



Product Solutions for Viral Research Workflows

- Sample Collection, Isolation and Preparation
- Virus Identification
- Antibody Analysis
- Vaccine and Therapy Development
- Vaccine Manufacturing and QA/QC

Infectious viral diseases can attack quickly and without warning. Scientists and healthcare providers need to be prepared to address these challenges swiftly in order to minimize viral spread and accelerate vaccine development. Beckman Coulter Life Sciences provides laboratory automation solutions, genomic reagents, centrifugation solutions, cell health analysis instruments, flow cytometry solutions, particle counting and characterization tools and other laboratory instrumentation to support research workflows related to testing, research, vaccine production and biopharma manufacturing.

ACCELERATING
answers

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Life Sciences

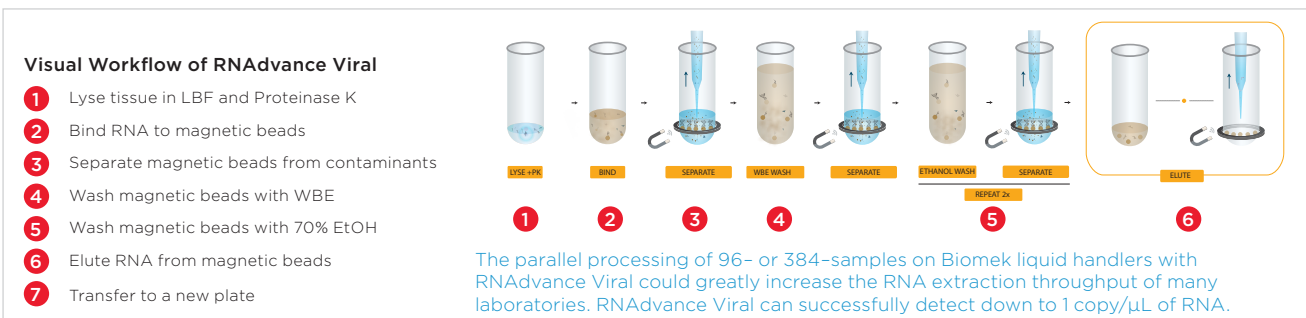
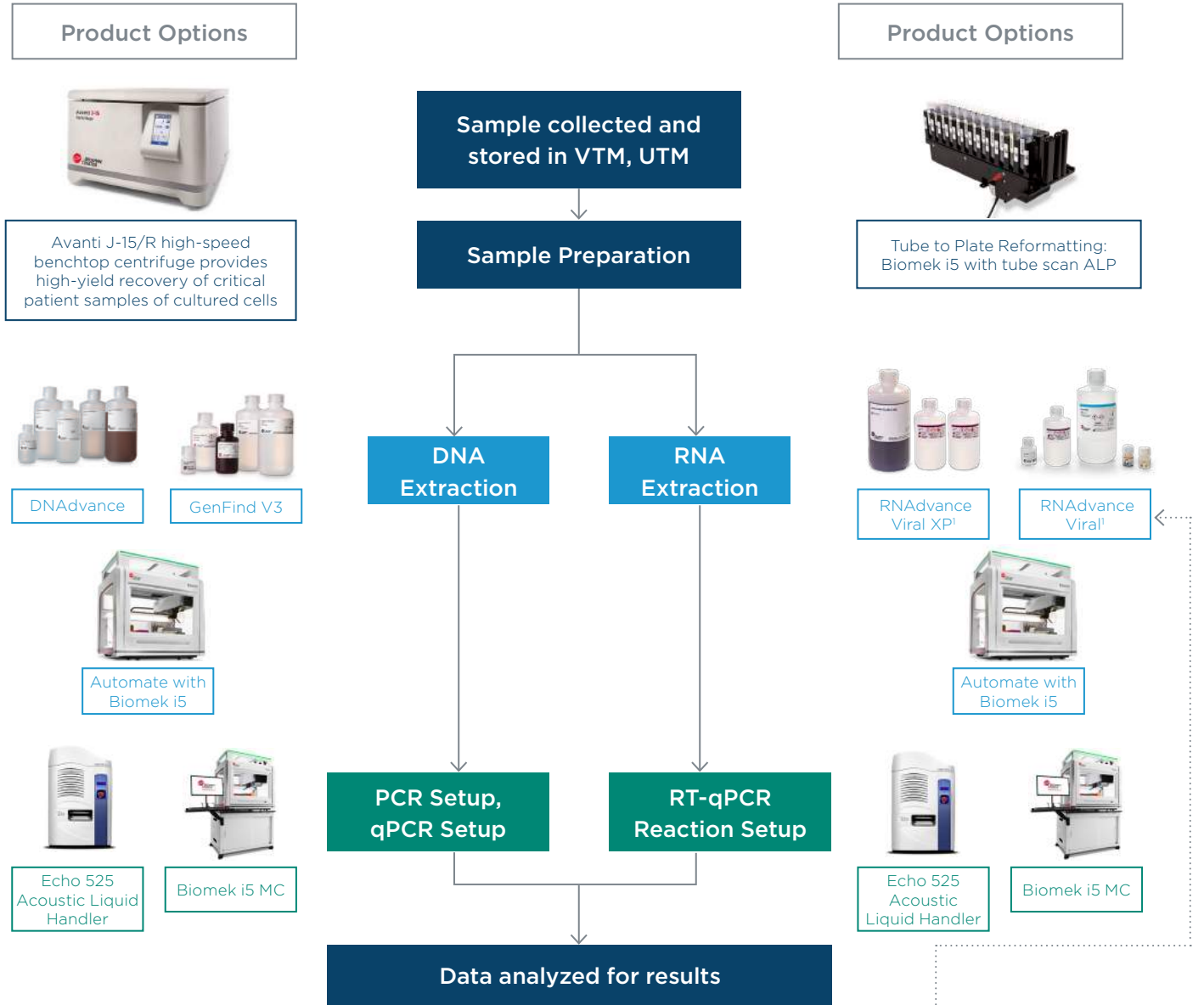
Viral Pathogen Identification

