EXOSOMES

DRIVING RESEARCH, USE, AND ENGINEERING OF EXOSOMES
PUTTING THE POWER OF EXOSOMES INTO YOUR HANDS

In 2009, the team at System Biosciences (SBI) recognized the great potential of exosomes and developed the first commercial exosome isolation kit. In the intervening years, we’ve worked with the growing exosome community to refine and enhance our products and expand our offerings. We are proud to support the life science community through an extensive portfolio of exosome research and engineering tools, backed by the largest number of peer-reviewed publications of any exosome reagent supplier in the world. With our ever-growing family of high-quality exosome products and services, SBI is harnessing the latest technological innovations and transforming them into powerful tools that accelerate your exosome-based discoveries.
With a variety of options to choose from, SBI speeds exosome isolation through products that enable fast, multiplexed exosome enrichment from a wide range of biofluids.

**ExoQuick Family ExoQuick** for Most Biofluids

The ExoQuick family of products—ExoQuick and ExoQuick-TC—enable high-throughput, quantitative exosome isolation from low sample volumes (as little as 100 µl serum). Using this unique, polymer-based reagent, exosomal vesicles are gently and reliably precipitated from solution. Compatible with virtually any biofluid and a wide variety of downstream applications, ExoQuick is an effective and proven alternative to ultracentrifugation.

Quick and easy—simple protocol isolates exosomes in as little as 30 minutes

Universal—enables exosome isolation from all biofluids tested to-date

Broadly usable—isolated exosomes perform well in a variety of downstream applications, including miRNA profiling, NGS, and mass spec analysis

Functional—isolated exosomes are intact and bioactive for functional studies and engineering


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**SALIVA** / **URINE** / **FOLLICULAR FLUID** / **PLASMA** / **SERUM** / **TISSUE CULTURE MEDIA** / **BREAST MILK** / **MALIGNANT ASCITES** / MORE
ExoQuick Family ExoQuick-TC

Because so many researchers need to isolate exosomes from cultured cells, we’ve created a reagent specifically optimized for isolation from tissue culture media—ExoQuick-TC. And it works great for urine samples as well.

Convenient, scalable, and easy-to-use, ExoQuick-TC is the ideal reagent whether you’ve got easy-to-grow cells or valuable samples from limited sources, such as stem cells or primary cell lines. Just as with the original ExoQuick reagent, ExoQuick-TC exosomes are bioactive in functional assays, and can be used to isolate exosomal proteins and RNAs for downstream applications such as miRNA profiling, NGS, or mass spec.

Exosomes isolated with ExoQuick-TC can be transferred between cells

In order to demonstrate bioactivity of ExoQuick-TC-isolated exosomes, we created a stable 293TN cell line overexpressing SBI’s Cyto-Tracer™ pCT-CD63-GFP fusion protein (catalog# CYTO120-PA-1). 48 hours after plating, we collected media and isolated exosomes using ExoQuick-TC. We resuspended the exosome pellet in 30 µl PBS, and added 10 µl of this solution to newly plated HT1080 cells, which were visualized and replated after 72 hours. Following another 24h (at time 96 hours), the cells were visualized for GFP fluorescence and imaged. Exosomes appear to dock with the cells within 72 hours and some are found to be internalized after 96 hours.

VALIDATION DATA

Find additional validation data and references using ExoQuick products from our website—visit systembio.com/exoquick

Biochemical and biologic characterization of exosomes and microvesicles as facilitators of HIV-1 infection in macrophages.

CONSIDER THIS

With just 100 µl plasma, ascites fluid, or serum, you can isolate exosomes from small animal models for biomarker analysis.
“We therefore pursued the ExoQuick method for further study, as these samples required much less sample input, a key benefit when working with clinical samples and mouse models.”

ExoQuick Validation

Exosomes isolated with ExoQuick appear similar to exosomes isolated using ultracentrifugation in electron microscopy studies, and are active in numerous functional assays. Backed by a growing number of publications, ExoQuick is often the best option for researchers working with low sample volumes, such as clinical research samples or small animal models.

