

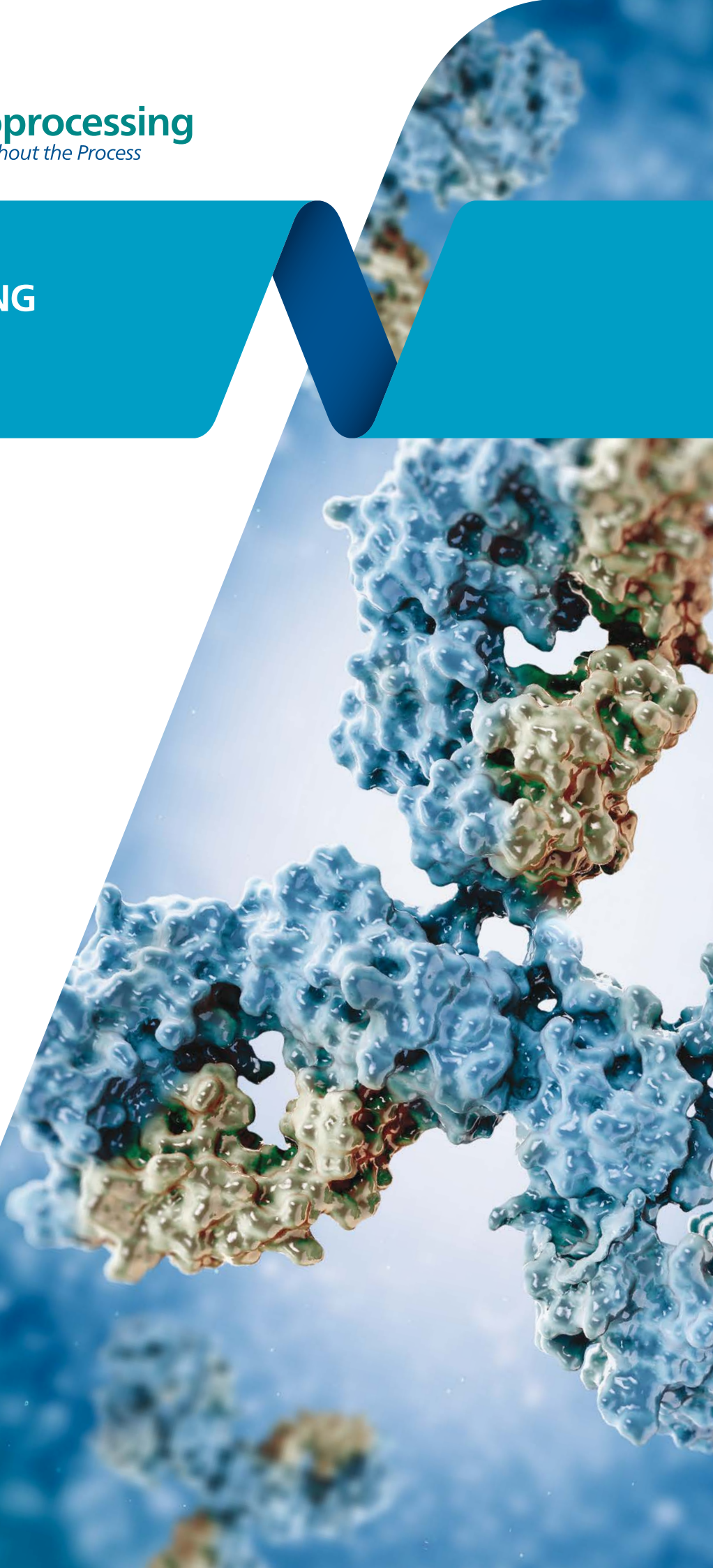
## VWR BIOPROCESSING SOLUTIONS

### Enabling your process with innovative choice

Dependable products and  
expertise from discovery to  
manufacturing

Ensure the quality and  
reproducibility of your  
biomanufacturing  
process

Reliable and  
transparent supply  
chain resources



# VWR BIOPROCESSING SOLUTIONS

## ENABLING YOUR PROCESS WITH INNOVATIVE CHOICE





VWR has solutions to address your needs as you manufacture your biologic of interest during upstream, downstream and final fill steps.

