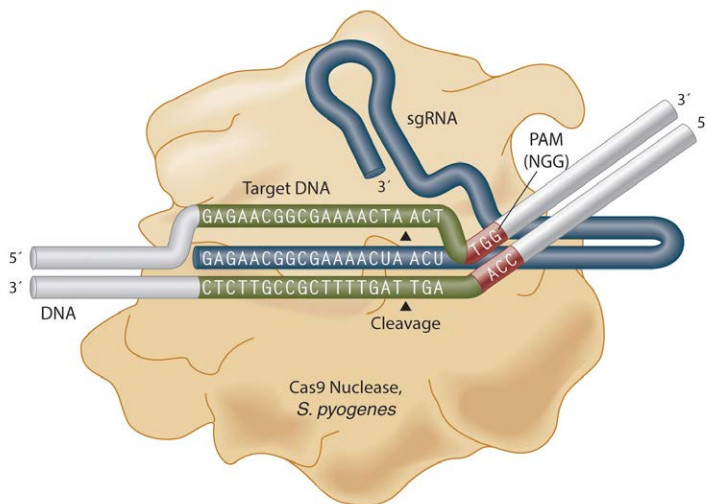
Visit [vwr.com/promotions](http://vwr.com/promotions) and search **Promo Code 4292**. Offer expires 12.31.2019.

# Single guide, simplified:

EnGen sgRNA Synthesis Kit, *S. pyogenes* generation of microgram quantities of sgRNA in less than one hour with the EnGen sgRNA Synthesis Kit, *S. pyogenes*

By Ezra Schildkraut, Ph.D.

CRISPR is an acronym for Clustered Regularly Interspaced Palindromic Repeats, which are genomic loci found in many bacteria and archaea. The CRISPR/Cas9 pathway naturally allows for the elimination of genomic material from invading sources in bacteria, and has recently been adapted as a molecular biology tool to edit genomes in a target-specific manner. Cas9 (CRISPR-associated protein 9) is a double-stranded DNA endonuclease that forms an active ribonucleoprotein (RNP) when complexed with guide RNAs (gRNAs) encoded at the CRISPR loci. gRNAs provide sequence-specificity to the RNP, directing the Cas9 nuclease to DNA targets resulting in double-strand breaks in the DNA.



**FIGURE 1. Cas9 nuclease, *S. pyogenes*.**

An sgRNA is complexed with Cas9, *S. pyogenes*. Cleavage occurs three nucleotides upstream of the PAM sequence (red). sgRNAs are complementary to the strand opposite of the PAM.

In nature, *S. pyogenes* Cas9 is programmed with two separate RNAs, the CRISPR RNA (crRNA) and the transactivating crRNA (tracrRNA). The crRNA contains 20 nucleotides of homology complementary to the strand of DNA opposite and upstream of the Protospacer Adjacent Motif (PAM) (NGG) sequence. The tracrRNA contains partial complementary sequence to the crRNA, as well as the sequence and secondary structure that is recognized by Cas9. These sequences have been adapted for use in the lab by combining the tracrRNA and crRNA into one long single guide RNA (sgRNA)<sup>(1)</sup> species capable of complexing with Cas9 to recognize the target DNA and induce double-strand DNA breaks (Figure 1).

Activation of the cellular double-strand break machinery can lead to insertions and/or deletions (indels) through Non-Homologous End Joining (NHEJ), resulting in disruption of the gene at that specific locus. In the presence of a homologous repair template, the homology-directed repair (HDR) pathway can be activated leading to the introduction of specific changes in the DNA at the targeted site.

This application note describes sgRNA synthesis using the new EnGen sgRNA Synthesis Kit, *S. pyogenes*, which simplifies the generation of custom sgRNA in an hour or less by combining template synthesis and transcription in a single-tube reaction.

## PROTOCOL:

The EnGen sgRNAs Synthesis Kit, *S. pyogenes* provides a simple and quick method for transcribing high yields of sgRNA in a single 30 minute reaction using the supplied reagents and target-specific DNA oligos designed by the user. This target-specific oligo contains a T7 promoter sequence, 20 nucleotides of target-specific sequence and a 14 nucleotide overlap region that anneals to a complementary region within the *S. pyogenes* Cas9-specific Scaffold Oligo (included in the EnGen 2X sgRNA Reaction Mix). The DNA polymerase within the enzyme mix extends both oligos from their 3' ends creating a double-stranded DNA (dsDNA) template for transcription by T7 RNA Polymerase, also provided within the enzyme mix. Synthesis



of the dsDNA template and transcription of RNA occur in a single reaction, resulting in the generation of a functional sgRNA.

Target sequences for modification are selected using online guide selection tools such as ChopChop or Desktop Genetics. Target-specific oligos to be ordered are designed using the EnGen sgRNA Template Oligo Designer within the NEBioCalculator (<http://nebiocalculator.neb.com/#!/sgrna>). Reactions are assembled at room temperature and incubated at 37°C for 30 minutes, followed by DNase I treatment. sgRNAs are purified using RNA spin columns, quantified by UV light absorbance and analyzed by gel electrophoresis. In vitro digestion of dsDNA templates in the presence of Cas9 is performed to demonstrate the functionality of sgRNAs synthesized using the EnGen sgRNA Synthesis Kit, *S. pyogenes*.