From isolation of viral particles, to their morphological, genotypic and phenotypic characterization, each method requires a uniquely qualified tool to produce reliable, quality results for viral identification. Sample workflows for viral detection and characterization can involve next generation sequencing (NGS), reverse transcriptase-polymerase chain reaction (RT-PCR), and enzyme-linked immunosorbent assay (ELISA) protocols. See the Beckman Coulter Life Sciences product offering for your pathogen identification workflow.

	Protocol	Sample	Products	Description
Viral Isolation	Isolation and purification	Viral	Avanti JXN Avanti J-15/R Optima XPN Optima MAX Airfuge	Our broad range of centrifugation products enable you to isolate virus from large or small volumes for downstream analysis.
Genotyping <i>Understanding the genetic sequence of the target virus</i> <ol style="list-style-type: none">1. Amplify2. Sequence	Nucleic acid isolation for genotyping	Sample	RNAAdvance DNAAdvance GenFind V3 FormaPure XL	SPRI chemistry with high yields of gDNA or RNA, and flexibility for multiple input sample types. Automation capable (bead based) with established Biomek methods.
	Genetic detection of the virus through automation PCR, qPCR, or RT-PCR	DNA RNA	Biomek i5 or i7	Demonstrated methods for nucleic acid extraction.
			Biomek i7	Demonstrated and vendor-qualified methods for PCR sample prep.
	Construct the library for virus sequencing - identify genetic variants for evolutionary and epidemiological studies	DNA RNA	Echo with/without Access Systems	The Access Laboratory Workstation/Access Systems with integrated Echo, combined with PCR, qPCR or RT-qPCR preparation workflow, for high-throughput detection, genotyping or gene expression screening.
			Biomek i7	Demonstrated methods for automated NGS sample prep with the Biomek i7 hybrid.
		Enzymatic Reaction	RNAClean XP AMPure XP	Use RNAClean XP or AMPure XP to purify nucleic acid products from enzymatic reactions to deliver quality nucleic acid with no salt carryover and without requiring centrifugation or filtration.
Phenotyping <i>Understand the protein expression of the viral target</i>	Viral characterization for surface expression of antigens	Particles, Cells	CytoFLEX with Violet Side Scatter ¹	Direct detection of viral particles to 90 nm using vSSC and fluorescence
Morphology <i>Size, shape, structure of the virus</i>	Characterize conformational changes, homogeneity, and shape for better understanding of the virus replication cycle.	Particle, Viral	Optima AUC	In conjunction with appropriate data analysis methodologies, analytical ultracentrifugation can be used to examine sample purity, detect and characterize conformational changes, determine subunit stoichiometries, characterize assembly and disassembly mechanisms of macromolecular complexes, and measure equilibrium constants and thermodynamic parameters of associating systems. Use the Optima AUC to characterize and quantify protein/nucleic acid interactions in solution.
	Monitor changes in cell morphology	Cells	Multisizer 4e ²	Accurate cell volume determination with the Coulter Counter
	Cell brightness, roundness, granularity	Cells	Vi-CELL BLU ²	Cell culture maintenance; cell pathology
Pathology <i>How the virus causes disease in target hosts (cellular morphology)</i>	Virus Isolation for downstream characterization and composition study	Particle, Cells	MoFlo Astrios EQ	Use the MoFlo Astrios cell sorter for downstream characterization and studies of viral composition, integrity and infectivity. Study composition of pathogen infection rate.