Achieving maximum cell density and productivity goals in your bioreactor, capturing and purifying the desired protein, and dispensing the formulated protein in its patient-ready configuration are not mutually exclusive objectives. **Each stage of bioprocessing is influenced by the steps preceding it.**

VWR's team of industry and technical experts understand these holistic influences and can help identify solutions that will meet your needs through product choice, operational excellence, and differentiated services.



### PRODUCT CHOICE

- Unbiased selection
- Evolving and expanding portfolio
- Raw, direct and indirect materials
- Process-focused solutions
- High quality suppliers
- Own manufacturing capabilities
- Dedicated acquisitions



### OPERATIONAL EXCELLENCE

- Global reach with cGMP-certified warehouses and cGMP manufacturing facilities
- Dedicated critical materials management resources
- Enhanced customer analytics
- Sourcing and management to mitigate risk



### DIFFERENTIATED SERVICES

- Custom chemical manufacturing that scales to your needs
- Single-use solutions
- **VWRCATALYST** Services
- Customised technology solutions
- Regulatory support (e.g. Change Notification Service)
- EXCiPACT™ certified manufacturing sites
- Triple certification to International Standards



## UPSTREAM & CELL CULTURE

### Enabling your scale-up with the right products and quality requirements

Whether your expressions system is prokaryotic (bacteria) or eukaryotic (mammalian, yeast), the biochemicals, supplements and equipment we provide to grow organisms meet required quality and performance parameters that allows seamless transfer from R&D to pilot scale and onto manufacture scale.

- VWR Life Science Seradigm
- Fermentation media and additives
- Biological buffers
- Inorganic salts
- Sugars and carbohydrates
- Proteins and amino acids
- Cell culture vessels
- Workstations and CO<sub>2</sub> incubators

### Production biochemicals

VWR's portfolio of production biochemicals can fulfill requirements for upstream applications. Outlined below you will find a table intersecting key suppliers by upstream bioprocessing application, representing structured product choice within VWR's Production Chemicals for primary and secondary qualification.

	VWR Bioprocess Chemicals	VWR Life Science Seradigm	Avantor	BD	Merck	Honeywell	Macco	Puritan Products	Spectrum
<b>Upstream and cell culture</b>									
Biological buffers	x		x		x				
Carbohydrates	x		x		x				
Inorganic salts	x		x		x	x	x		
Media and additives	x			x					
Proteins and amino acids	x			x					
Other materials	x	x	x		x	x	x	x	x

### VWR single-use solutions

We provide state-of-the-art mixing vessels, liquid holding and dispensing bags, also custom-assembled sterile tubing and connectors designed to deliver fluid from mixing vessels to your seed bioreactors, then to the production-scale bioreactor, and onto protein capture, clarification and concentration.

Our capabilities in the custom single-use transfer and collection assemblies include:

- Buffer and media transfer
- Sterile fluid connections
- Bioreactor feed and harvest
- 2-D/3-D bag assemblies, mixing bags and tank liners





## DOWNSTREAM & FINAL FILL

### Recovery and purification throughout the filtration steps, ensuring protein stability, solubility and bioavailability

We understand that quality and stability of your target protein must be maintained during the sequential purification steps of your process. VWR's portfolio of buffers and salts meet the quality and performance required to maintain protein attributes, and are available in powder form to allow preparation of solutions at concentrations defined during development or final buffer formulation.

- Biological buffers
- Inorganic salts
- Sugars and carbohydrates
- Proteins and amino acids
- Excipients
- Chromatography resins, columns and supplies
- Sterile vials, stoppers and seals

### Production biochemicals

VWR's portfolio of production biochemicals can fulfill requirements for downstream applications all the way through final formulation and filling into small volume vials. Outlined below you will find a table intersecting key suppliers by downstream bioprocessing application, representing structured product choice within VWR's range of production chemicals for primary and secondary qualification.