**RESULTS:**

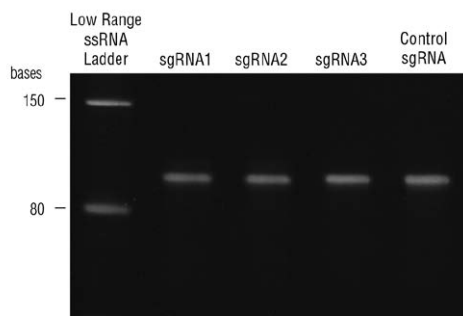
Using the guidelines above, 72 target-specific oligos were designed and used to generate 72 different sgRNAs. Yields ranged from 4-45 µg, with most falling between 4-25 µg. sgRNA quality and length were evaluated by denaturing gel electrophoresis and SYBR Gold staining (Figure 2). The sgRNA control oligo synthesized with the EnGen sgRNA Synthesis Kit was incubated with Cas9, *S. pyogenes* to form an active RNP complex that cleaved a double-stranded DNA target in vitro (Figure 3).

**SUMMARY:**

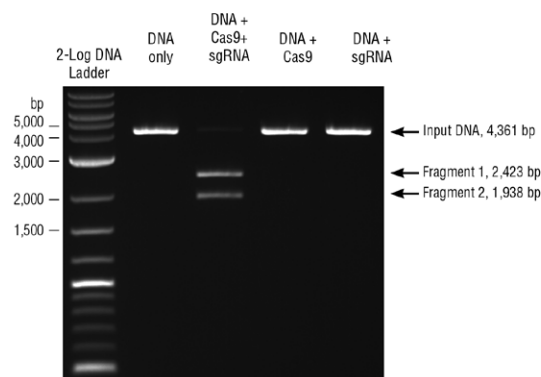
The EnGen sgRNA Synthesis Kit, *S. pyogenes* can be used to generate microgram quantities of functional custom sgRNAs in less than an hour. This method reduces protocol time with the single reaction-format and only requires the design of a single ~55 nucleotide ssDNA target-specific oligo for each sgRNA resulting, thus reducing the cost per reaction.

**REFERENCE**

1. Jinek, M. et al. (2012) Science 816-821. PubMed ID: 22745249



**FIGURE 2. Examples of sgRNA synthesized Using the EnGen sgRNA Synthesis Kit, *S. pyogenes*.** RNA was run under denaturing conditions on a 10% Novex TBE-Urea gel and post-stained with SYBR Gold.



**FIGURE 3. Example of an in vitro Cas9 Nuclease Assay.** A DNA target (PvuII-linearized pBR322) was cleaved by Cas9 complexed with the control sgRNA synthesized using the EnGen sgRNA Synthesis Kit, *S. pyogenes*. Reactions were set up following NEB protocols with a ratio of 20:20:1 (Cas9:sgRNA:target site). Cleavage products were resolved on a 1% TBE agarose gel stained with ethidium bromide



**VWR® PCR WORKSTATION PRO HEPA**

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- Active decontamination of work surface during non-working time by UV irradiation
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- Contaminant prevention thanks to antimicrobial stainless steel work surface
- Carbon filter to remove ozone and gases

**Construction:** Housing in stainless steel, front and side panels made of 8 mm Makrolon® protects from UV irradiation.

Description	Cat. No.
Workstation	
PCR Workstation Pro with HEPA, US	76289-386



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**CAPABLE OF HIGH SPEED PERFORMANCE UP TO 15,500 RPM**

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- Large LCD with RCF conversion
- Decelerated in just 10 seconds
- Capacity: 12 x 1.5/2.0 mL

A solid, high-grade aluminum rotor is included and accepts microtubes (1.5 to 2.0 mL)

Description	Capacity	Speed	Cat. No.
High Speed Microcentrifuge	12 x 1.5/2.0 mL	15,500 rpm/16,100 xg	75838-336



**BTX LEGACY ECM 2001 ELECTROFUSION AND ELECTROPORATION GENERATORS, HARVARD APPARATUS**

**MULTIPURPOSE SYSTEMS WITH AC WAVE FOR CELL ALIGNMENT AND SQUARE DC WAVE FOR CELL FUSION AND MAMMALIAN TRANSFECTION**

- Wide range of voltages from 5 to 3000 V
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- Arc quenching
- Digital display of actual voltage and pulse length delivered

The Legacy ECM 2001 is a multipurpose electro cell manipulation pulse generator capable of performing both electrofusion for hybridoma production, hybrid cell formation, and nuclear transfer applications in addition to electroporation of cells in suspension and *in vivo* applications. This versatile platform combines microprocessor-controlled precision with a wide range of possible parameters for a wide range of applications when combined with standard cuvettes, specialty electrodes, and other available accessories.