Exo-Flow Family

With modular kits and validated antibodies, the Exo-Flow family of reagents enables reliable, selective capture and purification of exosomes by FACS or immunoprecipitation (IP). Exo-Flow magnetic beads are coated with streptavidin and can be purchased pre-coupled to one of our exosome-specific antibodies, or uncoupled, enabling attachment of your own biotinylated capture antibodies. Our larger-than-typical bead size (9.1 µm diameter) increases the efficiency of exosome capture, assisting recovery of rare exosome populations.

Find validation data and more at systembio.com/exo-flow

CD9, CD63, CD81, CD31, HLA-G, Rab5b or other immune or cancer exosome markers

Biotin-conjugated Capture Antibody

Covalently cross-linked streptavidin

Outer core hydrophilic polymer surface

Iron magnetite central layer

Exo-Flow Beads

CD9 Beads + EXO-FITC

Gate on Bead Singlets

Find additional validation data and references using ExoQuick products from our website—visit systembio.com/exoquick

BUY KITS FOR FACS OR IP

- CD9
- CD63
- CD81
- CD14
- CD68
- CD31
- CD44
- A2M
- HLA-G
- PSMA
- RAB5B

**Exo-FBS**

Ensure that exosomes isolated from tissue culture media are free from bovine exosome contaminants with Exo-FBS—fetal bovine serum (FBS) that has been depleted of exosomes.

FBS is an important component of tissue culture media for a variety of systems. However, serum is a rich source of exosomes, FBS included. To support researchers who are purifying exosomes from tissue culture media, SBI offers the convenient, time-saving Exo-FBS media supplement.

- Exosome-sized vesicles greatly reduced
- Very low levels of CD63 positive cow exosomes
- Undetectable levels of cow microRNAs
- Comparable growth rates as standard FBS
- Identical use as standard FBS (add 10% in DMEM, RPMI, or other media)

Learn more at systembio.com/exo-fbs

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**CONSIDER THIS**
Exo-FBS is ready-to-use. Removing exosomes from FBS in your lab requires an 18-hour ultracentrifugation run.
Once thought to be little more than a way for cells to offload waste, exosomes are a rapidly expanding area of study in basic research, biomarker discovery, and even engineered tools for therapeutic delivery. They function as signal carriers and tissue reshapers through their cargo of RNA, proteins, and lipids, and are involved in a wide range of healthy and pathogenic processes including cancer, inflammation, immunity, CNS function, and cardiac cell function.
**Names**

What’s in a name? Some of the many (perhaps controversial) names of exosomes: epididimosomes, argosomes, exosome-like vesicles, apoptotic blebs, microparticles, promininosomes, prostatosomes, dexosomes, texosomes, dex, tex, exosomes, microparticles, nanoparticles, microvesicles, shedding microvesicles, ectosomes, archeosomes, oncosomes, nano-structures, nanoshuttles.

**Harnessing innovation to drive discoveries**

**Exosome web resources**

ExoCarta exocarta.org
A manually curated database of exosome proteins, RNA, and lipids

Vesiclepedia microvesicles.org
A manually curated database of proteins, RNA, and lipids found in extracellular vesicles

ExosomeRNA exosome-rna.com
A site for exosome RNA research and news

exRNA exrna.org
A research portal for the NIH Extracellular RNA Communication Program

Exosome University linkedin.com/groups/Exosome-University-6781295
A LinkedIn group for discussing all things exosome

**Exosome-related Nobel in 2013**

James E. Rothman, Randy W. Scheckman, and Thomas C. Sudhof for their "discovery of machinery regulating vesicle traffic, a major transport system in our cells."

**Nobel prize in physiology or medicine 2013**

**Number of citations using ExoQuick family products**

4407
Number of unique authors publishing exosome papers in 2014

**DID YOU KNOW?**

**Plants**

have been found to generate exosome-like vesicles that can interact with mammalian cells

**Exosome-related clinical trials currently recruiting or enrolling**

347
Number of citations using ExoQuick family products

**HSPA8**

The protein found in most studies of exosomal proteins. Identified in 52 studies from 27 different tissue sources.
Whether you just need to know if you have exosomes present or want a highly quantitative measurement of exosome amount, SBI offers products and services that can help. With a range of antibody- and activity-based options, a label-free analysis service using NanoSight, and expert technical support, we drive your exploration of this exciting new field.

