

cGMP Viral Product Development and Manufacturing

World-class process development and manufacturing for virus-based therapeutic products. From small scale toxicology and Phase I material to commercial-scale manufacturing and fill finish, our flexible facilities and expert staff are leaders in viral product manufacturing.

We work closely with clients to develop and manufacture exciting new treatments for cancer, hemophilia, orphan diseases and viral vaccines. Our fully segregated state-of-the-art viral product suites employ traditional stirred-tank reactors and the latest in single-use bioreactor technologies to support commercial-scale manufacturing.

The Carlsbad, California biologics manufacturing site has completed FDA/EMA pre-licensure inspections and meets EU and FDA compliance for cGMP clinical and commercial production and is fully validated and BioSafety Level 2-compliant, allowing manipulation of human pathogens.

Manufacturing Areas Feature:

- Separate facility areas for scale-up, process validation, phase III trials and commercial launch
- Unidirectional personnel and materials flow facility design
- 16 client-dedicated Class 10000 (ISO 7) Clean Room production suites
- Highly qualified process development teams focused on early-stage process optimization and scale up
- Single-pass cleanroom airflow systems exhausted directly from each clean room
- Aseptic manipulations performed in Class 100 (ISO 5) BioSafety cabinets
- Two dedicated Class 1000 (ISO 6) Fill suites; one designed for small commercial fills
- Successful history of complex process technology transfers
- Extensive QC and QA programs to support early-stage through commercial manufacturing
- Biosafety release testing assurance via BioReliance® Services

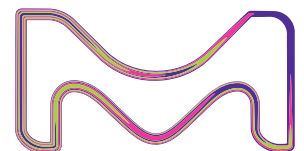


cGMP Viral Bulk Drug Substance Manufacturing

Backed by the experience of over 400 lots of viral substance production (including Adenovirus, Retrovirus, Lentivirus, AAV, Alphavirus and Reovirus), our scientific production teams employ an array of bioreactor systems and purification technologies.

This comprehensive compliance program for bulk drug substance manufacturing includes:

- Multiple cell culture systems for adherent or suspension cells
- Stainless steel bioreactors up to 100 L
- Multiple single-use bioreactors platforms
- Cell factories and Hyperstacks
- Shake flasks
- Cell cubes
- Column chromatography
- Tangential flow filtration
- Membrane absorption
- Gradient centrifugation
- Formulation



cGMP Viral Product Development and Manufacturing

cGMP Cell and Viral Banking

We manufacture key intermediates including Master and Working Cell and Viral Banks. Our services cover screening for clonal derivatives early in the development process and characterizing viral seed stock to determine the optimal processing parameters for manufacturing.

Services include:

- Process development (including clonal selection)
- Access to fully characterized 293-clonal AC2 cell lines
- Master and Working Cell Banks in any SAFC cell culture system
- Access to additional capacity in Rockville, Maryland, USA, and Glasgow, Scotland, UK

Quality Control and Process Development

Extensive collaborations with clients have helped us develop a wide range of tests and characterization studies to identify manufacturing issues early and determine the likely productivity parameters for cGMP manufacturing.

Services include:

- Process optimization
- Scaled-up manufacturing for pharmacologic/toxicity studies
- Stability and formulation studies
- Transfer of client-based processes for reproducibility assessment (prior to cGMP production)
- Transfer, qualification and validation of product-specific assays (HPLC, PCR, immunoassays and cell-based assays)
- PCR assay development
- Process validation

Sterile Fill Finish

Filtering, filling and finishing of bulk drug substances is performed by highly trained operators in dedicated clean room fill suites equipped with semi-automated and automated systems in order to meet cGMP regulations and remain FDA and EMA compliant. With fill capacity from 2,000 to 10,000 containers, our operations employ glass vials, cryovials and glass syringes, and use disposable bags for all product contact surfaces.

Fill capacity:

- Semi-automated capacity to 2,000 vials/day
- Fully automated capacity to 10,000 vials/day

Secure cGMP Biostorage

The facility has controlled temperature freezers of -80°C and -20°C along with on-site liquid nitrogen dewars for final product storage. Freezer units are continuously monitored via a networked system of data loggers with remote temperature information and alarm notifications.

This comprehensive biostorage program covers:

- Restricted key-card access
- Complete freezer inventories
- Full documentation
- Diesel-powered emergency generator



To place an order or receive technical assistance in the U.S. and Canada, call toll-free 1-800-645-5476
For other countries across Europe and the world, please visit: [EMDMillipore.com/offices](https://www.emdmillipore.com/offices)
For Technical Service, please visit: [EMDMillipore.com/techservice](https://www.emdmillipore.com/techservice)

MilliporeSigma
400 Summit Drive
Burlington, MA 01803

[EMDMillipore.com](https://www.emdmillipore.com)

© 2017 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved. MilliporeSigma, the vibrant M, and BioReliance are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. All other trademarks are the property of their respective owners. Detailed information on trademarks is available via publicly accessible resources.