Description	Includes	Cat. No.
Legacy ECM 2001 Cell Fusion System Complete	Legacy ECM 2001 Generator, Microslides (0.5 mm Gap, 3.2 mm Gap), Meander Fusion Chamber, Flat Electrode / Divergent Field, Electrode Adapter, Connection Cable, Safety Stand 630B, Cuvettes 1 mm, 2 mm, 4 mm Package of 30 (10 each) and Cuvette Rack 660	58018-008



**EPENDORF® EPORATOR® ELECTROPORATION SYSTEM**

**A COMPACT INSTRUMENT DESIGNED FOR FAST AND CONTROLLED ELECTROPORATION OF BACTERIA, YEAST, AND OTHER MICROORGANISMS**

The unit ensures faster sample handling due to simple, intuitive operation. Two program buttons allow storage and recall of most commonly used parameters. Safe electronics and an integrated electroporation chamber eliminate voltage leaks and misuse. The compact, space-saving design allows for easy transport and storage. GLP-compliant documentation is quickly and easily made available via USB port.

Description	Electrical	Pulse Voltage	Time Constant	Cat. No.
Epurator® for Bacteria and Yeast	110 V	20–2500 V	5 µs (Nominal)	71002-390



**VWR® COMPACT MICRO CENTRIFUGES**

**IDEAL FOR DNA, RNA, AND TEMPERATURE-SENSITIVE SAMPLES**

- Refrigerated model with pre-cool function available
- Robust and steady temperature control
- High performance; ideal for sample preparation
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- Pulse button for short centrifugation runs

Safety locking lids are equipped for biocontainment.

Description	Dimensions	Temperature Range	Rotor	Cat. No.
Centrifuges				
Microcentrifuge, Refrigerated	260 x 281 x 553 mm	-10 to +40°C, down to +4°C in 10 to 15 min.	4 x 8 Strip Tube	76019-138



**BIOMETRA THERMAL CYCLERS, ANALYTIK JENA**

**OFFERS PCR DEVICES RANGING FROM STANDARD TO PREMIUM EQUIPMENT ALL DESIGNED IN LINE WITH THE COMMON PRINCIPLES OF BEING RELIABLE, EASY-TO-USE AND PRECISE.**

- One block, two block, or three block systems available
- Integrated 7" touchscreen control
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- High performance smart lid
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The Biometra TOne is a full-featured, budget-friendly thermal cycler perfect for standard PCR work.

Description	Cat. No.
Biometra TAdvanced Base Unit	76102-428



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- Ideal for low-throughput workflows
- 12 Deck positions
- Flexible pipetting with interchangeable pipetting tools and gripper
- Fits in laminar flow hood
- Optional enclosure to protect samples from airborne particles

The Biomek® 4000 Automated Workstation features liquid-level sensing, windows 7 operating system, and a 22" display control screen. Execute accurate intra-well pipetting, efficient wash, and bulk dispense tool. Supports labware from tubes to 384-well microplates.

Description	Volume	Cat. No.
Laboratory Automated Workstation, 100/240 V	1-1000 $\mu$ L	10809-032



### VWR® BEAD MILL HOMOGENIZER, 120V

PART OF THE NEWEST GENERATION OF BEAD MILL HOMOGENIZERS. THIS ECONOMICAL SYSTEM IS SPECIFICALLY DESIGNED FOR GRINDING, LYSING AND HOMOGENIZATION OF UP TO 16 SAMPLES

- 16 sample capacity
- Run time 1 second to 10 minutes
- 0.8 to 6 m/s
- Up to 99 programs
- TUV Certified
- Two-year warranty

The VWR® Bead Mill simultaneously homogenizes 12x0.5mL, 4x1.5mL, 12x2mL, or 4x7mL samples.

Description	Sample Size	Cat. No.
Bead Mill Homogenizer	25 $\mu$ L-5 mL	75840-022



### Q qPCR INSTRUMENT, QUANTABIO

USES A PATENTED MAGNETIC INDUCTION TECHNOLOGY TO RAPIDLY HEAT SAMPLES COUPLED WITH FAN FORCED AIR FOR COOLING TO ACQUIRE DATA IN ONLY 25 MINUTES.

- Ultra-fast data acquisition - 35 cycles in 25 minutes
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- Scalable & wireless - Connect up to 10 instruments (48 samples/instrument)
- Magnetic induction technology - eliminate variability vs block-based cyclers

Description	Size	Cat. No.
Q 2-channel qPCR Instrument	1 instrument	76175-392
Q 4-channel qPCR Instrument	1 Instrument	76175-394



**analytikjena**



### QTOWER<sup>®3</sup> 84 REAL-TIME QPCR, ANALYTIK JENA

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- 384 well microplates
- Homogeneity  $\pm 0.15$  °C at 55 °C
- 2 year system warranty
- 10 year optics warranty
- No calibration/maintenance required
- License-free software

Enhance Your Throughput – A new standard for speed and precision in high-throughput qPCR

With steadily growing sample volumes and new options for molecular biology experiments, the requirements for quantitative real-time PCR are changing. The transition to the multiwell format with 384 samples opens up new application areas in gene expression, mutation analysis, and diagnostics.