**Antibodies**

For affinity-based exosome detection, SBI offers validated rabbit anti-human and rabbit anti-mouse primary antibodies, available individually and in kits.

**Additional validated exosome marker antibodies:**
ANXA5 / CETP / TSG101 / EpCAM1 / Vimentin / ALIX / FLOT1 / CXCR4

**General exosome marker antibodies:**
CD63 / CD9 / CD81 / HSP70

**Exo-Check Antibody Array**

Our Exo-Check antibody array offers detection of eight known exosome markers—CD63, CD81, ALIX, FLOT1, ICAM1, EpCam1, ANXA5, and TSG101—and GM130, a cis-Golgi marker to monitor for cellular contamination. The array also includes one blank spot and two positive controls with human serum exosome proteins.

**Exo-Check array hybridized to 300 µg of exosomal proteins from human HT1080 lung sarcoma cells. Exosomes were isolated from the growth media using ExoQuick-TC.**

**Acute Stressor Exposure Modifies Plasma Exosome-Associated Heat Shock Protein 72 (Hsp72) and microRNA (miR-142-5p and miR-203)**
**ExoELISA Kits**

Our ExoELISA kits—available for detection of either CD63, CD9, or CD81—are for conducting direct Enzyme-Linked ImmunoSorbent Assays (ELISA). All kits come with the exosome standards needed for calculating exosome concentration.

**Assay overview:** Isolated exosome proteins are immobilized directly to the wells of the microtiter plate, blocked, detected using primary antibody, and quantitated using a secondary antibody conjugated to horseradish peroxidase (HRP).

Learn more about SBI's antibodies, Exo-Check, and ExoELISAs at systembio.com/antibodies

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**EXOCET Rapid Exosome Quantitation Assay**

SBI is excited to offer a solution-based assay that enables exosome quantitation in as little as twenty minutes. The EXOCET assay directly measures Acetyl-CoA Acetylcholinesterase (AChE) activity, known to be enriched within exosomes. The EXOCET assay is an enzymatic, colorimetric assay read at OD405, and each kit includes a standard curve calibrated by the scientists at SBI to exosome concentrations as determined by NanoSight analysis, enabling quantitation of the absolute number of exosomes present.

Learn more about EXOCET at systembio.com/exocet

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**NanoSight Exosome Analysis Service**

Obtain highly quantitative measurements of your exosome preparation with SBI’s NanoSight Service. Starting from biofluid samples or purified exosomes, SBI will provide mean and mode diameter measurements and exosome concentrations using NanoSight’s Nanoparticle Tracking Analysis (NTA) system. Take advantage of accurate and precise exosome characterization without needing to invest in your own NanoSight system.

Learn more at systembio.com/services/exosomes/overview
Loaded with cargoes of nucleic acids, proteins, and lipids, exosomes contain a gold mine of potential disease biomarkers. To help you take full advantage of the insights exosomes can provide, SBI offers a wide variety of exosome characterization tools that enable identification of exosomal proteins, profiling of miRNA and other exosomal nucleic acids, and even tracking of protein and RNA cargo once the exosome has been internalized into a target cell.

Exosome miRNA and Protein Analysis

Take an even deeper look at what your exosomes can tell you with SBI’s XRNA prep kit for next generation sequencing (NGS) from as little as 1 to 10 ng miRNA, SeraMir kit for qPCR or NGS, and XPEP kit for mass spec analysis.

RNA recovery with SeraMir is higher and more consistent across samples and is more easily scalable when compared to other RNA isolation kits.

With the XPEP kit, you can create complete peptide libraries or only isolate exosome surface peptides (aka “shaving”).

Our kits are start-to-finish solutions optimized for isolating quality nucleic acid or protein from exosomes.