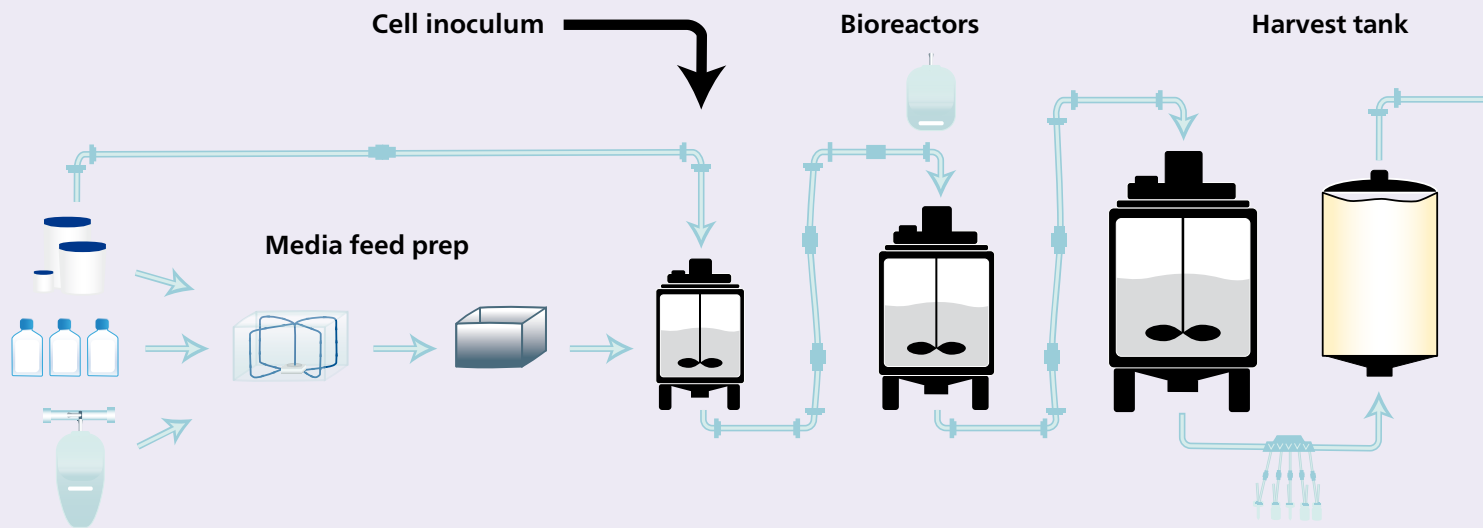
	VWR Bioprocess Chemicals	Avantor	Merck	Honeywell	Macco	Puritan Products	Spectrum
<b>Downstream and final fill</b>							
Biological buffers	x	x	x				
Carbohydrates	x	x	x				
Excipients	x	x	x				x
Inorganic salts	x	x	x	x	x		
Proteins and amino acids	x						
Other materials	x	x	x	x	x	x	x

### VWR single-use solutions

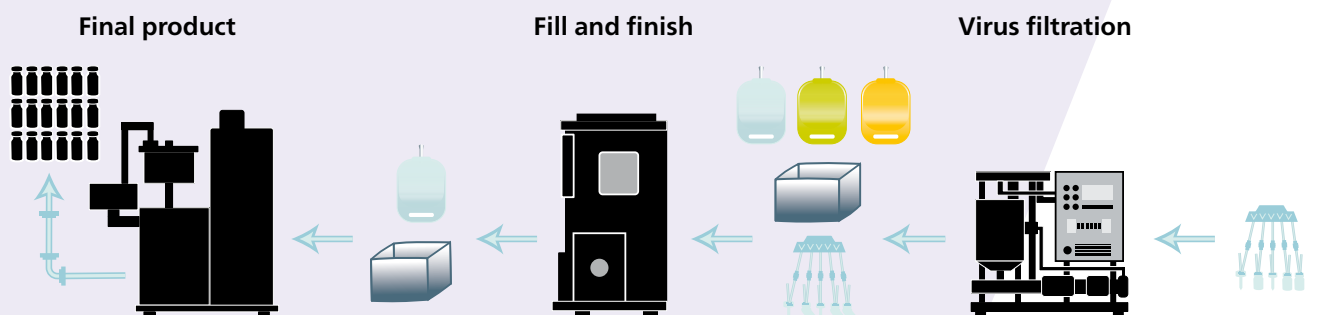
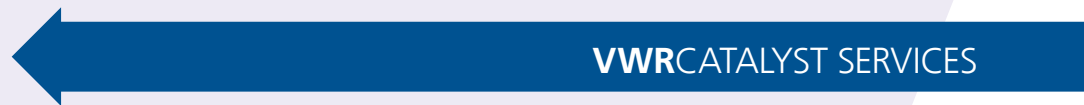
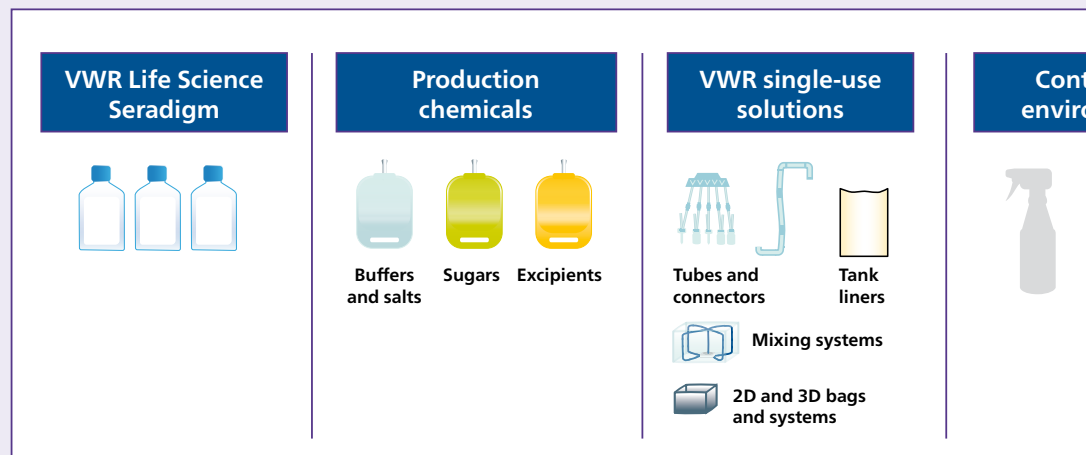
Single-use assemblies are proving to reduce contamination risk, improve resource efficiency and lower labour, energy and process validation costs. We provide the right component and connection options to support sterile transfer of solutions between chromatography and filtration steps, then into collection bags and bottles or vials for the final product.