Description	Cat. No.
Non-Gradient, Non-Touch	76414-158



### MULTI-WELL PLATE VACUUM MANIFOLD, PALL LABORATORY

#### OPTIMIZED FOR THE VACUUM FILTRATION OF ACROPREP™ AND ACROWELL™ MULTI-WELL PLATES, MANIFOLD CAN ALSO BE USED WITH OTHER MULTI-WELL FILTER PLATES THAT MEET ANSI/SBS X-2004 SPECIFICATIONS

- For vacuum filtration
- Can be used with other multi-well plates
- Anodized aluminum

Manifold is constructed of anodized aluminum and is designed to facilitate the filtration of liquid through a multi-well filter plate into a receiver plate for collection.

Description	Cat. No.
Multi-Well Plate Vacuum Manifold	16003-836



### PLATEMAX™ SEMI-AUTOMATED PLATE SEALER

#### IDEAL HEAT SEALER FOR THE LOW TO MEDIUM THROUGHPUT LABORATORY THAT REQUIRES UNIFORM AND CONSISTENT SEALING OF MICROPLATES

The PlateMax accepts a wide range of microplates and heat seals utilizing a control system with a large digital display that shows all operating parameters. The sealing temperatures are adjustable from 100°C to 190°C and sealing times are adjustable from 0.5 to 10 seconds. The power saver feature that saves power by shutting down heating block when inactive, can now be toggled off for labs that wish to keep unit at sealing temperature for immediate use throughout the day.

Voltage	Quantity	Cat. No.
115V	Ea.	89203-178



### ARIAMX REALTIME PCR SYSTEM, AGILENT TECHNOLOGIES

#### A FULLY INTEGRATED QUANTITATIVE PCR AMPLIFICATION, DETECTION, AND DATA ANALYSIS SYSTEM

- Gene expression analysis
- New genotyping/HRM capability, mRNA quantification
- NGS quantification: library preparation, result validation, nucleic acid monitoring, rare allele detection
- Can use self-Installable optical cartridges

The system design combines a state-of-the-art thermal cycler, an advanced optical system with an LED excitation source, and complete data analysis software.

Description	Details	Cat. No.
<b>Base Instrument</b>		
AriaMx Real-Time PCR System	Base instrument does not include any optical cartridges. Purchase of at least one optical cartridge is required for a functional instrument.	76193-704



### VWR® UNIVERSAL PIPET TIPS

#### REPEL LIQUID BY CREATING A HYDROPHOBIC SURFACE ON THE INSIDE OF THE TIP INCREASING YOUR ACCURACY AND DATA QUALITY

- Compatible with the widest range of pipets
- Maximizes sample recovery with low binding resin and a fine point design
- Autoclavable at 15 psi, 122°C for 15 minutes
- Manufactured under an ISO 9001 quality management system

Volume	Length	Sterility	Packaging	Cat. No.
1-20 µL	50.75 mm (2.00")	Pre-sterilized	10×96 Tips/Pack	76322-134
20-200 µL	59.54 mm (2.34")	Pre-sterilized	10×96 Tips/Pack	76322-150
100 - 1250 µl	98.40 mm (3.87")	Pre-sterilized	10×96 Tips/Pack	76322-156



### VWR® COOLING THERMAL SHAKE TOUCH WITH 1.5ML BLOCK

#### DESIGNED FOR APPLICATIONS THAT REQUIRE CONSISTENT AND PRECISE RESULTS

- Intuitive 4.3" LCD Touch Screen simultaneously displays all settings for complete control and monitoring
- Rapid temperature cycling and high-speed shaking ability result in increased throughput
- Internal memory stores five separate 5-step programs, and operational data can be exported via USB
- Interchangeable blocks are ideal for processing micro tubes, conical tubes, cryotubes, and microplates

With heating, cooling, and shaking capabilities, the Cooling Thermal-Shake Touch uses interchangeable blocks to accommodate a wide variety of tubes and microplates

Description	Electrical	Cat. No.
<b>Shakers with NIST Traceable Certificate</b>		
VWR Cooling Thermal Shake Touch with 1.5mL Block	120V, 1.8A, 215W	10027-170



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- Environmentally friendly
- Stainless steel solid door and front
- Swinging doors
- Automatic defrost
- Lifetime guaranteed recessed door handles and door hinges

Standard with 3, 6, or 9 adjustable heavy duty PVC coated full gray shelves and LED lighting.