Sample Collection, Isolation and Preparation

Beckman Coulter Life Sciences supports research workflows related to testing with automation, PCR setup and viral extraction kits. Our RNA and DNA isolation chemistries built on Solid Phase Reversible Immobilization (SPRI) paramagnetic bead-based technology enable purification of high-quality nucleic acid. These kits have demonstrated compatibility with saliva or transport media.



Antibody Research Workflow

High throughput automation can provide larger amounts of information on more samples, and serves as an important end-goal for antibody (Ab) research. Antibody research can show exposure to a certain antigen. Through exposure to the antigen, the immune system produces antibodies and/or cytokines.

Antibody Research Workflow

Identifying IgM, IgG, IgE, IgD and IgA antibodies

Instrument Configuration: Use a Biomek i5, Biomek Tips, and CytoFLEX flow cytometer with bead-based immunoassay for automating ELISA

- 96-well plates
- Throughput flexibility (medium-to-high based on need)
- Scale-up or scale-down flexibility

Direct integration of a CytoFLEX Flow Cytometer¹ to the Biomek i-Series Workstations enables complete automation of sample processing and data acquisition.

- CytoFLEX, a small footprint benchtop analyzer, can collect 13 fluorescence colors with high sensitivity.
- Automate the plating, drug treatment, trypsinization, and staining of cells for apoptosis and cytotoxicity analysis
- Selective tip pipetting enable serial dilutions and processing of partial plates for time course studies
- Measure dose and time responses for multiple compounds in both suspension and adherent cell lines



Vaccine and Therapy Development for Infectious Diseases

Though there is variation, vaccine development happens in 6 general stages.**

1. Exploratory Stage - Target Discovery and Validation
2. Pre-Clinical - Therapeutic Development and Pre-Clinical Testing
3. Clinical Development - Scale-up or scale-down, optimize and/or increase production
4. Regulatory Review and Approval
5. Manufacturing (Bulk Manufacturing)
6. Quality Control

Exploratory Stage - Target Discovery and Validation

	Vaccine Candidate Type	Application	Products
Isolation & Preparation of Vaccine Strain	Nucleic Acid (DNA, RNA) Protein (mAb) Particle (multi-antigen, viral vector)	<ul style="list-style-type: none"> Separation - Expansion, Multiple passaging, Harvesting High resolution isolation and purification of intact viral particle and plasmids to determine how they're encoded with the virus. 	Avanti J-15/R Avanti JXN Series Optima XPN Optima MAX-XP
	Nucleic Acid (DNA, RNA)	Screening	Biomek i-Series
Genotyping Understanding the genetic sequence of the target 1. Amplify 2. Sequence	Nucleic Acid (RNA) based	RNA Sequencing	Automated Illumina RNA method
	Nucleic Acid (DNA) based	DNA Sequencing	Automated Illumina DNA method
Phenotyping Protein expression of the viral target	Protein (mAb) based	Functional assay. Characterize and quantify protein and nucleic acid interaction in-solution	Optima AUC
Morphology Size, shape and structure of virus	Particle (Inactivated Viral, viral vector)	Particle size	LS 13 320 XR
	Protein (mAb) based	Protein Structure - characterization	Optima AUC



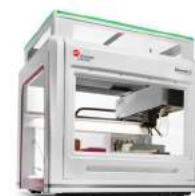
Avanti J-15/R



Avanti JXN



Optima Ultracentrifuges



Biomek i-Series



Optima AUC

Therapeutic Development and Pre-Clinical Testing Instrumentation Solutions

Vaccine Development, Preparation, and Verification

Robotics / automated liquid handling solutions for cell culture applications

Minimize the labor-intensive bottlenecks in your lab through automation. As your throughput increases, the Biomek automated continuous cell culture solutions enable you to obtain results you can trace and rely on in an efficient manner, while managing multiple cell lines in parallel to increase efficiency, and reducing the wait time for bulk quantities of cell lines and assay plates for screening. Biomek solutions are developed based on your laboratory's workflow.