- Sterile fluid transfer and filling
- Standard and custom products
- Aseptic sampling
- Bulk drug substance
- Buffer and media transfer
- 2-D/3-D bag assemblies, mixing bags and tank liners

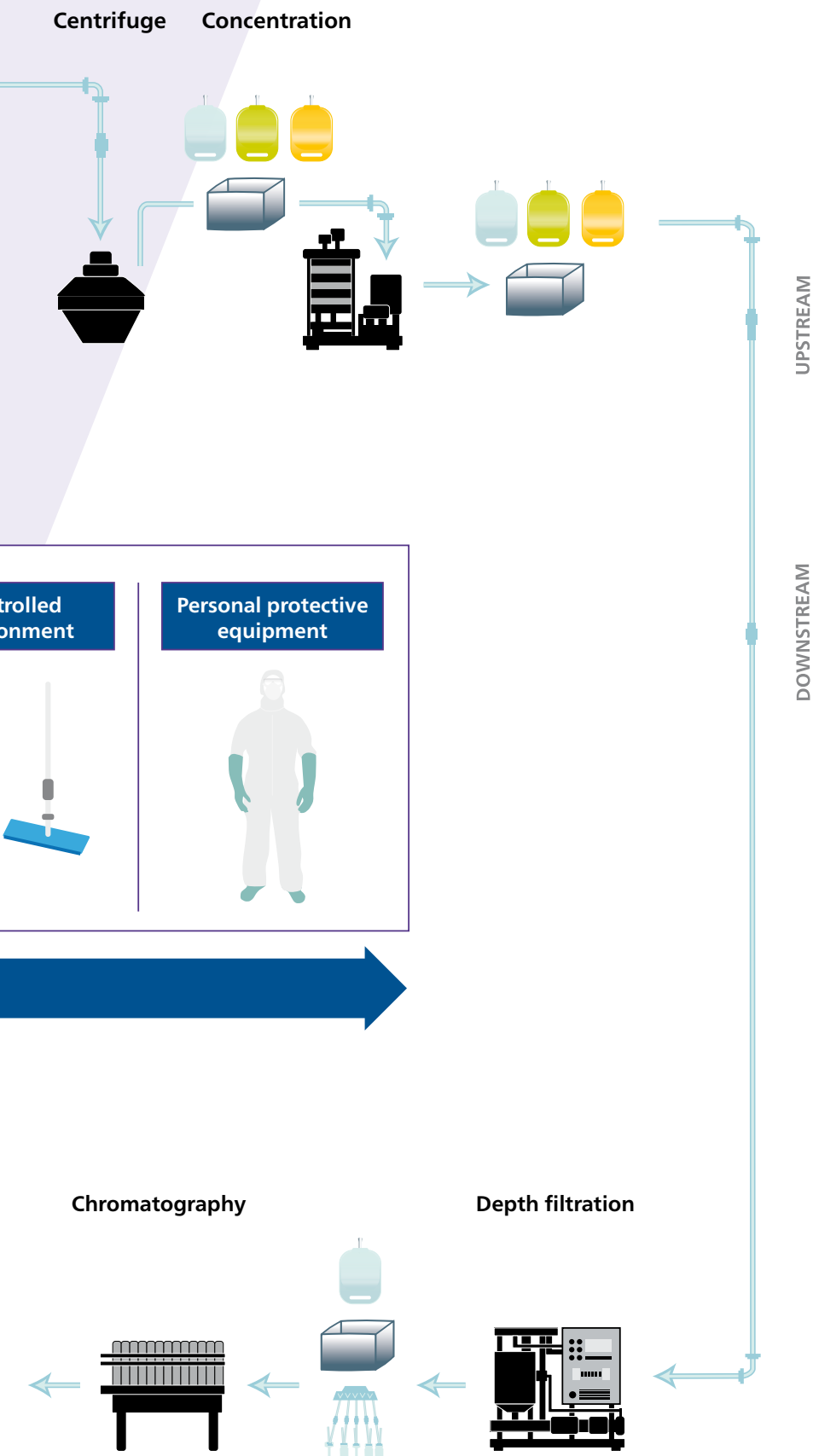
# Delivering innovative product choice throughout your process