Electrical	Volume	Compressor	No. of Doors	No. of Shelves	Temperature Range	Shipping Weight	Cat. No.
<b>Freezers</b>							
115 V, 5.5 A	651 l (23 cu.ft.)	1/2 hp	1	3	-10 °F (-23.3 °C).	270 lbs.	10018-870

CORNING



## COOLRACK® MODULES, CORNING®

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- "Ensures +/- 0.1°C temperature uniformity across all tubes when cooling, snap freezing, heating or thawing
- All CoolRack modules may be autoclaved, high heat sterilized or decontaminated with bleach, alcohol or other disinfectants or lab detergents
- Suggested applications include cooling reagents such as restriction enzymes, dNTPs and antibodies, alcohol-free dry ice snap freezing of tissue, virus and bacteria samples and bench top cryogenic tube sorting in liquid nitrogen
- All modules may be autoclaved, high heat sterilized or decontaminated with bleach, alcohol or other disinfectants or lab detergents"

Place CoolRack® or CoolSink™ modules on ice, dry ice, liquid nitrogen, water baths, heat blocks (-200 to 100°C), or other vessels and they rapidly adapt to source temperature. Cool, (snap) freeze, or thaw samples consistently and reproducibly without directly inserting them into a temperature source to reduce variability and contamination.

Description	Size	Color	Cat. No.
CoolRack M15, Holds 15 x 1.5 or 2 mL Microfuge Tubes, Green	10.2 x 6.4 x 3.8 cm	Green	75779-886



## VWR LIFE SCIENCE NUCLEASELIMINATOR™

- Effectively removes and deactivates nuclease contamination even at high concentrations
- Safe on all laboratory glass and plastic ware
- Stable at room temperature for at least two years

DNase and RNase contamination ruins expensive samples and time-consuming protocols in research laboratories every day. NucleasEliminator™ can help protect your investment by removing and deactivating even high concentrations of nuclease contamination from glass or plastic surfaces. Simply wipe, immerse or fill the surface or vessel to be decontaminated with NucleasEliminator™, incubate 5 minutes at room temperature and rinse thoroughly with nuclease-free water. NucleasEliminator™ is safe to use on all surfaces at the laboratory bench ranging from glassware, microcentrifuge tubes, pipette tips and electrophoresis units. NucleasEliminator™ is supplied as a ready-to-use liquid. A 100 ml bottle will treat up to 100 microcentrifuge tubes or 25 agarose electrophoresis casting trays.

Description	Size	Cat. No.
NUCLEASELIMINATOR™	500 mL	97063-076

# Can your water keep up with your needs?



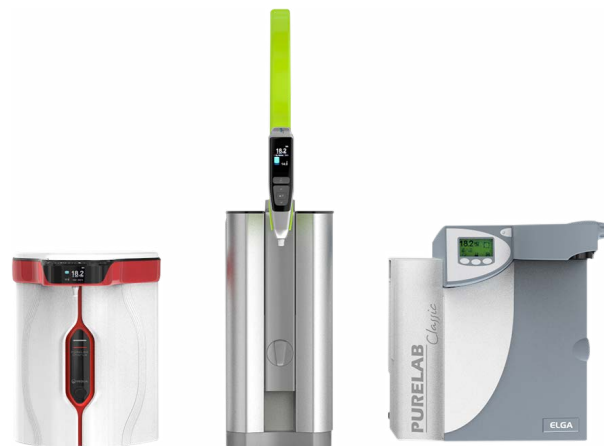
## ELGA LABWATER PURELAB® SYSTEMS

### FREE 2<sup>ND</sup> PURIFICATION PACK WITH PURCHASE OF AN ELGA LABWATER SYSTEM!

ELGA specializes in delivering water purification systems for research, science, and clinical environments. Our comprehensive range of pure and ultrapure water (Type I, II, III) purification systems offer several features and benefits, including either a few liters or up to thousands of liters of water per day. Why should you choose ELGA for your laboratory water needs?

- Customized service and support
- Cost reliable water systems with low running costs
- Thousands of systems installed successfully around the world

Purchase any qualifying ELGA LabWater system between January 1 and December 31, 2020 by visiting [vwr.com](http://vwr.com), calling 1 800 932 5000, or contacting your VWR Sales Representative. Customer must purchase 1st purification pack with order to receive the 2<sup>nd</sup> free through online redemption. Cannot be combined with other offered promotions. One redemption per system only. To redeem, have your VWR invoice, VWR purchase order, or VWR packaging slip available and visit [vwr.com/promotions](http://vwr.com/promotions) and search for **Promo Code 5188**. Fill out the form online before January 15, 2021.



Description	Cat. No.	FREE 2nd Purification Pk.
PURELAB Chorus	10034-540, 10034-542, 10034-544, 10034-546, 10034-548, 76048-804, 76048-806, 76048-808, 76048-810, 76048-796, 76048-798	10035-894, 10035-890, 76048-854, 76048-852
PURELAB Classic	89204-072, 89204-076, 89204-080, 89204-084	89204-376
PURELAB Flex	89204-088, 89204-092, 89221-838, 89221-840, 89221-844	89204-392, 89204-404

# The ideal solution to safely hold everything in your lab!



## VWR® TALON® MULTI-PURPOSE CLAMPS AND SUPPORTS

- Choose premium, corrosion-resistant stainless steel when working with corrosive materials to prolong the life of the clamp, lab-lift, or support
- Nickel-plated zinc and aluminum offer a high tensile strength at an economical price
- Secure any glassware with sturdy two and three prong clamps
- Durable lab-jacks are available in seven convenient sizes; choose premium stainless steel or anodized aluminum whenever a variable height is needed for your application

The unique design of the Talon clamp line offers one of the most extensive selections in the industry. With a variety of sizes, materials, hardware, and designs, there is always an option to accommodate any application.