Cell Culture Instrumentation



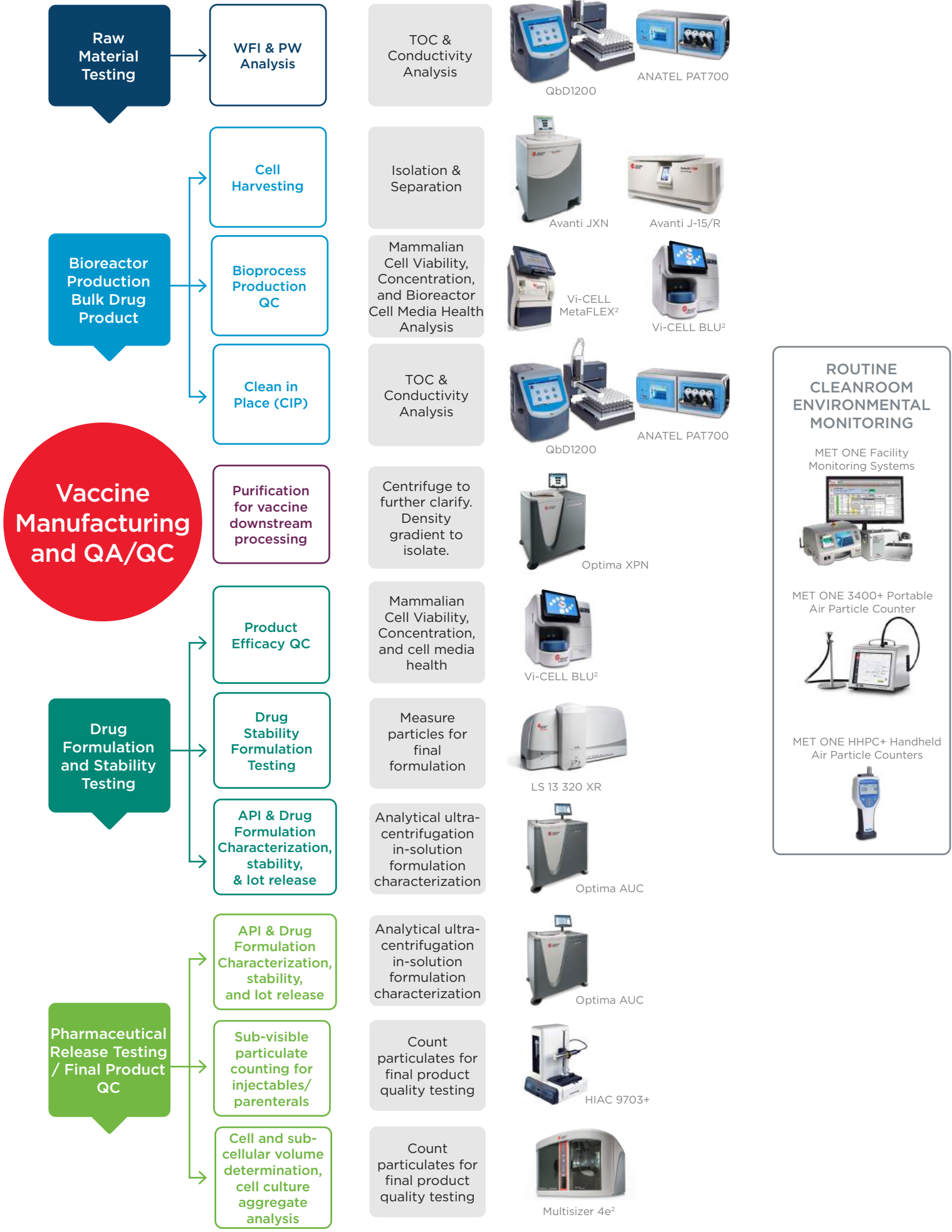
Cell Counting / Viability Analysis	Cell Media Analysis	Robotics / Liquid Handling
<p>Vi-CELL BLU</p> <p>Fully automated sample prep</p> <p>Minimum required sample volume as small as 170 μL for FAST mode and 200 μL for normal operation.</p> <p>Facilitates 21 CFR Part 11 compliance</p>	<p>Vi-CELL MetaFLEX</p> <p>Monitor cell culture parameters for cell media health analysis</p> <p>Measured parameters include pH, pCO_2, pO_2, cK_+, cNa_+, cCa^{2+}, cCl_+, $cGlu$, $cLac$</p> <p>Facilitates 21 CFR Part 11 compliance</p>	<p>Biomek i-Series</p> <p>Biomek i-Series solutions provide reliable pipetting, integrated data management, and management software for the week to month long processes.</p>

Genomic Chemistry Options

Our reagent portfolio is powered by Solid Phase Reversible Immobilization (SPRI) technology—widely known as the science behind AMPure XP—which uses paramagnetic beads to selectively bind nucleic acids by sequence size. It's ideal for nucleic acid extraction from cells, tissue, blood and even challenging formalin-fixed, paraffin-embedded (FFPE) samples. Use our chemistries with manual and/or fully automated methods on your choice of platforms, for optimum performance, flexibility and scalability.