## VWR capabilities







## UPSTREAM

- Media and additives
- Serum
- Biological buffers
- Inorganic salts
- 2-D/3-D single-use bag assemblies, mixing bags and tank liners
- Single-use sterile fluid connections

## DOWNSTREAM

- Biological buffers
- Inorganic salts
- Sugars/carbohydrates
- Excipients: Proteins and amino acids
- 2-D/3-D single-use bag assemblies, mixing bags and tank liners
- Single-use sterile fluid connections

## FINAL FILL

- Biological buffers
- Inorganic salts
- Sugars/carbohydrates
- Excipients: Proteins and amino acids
- 2-D/3-D single-use bag assemblies and tank liners
- Single-use sterile fluid connections
- Sterile vials, stoppers and seals

## CONTROLLED ENVIRONMENT SOLUTIONS

- Cleanroom garments
- Cleaning systems
- Disinfectants and detergents
- Gloves, wipes and swabs
- Equipment for contamination control

## VWRCATALYST SERVICES

- On-site services
- Procurement and supply management services
- Kitting services



*Biosafety cabinets*



*Cleanroom gloves*



*Disinfectants*

## CONTROLLED ENVIRONMENT SOLUTIONS

### Leading the way in controlled environment conditions

You can rely on VWR when you need to ensure ultra-clean manufacturing conditions for your production facility. This carefully selected portfolio is specifically designed to help you prevent potential contamination and maintain aseptic conditions in cleanrooms and controlled environments.

- Reusable and disposable garments
- Gloves and fingercots
- Wipes and swabs
- Detergents and disinfectants
- Cleaning systems
- Mats and flooring
- Labelling and documentation
- Environmental monitoring
- Equipment for contamination control (biosafety cabinets, tubing, etc)

### Managing a stable environment throughout the process to reduce product rejection

In addition to products from industry-leading manufacturers, we also have a team of controlled environment specialists with technical and industry experience, who can recommend the best solutions to meet your needs.



*Cleaning systems*



*Equipment for contamination control*



*Cleanroom garments*



*Wipes*



## PRODUCT PERFORMANCE & QUALITY UNLIKE ANY OTHER

VWR is a fully integrated supplier of animal sera that provides the cell culture community with access to the most reliable supply of high performance, exceptional quality Fetal Bovine Serum (FBS) and cost effective FBS alternatives. Our approach to sourcing and manufacturing is refreshingly unique and distinct from the competition, resulting in product performance and quality unlike any other.