Description	Cat. No.
Large three-prong stainless steel multi-purpose clamp	12621-236
Medium three-prong stainless steel multi-purpose clamp	12621-238
Small three-prong stainless steel multi-purpose clamp	12621-240
Jumbo holder stainless steel	12621-250
Medium three-prong swivel clamp	21573-708
Medium two-prong fixed position clamp	21573-266
Lab-jack 6x6" stainless steel	14233-364
Lab-jack 10x10" stainless steel	14233-368

For a complete listing of all VWR Talon Clamps, Lab-Lifts, & Supports with additional styles, sizes, and materials, visit [vwr.com](http://vwr.com)



# Cubis® II: The new generation of modular premium balances

The modular weighing system Cubis® II can be individually configured from different components. The combinability of the display unit, weighing module, draft shield, software packages for various applications and functions, and a comprehensive range of accessories allows the individual adaptation of the Cubis® II balance to all weighing tasks.

The Cubis® II range of premium laboratory balances with a maximum load between 2.1 g and 70 kg and a readability between 0.1 µg to 1 g provide the ideal model for every application.

- Leading performance
- Monolithical weighing system
- Integrated climate sensors
- Individual sample holders
- Error-free operation
- Individual QApp workflows
- Motorized auto-leveling\*
- Full end-to-end data integrity.
- 21 CFR Part 11 compliance



Description	Weighing Capacity (g)	Dimensions (W x L x H)	Linearity (mg)	Readability (mg)	Repeatability (mg)	Cat. No.
Cubis® II essential precision laboratory balances	5200	240 x 425 x 95	≤±100	100	≤50 ±	76376-854
Cubis® II essential precision laboratory balances	1200	240 x 425 x 95	≤±20	10	≤7 ±	76376-856
Cubis® II premium precision laboratory balance	5200	240 x 425 x 95	≤±100	100	≤50 ±	76376-858
Cubis® II essential precision laboratory balances with QP99 software	2200	240 x 425 x 95	≤±20	10	≤7 ±	76376-860
Cubis® II essential precision laboratory balances	2200	240 x 425 x 95	≤±20	10	≤7 ±	76376-862
Cubis® II essential precision laboratory balances with QP99 software	8200	240 x 425 x 95	≤±100	100	≤50 ±	76376-864
Cubis® II essential precision laboratory balances	8200	240 x 425 x 95	≤±100	100	≤50 ±	76376-866

## Environmental test chambers

Caron offers a full line of chambers for ICH Q1A drug stability testing, shelf life and packaging testing, and elevated and sub-ambient temperature and humidity studies. These units combine validatable performance with cost saving features:

- Plenum-directed back to front airflow for high uniformity even when full
- Steam-free gVapor™ humidification controls RH levels without raising power bills or facility HVAC loads
- On-demand gROD™ smart refrigeration only powers up when it's actually needed

Caron chambers are also extremely easy to use, with tool-free interior component removal and a powerful and intuitive touchscreen controller.



Workspace, L (cu. ft.)	Electrical	Cat. No.
283 (10)	115V, 60Hz, 12A	10204-764
708 (25)	115V, 60Hz, 16A	10204-770
934 (33)	115V, 60 Hz, 16A	10204-776
1,416 (50)	115V, 60Hz, 14A	10033-898
2,124 (75)	115V, 60Hz, 16A	10033-836

# Security, protection & compliance from Nor-Lake



## NOR-LAKE SCIENTIFIC WHITE DIAMOND SERIES LABORATORY AND MEDICAL REFRIGERATORS

- Natural, environmentally friendly refrigerants with zero ozone depletion
- Battery back-up to support temperature monitoring and alarms
- USB port for easy data transfer and software updates
- Keyed door locks for added security of valuable samples and medications
- Backed by an industry leading three-year parts and labor warranty plus two year compressor parts warranty



The White Diamond Series Upright Refrigerators from Nor-Lake are skillfully designed and purpose built with both laboratory and medical applications in mind. These upright models come in a glass or solid door configuration and sizes range from 12 - 72 cu. ft. capacity. This premier line utilizes the latest in cold storage technology including a digital microprocessor temperature controller, an intuitive digital touch screen temperature display, data logging, and a full complement of audible and visual alarms providing additional security of valuable samples and medications.

