



WHITE PAPER

Extracellular Vesicles: Building the Next Therapeutic Modality with End-to-End Product and Service Support

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Extracellular vesicles (EVs), lipid membrane-bound vesicles secreted into a cell's extracellular environment, possess a number of advantages for both their innate therapeutic potential and versatility as a delivery vehicle. These cell-derived products are packed with bioactive cargo (from proteins to lipids to nucleic acids), are unlikely to exhibit immunogenicity, can cross the blood brain barrier, and can be engineered for enhanced cargo or cell/tissue targeting. This enables a wide range of potential applications for EVs, which can be leveraged as a carrier system for a therapeutic payload or as a standalone therapeutic.

Human cell-derived EVs hold significant therapeutic potential. As a product, EVs can be manufactured at large scale, and due to their thermodynamic stability, can be stored and shipped with much less difficulty than other biopharmaceuticals. Cryopreserved EV can be shipped on dry ice, and lyophilized EV can be shipped at room temperature. As naturally occurring nanocarriers, EVs offer enhanced biocompatibility and stability when compared to synthetic carriers, as well as an improved safety profile over lipid nanoparticles (LNPs). Moreover, these products can circulate systemically, allowing them increased access to target sites. Once they have reached their destination, EVs deliver their therapeutic cargo and modulate target cell processes. Taken together, EVs are an ideal, next generation therapeutic modality.

Despite the potential EVs have, there remain a few significant technical hurdles to their wider commercial potential. Analytical characterization is difficult and not agreed upon; as a complex biological mixture, EVs need a different approach, compared to LNP or viral vectors. Manufacturing considerations, such as improving productivity through media optimization or standardized unit operations to support product consistency, are likewise crucial to securing EVs within the larger biopharmaceutical pipeline.

Convening Expertise to Drive Innovation: Fujifilm's EV Total Solutions for Seamless Support

In order to further the development of EV applications, Fujifilm Life Sciences is leveraging its expertise across four of its Life Sciences companies to provide the full range of products and services required for the development and manufacture of EV therapeutics (illustrated in Figure 1). To support this offering, Fujifilm Life Sciences offers an established, standardized library of deeply characterized vesicles isolated from the catalog of products at FUJIFILM Cellular Dynamics; to date, the library consists of vesicles from more than 30 different human cell types, in different culture conditions, using an array of isolation technologies. Once a cell line is established, Fujifilm offers platformed development to generate consistent batch-to-batch reproducibility. Included in the development is key analytical data such as molecular, single particle, and 'omic characterization across multiple biological replicates. Finally, Fujifilm offers cGMP manufacturing at several sites within the network in order to bring therapeutics to the clinic. Because Fujifilm Life Sciences has standardized every step from manufacturing through analytics, it has established highly comparable data as well as teased out trends and unique vesicle signatures.

Figure 1: Group expertise across a range of Fujifilm companies provides the Fujifilm EV Total solution offering.



Supplier of high-quality, high-purity Exosome reagents; production, isolation and characterization for life science research.



Providing a diverse portfolio of advanced culture media solutions including media product, services, and technologies for bioprocessing targeted to meet the evolving demands of the biopharmaceutical, vaccine, and cell and gene therapy industries.



Manufacturer of human cells, from induced pluripotent stem cells, for use in research, drug discovery and regenerative medicine applications. CDMO for early stage therapeutics programs, including cell and EV therapies.



Contract Development Manufacturing Organization (CDMO) with experience in the development and manufacture of recombinant biopharmaceuticals, viral vaccines, gene and cell therapies.

By convening these capabilities and directing them toward the EV space, Fujifilm is building a seamless, end-to-end solution that assists clients from early discovery to commercial cGMP manufacturing. This offering leverages FUJIFILM Cellular Dynamics' experience in mother cell selection, functional screening, potency assay development, and iPSC-derived cell differentiations and cGMP manufacturing, combined with FUJIFILM Biosciences' offering of media development and supply. Wako contributes product support in preclinical research and development. FUJIFILM Biotechnologies offers quality cGMP systems with experience in the clinical manufacture of EVs. To mitigate single-site GMP manufacturing risks, there are multiple geographic sites available across Fujifilm companies. Fujifilm's EV Total Solutions are positioned to integrate knowledge from across space under one umbrella.

By combining longstanding experience in bioprocessing with incumbent EV-specific project experience, Fujifilm EV Total Solutions can provide all the tools and services for a research organization to advance a therapeutic candidate to the clinic and beyond.

Supporting the Future of EV

Fujifilm EV Total Solutions offer end-to-end support to researchers to help them bring their therapeutics to the clinic. For EV — as with any other biotherapeutic — the process is the product, and there are many choices that can be made during EV development: which cell type or cell lines should I choose;

do I need cell or vesicle engineering; should I load EV with new cargo; what are the ideal reagents and manufacturing steps for safety and therapeutic efficacy? While answering these questions requires significant development up front, the Fujifilm EV Total Solutions team has developed screening, optimization, manufacturing, and analytical platforms to streamline EV therapeutic development.

From the point at which a client initiates a project with Fujifilm, their asset is supported by expert teams from across the companies involved in Fujifilm EV Total Solutions. This cross-functionality happens largely behind the scenes, as a project moves from early phase development support from FUJIFILM Cellular Dynamics to process development and manufacturing support through FUJIFILM Cellular Dynamics or FUJIFILM Biotechnologies, with supply chain support and optimization from FUJIFILM Wako Pure Chemical Corporation and FUJIFILM Biosciences. With technical teams dedicated to R&D, process development, assay development, cGMP tech transfer, cGMP manufacturing, and quality control, Fujifilm EV Total Solutions combines communication and project management with comprehensive capabilities to enable end-to-end support for EV-therapeutic discovery, development, and manufacturing.

For more information on the Fujifilm EV Total Solutions visit www.fujifilmcdi.com/fujifilm-extracellular-vesicles-solutions/ or contact us directly at Fujifilm-EVSolutions@fujifilm.com.

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"Partners for Life" represents a transformative approach to development and manufacturing, emphasizing relationships founded on trust and transparency — founded in people-centric values, transformative science and innovation, and unprecedented delivery.

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About Fujifilm Life Sciences

FUJIFILM Biotechnologies is a global CDMO operating in Europe and North America with integrated platforms to meet client demands and deliver medicines to patients faster. FUJIFILM Cellular Dynamics, Inc. is a leading developer and manufacturer of human cells used in drug discovery, toxicity testing, stem cell banking, and cell therapy development. FUJIFILM Wako Pure Chemical Corporation provides highly functional and high-quality laboratory chemicals, specialty chemicals, and clinical diagnostic reagents based on advanced technological development, to address various customer needs as a general reagent manufacturer. FUJIFILM Biosciences supports the biopharmaceutical industry in successful development and commercialization of human therapeutics and vaccines.



FUJIFILM Biotechnologies

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