Product differentiation table

		FBS products			FBS alternatives	
		Ultimate grade FBS	Premium grade FBS	Ultra-low IgG FBS	FB essence	Bovine calf serum, iron supplement
COUNTRY OF ORIGIN	100% US origin	X	X	X	X	X
PRODUCT FEATURES	Single-use filtration technology	X	X	X	X	
	Cold chain manufactured	X	X		X	
	Class 100 cleanroom manufactured	X	X		X	
	Triple 0,1 µm sterile filtered	X	X	X	X	
	Homogenous lots	X	X	X	X	X
	Independently tested by 3rd party laboratories	X	X	X	X	X
SPECIFICATIONS	ISIA† certified traceability	X	X	X		X
	Endotoxin	≤10	≤20	≤20	≤20	≤20
	Haemoglobin	≤25	≤25	≤25	≤25	≤30
	9CFR virus testing, sterility, mycoplasma	X	X	X	X	X
	Biochemical assay	X	X	X	X	X
	Electrophoretic profile	X	X	X	X	X
	Additional virus resting by qPCR Technology	X				
	Single sourced from 1 USDA-approved facility	X				
	Certified US-originating animals only	X				
	Enhanced traceability and regulatory compliance	X				

†International Serum Industry Association (serumindustry.org)

### Universal product features\*

- Quality you can see — crystal clear sera, vibrant amber colour, with an absence of turbidity and flocculent matter
- Superior final product performance, quality, traceability, and lot-to-lot consistency
- More nutritionally-rich sera due to preservation of performance-enhancing factors
- Low endotoxin and hemoglobin levels as indicators of overall product quality
- Bottle-to-bottle consistency within lots through proprietary, whole-lot homogenisation technology

\*Some features do not apply to BCS.



The care and attention devoted to the manufacture of VWR Life Science Seradigm serum products generates final test results that are substantially lower than set specifications. See lot-specific Certificates of Analysis for actual test results.

## VWR CUSTOM MANUFACTURING

VWR enables the advancement of science by providing high quality chemicals and services, customised to your product or manufacturing needs. We use operational excellence to deliver solutions that enable research, testing, production and commercialisation across the globe.

### **Our core custom capabilities include:**

- Liquid manufacturing, dispensing and packaging
- Powder manufacturing, dispensing and packaging
- Assembly and finishing

**We are committed to providing the highest manufacturing services. As we align with your needs, we remain dedicated to:**

- Flexibility and innovation
- Supply chain security
- Quality and regulatory compliance
- Operational excellence
- Breadth of capabilities
- Product transfer and design

**Focus on your core business — let VWR take care of sourcing, production, testing and documentation of your chemicals**





*200 l jetmixer system*



*Single-use bottle assembly*



*Virus inactivation skid*



## SINGLE-USE SOLUTIONS

### Get connected...

Our solution provides product **choice, services** and the **expertise** to help navigate through the various fluid handling challenges, component options plus quality and regulatory compliance constraints of the single-use world.

**At VWR, our goal is to help accelerate your scientific innovation by providing solutions that allow you to focus on your work and keep your production line running**

Through our single-use solutions, we can help solve unique problems in all areas of a biopharmaceutical manufacturing operation. Our custom single-use transfer and collection assembly capabilities include:

- Solutions for all process equipment providers
- Successful design and fabrication of connectivity for the manufacture of licensed biologics
- Expedited design and approval process
- Unmatched global logistics and planning
- Predictable delivery timetable
- Quality, regulatory compliance and supplier management programme that mitigates risks
- 100+ standard solutions in stock
- Comprehensive customisation capabilities



*Ultrafiltration assembly*



*Container with QF pump*



*Custom sampling manifold*

## VWRCATALYST- BIOPROCESSING FACILITY SUPPORT SERVICES



### Improve efficiency and quality management with support from VWRCATALYST

A **VWRCATALYST** Bioprocessing Specialist can help you tap the productivity of your pilot or manufacturing suites by reducing the burden of non core and routine scientific tasks. We deploy experienced professionals with degrees in biology, chemistry and engineering. All team members are full time **VWRCATALYST** associates.

Our specialists support upstream areas including cell culture, cell banking and on-site media/buffer preparation. We assist with facility set-ups and support process development. In downstream operations, our specialists assist with filtration, chromatography and routine analytical checks according to lab protocols.