Learn more at systembio.com/seramir
Learn more at systembio.com/xrna-xpep
Exosome Services

For researchers and research teams that want to stay focused on biology instead of new technologies, SBI offers a number of exosome services. Simply send us any biofluid (serum, media, urine, CSF) and we’ll take care of the rest. Learn more at systembio.com/exosome-services

EXOSOME ISOLATION & MANUFACTURING
From the experts that pioneered fast and easy exosome isolation with ExoQuick

EXO-NGS NEXT-GENERATION RNA SEQUENCING
Complete exosome RNA-seq analytics solution including abundance, RNA type, expression heatmaps, and genomic mapping

PROTEOMICS
Receive raw and fully analyzed data including robust statistical validation, protein homology analysis, and publication-ready graphics

EXOSOME ENGINEERING SERVICES
Have SBI engineer exosomes for you—see page 14 for a few of the possibilities

LIPOIDOMICS & METABOLOMETICS
—UPLC-FTMS analysis of very polar and nonpolar metabolites standard, individual polar/non-polar analysis upon request

Sample Data from Exo-NGS Service—RNA Types
Exo-NGS service includes a robust data analysis pipeline with a variety of standard visualizations and analyses.

1. Serum Exosomes
2. CSF Exosomes
3. Urine Exosomes
4. Stem Cell Media Exosomes

Sample Data from Exo-NGS Service—RNA Types
Exo-NGS service includes a robust data analysis pipeline with a variety of standard visualizations and analyses.
Used by cells to transport cargoes of active biomolecules, exosomes are emerging as a powerful way for scientists to deliver specific proteins and miRNAs to target cells. As the field transitions from observation and analysis of exosomes to custom exosome design for therapeutic and other uses, SBI is already offering the necessary tools to push exosome engineering to the next level. With today's family of products, you can deliver miRNA for knockdown studies, plasmid DNA for expression studies, even small molecules for biochemical or therapeutic studies… imagine the possibilities. Find the latest exosome engineering products at systembio.com/exosomes

**Purified exosomes** ready for engineering, protein or nucleic acid cargo studies, experimental controls and standards, and more… Visit systembio.com/purified-exosomes

**Exosome Cargo Labeling with Exo-Glow**
What happens to exosome cargo once it’s delivered to a cell? You can now find out using SBI’s Exo-Glow kits. Starting with isolated exosomes, you can label internal RNA with our Exo-Red dye, or internal protein with our Exo-Green dye. When labeled exosomes are incubated with target cells, you can use fluorescence microscopy to track cell-exosome interactions, and then follow the fate of labeled RNA or protein once they’ve entered the cell. Learn more at systembio.com/exo-glow
**Exo-Fect** reagent for loading, or “transfecting,” exosomes with cargoes of siRNA, microRNA, mRNA, plasmid DNA, or even small molecules. Create your own “FedExosome” to deliver specific cargo into targeted cells. Visit systembio.com/exo-fect

**XPack** is the protein equivalent of XMIR/AXMIR, and tags proteins for incorporation into exosomes. We’ve optimized a peptide sequence that targets a protein to the interior exosomal membrane, allowing the fusion protein to be packaged into exosomes for secretion. You can use our convenient, pre-made XPack-GFP and XPack-Luciferase reporters for tracking exosomes, or design your own exosome-targeted protein for custom exosomes.

**XMIR** and **AXMIR** kits enable packaging of specific sense or antisense miRNAs into exosomes. Simply transfect one of our XMotif-tagged miRNAs or lentivectors into the exosome-producing cells of your choice. The secreted exosomes will be enriched for your miRNA, which can then be delivered to target cells. Great for knocking down or up-regulating expression of a target in the recipient cells. Visit systembio.com/xmir

**XStamp** kits deliver exosomes where you need them to go. By placing tissue-specific ligands on the exosome surface, you can engineer exosomes to interact with specific target cells.

**NCAM** NEURAL CELL-SPECIFIC

**EGFR** CANCER-SPECIFIC

**HOMING PEPTIDES** BRAIN, BLOOD-BRAIN BARRIER-SPECIFIC

**IL-2** IMMUNE CELL-SPECIFIC

**HER2** BREAST CANCER-SPECIFIC

**MOTILIN** GI TRACT-SPECIFIC

SBI now offers exosome engineering services. To learn more contact us at info@systembio.com
References


10. PubMed

11. Clinicaltrials.gov


About System Biosciences

Seeking out novel technologies and tomorrow’s hot new research areas, the team at SBI accelerates research by striving to be the first company to develop and commercialize new inventions. From novel genome editing tools to exosome research, expression and imaging vectors, RNAi libraries, and stem cell tools, SBI harnesses today’s innovations to drive tomorrow’s discoveries.

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