Description	Adjustable Shelves	Cat. No.
<b>Lab &amp; Medical Glass Door Refrigerator (cu. ft.)</b>		
12	5	76314-436
16	5	76314-438
23	5	76314-440
26	5	76314-442
33	10	76314-444
36	10	76314-446
47	10	76314-448
49	10	76314-450
69	15	76314-452
72	15	76314-454

Description	Adjustable Shelves	Cat. No.
<b>Lab &amp; Medical Solid Door Refrigerator (cu. Ft.)</b>		
12	5	76314-456
16	5	76314-458
23	5	76314-460
26	5	76314-462
36	10	76314-464
49	10	76314-466
72	15	76314-468

## Designed for the human experience



### REDISHIP PURIFIER® LOGIC®+ CLASS II BIOSAFETY CABINETS

These biosafety cabinets raise the bar for not only safety but comfort, too. They were designed for the human body and habits. The more comfortable you are, the safer you will be. They include a telescoping base stand and Type A2 biosafety cabinet with a 10" working height sash.

- Performance: Constant Airflow Profile™ (CAP) technology works with the ECM for precise airflow control
- Safety: MyLogic™ OS visible on a large, color LCD display; NSF-listed
- Comfort: True line-of-sight display, curved inlet grille for forearm support, and flush-mounted electrical receptacle covers with dampened hinges for easy opening and closing
- Sustainable Design: 94.9% recyclable content when the cabinet's lifetime is completed



Description	Dimensions (in.)	Cat. No.
3' with stand, 10" sash	42.3 x 31.2 x 63.7	76318-336
4' with stand, 10" sash	54.3 x 31.2 x 63.7	76317-622
5' with stand, 10" sash	66.3 x 31.2 x 63.7	76317-630
6' with stand, 10" sash	78.3 x 31.2 x 63.7	76317-638



**WARD'S® AUTOMATIC AUTOCLAVE SERIES**  
**THREE CONVENIENT OPTIONS FOR BENCHTOP STERILIZATION.**

- Rapid, complete sterilization for educational/research use
- Built-in water tank doesn't require external water supply
- Safety interlocks prevent door from opening while pressurized
- Stainless steel sterilization chambers
- One-year warranty

Ward's® BioClaves offer three preset standard cycle options, for sterilization of liquids, wrapped instruments or unwrapped instruments/plastic ware. A fourth option "Dry Only" is also available for additional drying time to be added to the end of a cycle.

Description	Electrical	Capacity	Dimensions	Cat. no.
BioClave 16	115 V, 50-60 Hz, 1600 W	16 L	22x17.5x15.7"	470230-598

# Set science in motion with your everyday glassware needs

At Avantor, we meet your lab's needs by offering a comprehensive line of glassware products including disposable glassware, reusable glassware, and bottles. We provide Class A and Class B products manufactured according to ASTM methods, so no matter how simple or complex your task may be, we are calibrated to contain and deliver!

- VWR Collection
- Corning
- DWK
- Ace glass

Visit [vwr.com](http://vwr.com) today to learn more about our glassware portfolio.

PB19042-NA

# Fast, reliable, and quiet automated plate sealing



The Thermo Scientific™ ALPS 5000™ Heat Sealer is the next generation in plate-sealing equipment offering fast sealing times, increased process customization, and all-electric operation, improving reliability and reducing noise. The ALPS 5000 Heat Sealer has a compact footprint to conserve precious bench space and top-loaded seals are easily accessible and can be loaded without the aid of a tool. With automated, electrically controlled microplate sealing, seal up to 4 plates per minute in a variety of hand-fed, benchtop or high throughput robotic applications.

Designed with the ability to program sealing time, temperature, pressure, foil length, and sealing distance, the ALPS 5000 Heat Sealer allows for ability to offer complete customization of the sealing process for a wide range of applications. The ALPS 5000 Heat Sealer is semi-automated and equipped with both on-board touch screen operation, savable protocols for benchtop use, and an RS232 port with included programming parameters for robotic integration.

Features	Benefits
Fast sealing of multiple plate heights	Seal plates from 8 mm to 46 mm in height with no adapters required
Touchscreen control and savable protocols	Easily integrated into an automation or a robotics workflow
Electrically driven with tool-free loading	No need to connect to an external air source or replace expensive vacuum cups
	Helps reduce risk of contamination inherent in pneumatically driven sealers

Description	Cat. No.
Automated microplate heat sealer	76376-438





**BACTRON ANAEROBIC CHAMBER, 900 PLATE CAPACITY, SHELDON TOTAL ANAEROBIC PROCESS WORKSTATIONS. SAMPLES CAN BE PREPARED, CULTURED, AND INSPECTED IN THE OXYGEN-FREE CHAMBER AND STANDARD INCUBATOR**

- Ergonomic arm ports provide a comfortable work space
- Integrated vacuum pump for quieter operation
- 60% faster airlock cycle with 3, 4, or 5 auto cycle iterations
- Auto-sleeve cycle with integrated HEPA filter, 40% faster sleeve cycle

An economical anaerobic environment system with air lock, a 16 cu.ft. workspace and a 900 plate capacity incubator allows the BACTRON900 to deliver optimum productivity in a compact space. The operator has total command of the work area, yet enjoys ample bench space for efficient performance of all procedures requiring an anaerobic atmosphere.