#### Upstream support

- Large scale media and buffer preparation
- Cell banking
- Execute small scale process studies
- Maintain GMP lab records and Standard Operating Procedures (SOPs)
- Maintain lab and production supplies

#### Downstream support

- Operation of fixed tank systems
- Transport tanks and equipment to other production areas
- Pack and recycle chromatography equipment
- Perform routine analytical methods
- Equipment cleaning and sterilisation
- Maintain batch process records
- Freezer farm management of production-retained samples
- Waste handling, including single-use

**VWRCATALYST** offers managed services customised for the bioprocessing industry. Our mission is to enable the advancement of bioprocessing science throughout the world. We use process excellence to deliver what we promise, accelerate discovery, scale-up and improve productivity for our customers.

Visit [vwr.com/Science\\_Service](http://vwr.com/Science_Service) to learn more

Learn more about why and how  
**VWRCATALYST** supported companies like  
yourself and what the results where.  
Go to [vwr.com/vwrcatalyst\\_success](http://vwr.com/vwrcatalyst_success).



## MANAGING YOUR RISK

### Offering reliable and transparent supply chain solutions

Built on a foundation of supply chain innovation, our goal is for our customers to have a consistent and reliable experience wherever they are in the world. We designed our quality and security programmes to provide a customer-centric approach that offers flexibility and solutions, thereby decreasing the complexity of our customers' experience around quality, regulatory and security requirements. This includes operations that meet ISO and cGMP compliance standards and necessary document and product certificates.

### VWR manages risk and maintains security through:

- **Quality and change control:** Through our own internal Quality Assurance team and change control systems to ensure compliance
- **Collaborative planning, forecasting and replenishment (CPFR):** Enabling then demonstrating through service level reports on assurance of supply through the Critical Materials Care team
- **Documentation:** Ensuring availability on vwr.com such as Certificates of Conformance, Quality or Analysis, making them available with the SDS's
- **cGMP-certified distributor programme:** Demonstrated through 14 of our distribution facilities that have been cGMP certified to be compliant with IPEC guidelines by an outside qualified auditor.
- **Local support:** By using VWR's field-based technical experts across five continents who will help you match your requirements to high quality suppliers of bioprocessing materials
- **Supplier auditing and integrity:** Conducting risk-based audits enables us to understand the capabilities of new suppliers and collaborate effectively to address corrective and preventive actions (CAPA)





## SUPPORTING YOU WHEREVER YOU ARE

VWR has an extensive network of regional distribution centres, manufacturing facilities and customer care call centres, leading in global reach with operations in 34 countries. We also operate 14 distribution facilities across three continents certified for Good Distribution Practices (cGDP) by a qualified outside auditor under International Pharmaceutical Excipient Council's (IPEC) guidelines:

Atlanta, GA	Houston, TX	Leuven, Belgium
Boston, MA	Philadelphia, PA	Dublin, Ireland
Chicago, IL	Portland, OR	Lutterworth, UK
Denver, CO	Toronto, Canada	Singapore
Fresno, CA	Manati, Puerto Rico	Briare, France

# ENABLING YOUR PROCESS WITH INNOVATIVE CHOICE



## VWR Life Science Seradigm

- Fetal bovine serum
- Supply assurance
- Quality assurance measures at source
- Multiple lot testing
- Fully certified supply chain for traceability by the International Serum Industry Association (ISIA)
- Consistent, reliable performance

## Production chemicals

- Biological buffers
- Carbohydrates
- Inorganic salts
- Media and additives
- Proteins and amino acids
- Excipients
- VWR custom manufacturing services
- Strategic sourcing
- cGDP-compliant warehousing

## VWR single-use solutions

- Standard and custom products
- Buffer and media transfer
- Sterile filtration
- Bioreactor feed and harvest
- Bulk drug substance
- Aseptic sampling and filling
- 2-D/3-D bag assemblies and tank liners
- Application-specific connections
- Sampling methods
- Mixing vessels

## Controlled environment

- Reusable and disposable garments
- Gloves and fingercoats
- Wipes and swabs
- Detergents and disinfectants
- Cleaning systems
- Mats and flooring
- Labelling and documentation
- Environmental monitoring
- Equipment for contamination control (biosafety cabinets, tubing, etc)

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LATEST NEWS, SPECIAL OFFERS  
AND DETAILS FROM YOUR  
LOCAL VWR SUPPORT TEAM