Separation parameters for cell harvest, purification, and other cell culture protocols

	Max Volume	Speed	Max g-Force	BioSafe Options
Avanti JXN-26	6 liters at 15,970 x <i>g</i>	500 to 26,000 RPM	81,770 x <i>g</i>	Yes
Avanti JXN-30	4 liters at 16,800 x <i>g</i>	500 to 30,000 RPM	110,500 x <i>g</i>	Yes
Avanti J-15/R	3 liters at 5,250 x <i>g</i>	200 to 10,200 RPM	10 to 11,420 x <i>g</i>	Yes
Optima XPN	1500 mL at 53,900 x <i>g</i>	Up to 100,000 RPM Up to 90,000 RPM Up to 80,000 RPM	802,400 x <i>g</i> 694,000 x <i>g</i> 548,300 x <i>g</i>	Yes
Optima MAX-XP	195 mL at 233,000 x <i>g</i>	150,000 RPM	1,019,000 x <i>g</i>	Yes
Airfuge Air-Driven	7 mL at 132,000 x <i>g</i>	110,000 RPM	199,000 x <i>g</i>	



ROUTINE CLEANROOM ENVIRONMENTAL MONITORING

MET ONE Facility Monitoring Systems

MET ONE 3400+ Portable Air Particle Counter

MET ONE HHPC+ Handheld Air Particle Counters

Better Biosafety

Biosafe Centrifugation Labware

Beckman Coulter offers a wide variety of labware designed to ensure biosafety during centrifugation. Our third-party tested and BioCertified Aerosolve canisters and bucket covers create a sealed, standalone containment system that's easy to lift in and out of the rotor bucket. Labs also rely on our three-piece liquid tight cap assembly. Sample handling and exposure is further minimized by our easy-to-fill OptiSeal tubes with one-touch sealing, and disposable HarvestLine System Liners that retain hazardous pelleted samples for optimal safety.

BioCertified Aerosolve Canisters and Bucket Covers

- Protect from aerosol leakage and spills from rotor buckets
- Transparent design makes it easy to check for broken labware
- Can be autoclaved up to 121°C
- Bucket covers available for 1.5 mL tubes to 750 mL bottles
- Microplate carrier covers accommodate 96-well plate format



Biomek i-Series Automated Liquid Handlers with Enclosure

The Biomek i-Series can be configured with an enclosed perimeter protective system for additional environmental shielding around the instrument. It allows for safe handling of pathogens, contaminants, or other potentially hazardous materials.

- The system is compatible with an optional HEPA filtration unit(s). HEPA filters reduce contamination by providing environmental control.
- A diffuse-reflective light curtain along the front of the instrument
- Transparent safety shields along the left, right, and back sides of the instrument. An optional Conveyor Integration Side Panel is available to allow an external storage device to be connected to the Biomek i-Series instrument via a conveyor.
- A vertically-sliding front door that allows access to the instrument. Opening or closing the door does not affect the light curtain operation and will not stop the movement of the instrument.
- A halo that encloses the top of the instrument and protects the instrument from particulates.



Danaher Life Sciences Operating Companies

For the products you need that we don't supply, we recommend reaching out to our sister life sciences operating companies in the Danaher network:



1. For research use only. Not for diagnostic purposes. All other products identified are not for use in diagnostic procedures.
2. The Multisizer 4e, Vi-CELL BLU, and Vi-CELL MetaFLEX products are not for use in diagnostic procedures.

* RNAdvance Viral XP is listed as an extraction method for use with the Centers for Disease Control's EUA-authorized COVID-19 test referenced in FDA's FAQ on testing for SARS-CoV-2. Other than this designation, RNAdvance Viral XP is for research use, and not intended for diagnostic purposes.

** "Vaccine Testing and the Approval Process." CDC. <https://www.cdc.gov/vaccines/basics/test-approve.html>

BioCertified is a term used to describe our products which have been tested and validated to demonstrate containment of microbiological aerosols by an independent, third-party facility (Health Protection Agency, Porton Down, UK or USAMRIID, Ft. Detrick, MD, USA).

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