Description	Cat. no.
115 V Unit Anaerobic Chamber, 900 Plate Capacity	76097-900



**REBEL HYBRID MICROSCOPE BUNDLE, UPRIGHT AND INVERTED, DISCOVER ECHO**

**DESIGNED AROUND THE USER TO CHALLENGE THE STATUS QUO**

- Ultra-high resolution 13" touch display
- 8MP CMOS color camera
- Plan achromat and apochromat options available

Rebel True Ergo Table and Rebel Logic+Biosafety cabinet by Labconco bring the microscope stage down flush to the tabletop, setting a new precedent in microscope ergonomics.

Description	Cat. No.
Rebel Hybrid Microscope Bundle	76359-898

# Grow cells. Preserve them forever.

## SELECT CELL-IQ™ CO<sub>2</sub>/O<sub>2</sub> INCUBATORS AND VIP® ECO ULTRA-LOW FREEZERS

### CHOOSE REPRODUCIBILITY AND RELIABILITY FOR THE CELL CULTURE EQUATION

PHCbi brand cell culture incubators and ultra-low freezers offer a high performance combination of tissue culture growth and long-term preservation for clinical, research and pharmaceutical applications. Incubators are designed to mitigate contamination before it becomes a problem. Ultra-low temperature freezers include new inverter compressor refrigeration platforms with natural refrigerants to assure long-life performance with energy savings independently determined as best-in-class.

- ENERGY STAR® Certified ultra-low freezers save operating costs
- Quick recovery, interior uniformity, dependable lifetime operation as low as -86°C
- Select from three models, 18.6, 25.7 and 29.8 cu.ft.
- Cell culture incubators create accurate in vitro models of in vivo environments
- Choose from CO<sub>2</sub> or CO<sub>2</sub>/O<sub>2</sub> gas control systems.
- Select from high heat, H<sub>2</sub>O<sub>2</sub> or UV decontamination methods
- Control systems designed for precise management of growth conditions
- Single chambers can be stacked to optimize footprint and capacity



Description	Certification	Volume	Cat. No.
VIP ECO ULT Freezer	Energy Star Certified	25.7 cu.ft.	76020-716
VIP ECO ULT Freezer	Energy Star Certified	18.6 cu.ft.	76269-676
VIP ECO ULT Freezer	Energy Star Certified	29.8 cu.ft.	76371-774
Cell-IQ CO <sub>2</sub> Incubator	Infrared CO <sub>2</sub> Control	8.1 cu.ft.	10830-874
Cell-IQ CO <sub>2</sub> Incubator with Dry Heat	Infrared CO <sub>2</sub> Control	5.8 cu.ft.	75856-512
Cell-IQ Incubator	Multigas CO <sub>2</sub> and O <sub>2</sub> Control	5.7 cu.ft.	76383-302

# Intuitive touchscreen repeater

## INTRODUCTORY PRICING ON BRAND HANDYSTEP® TOUCH REPEATING PIPETTE

- Simple touchscreen operation with easy menu navigation
- Automatic tip ejection
- Automatic detection of BRAND PD-tip II syringe tips

Description	Cat. No.
BRAND HandyStep touch	MP76376-600

No redemption required, simply use this MP catalog number. It 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](http://vwr.com). (Promotional part numbers cannot be found via Search on [vwr.com](http://vwr.com).) For assistance with ordering, please contact VWR Customer Service at 800 932 5000. Offer expires 12.31.2020. **Promo Code 5526.**

SAVE  
OVER  
\$100



# Baths are better waterless

Lab ARMOR®

## LAB ARMOR BEAD BATHS

The Lab Armor Bead Bath's eco-friendly, state-of-the-art design takes full advantage of the robust properties of Lab Armor Beads™ made from solid recyclable metal. More energy efficient, uses over 4X less energy when set to 65°C and over 2X less energy at 37°C.

Lab Armor Bead Baths deliver exceptional temperature uniformity and gets up and running faster. You can do things with this bath that you can't do with your old water bath. You aren't limited to watertight containers, so you can safely incubate multi-well plates, petri dishes, and open-top samples at any angle.

- Available in three sizes 6L, 14L and 20L
- Digital microprocessor control
- Over-temperature protection
- Easy-to-clean stainless steel body and lid



Description	Cat. No.
Lab Armor 6 L Bead Bath with 5 L Beads, 120V	89409-218
Lab Armor 6 L Bead Bath, with 5 L Beads, 230V	89409-230
Lab Armor 14 L Bead Bath with 12 L Beads, 120V	89409-222
Lab Armor 14 L Bead Bath, with 12 L Beads, 230V	89409-234
Lab Armor 20 L Bead Bath with 15L Beads, 120V	89409-226
Lab Armor 20 L Bead Bath, with 15L Beads, 230V	89409-238

# FOCUS: EQUIPMENT & INSTRUMENTS

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