임상의과학자로서
연구개발을 통한 사업화 전략

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고려대학교
의과대학

SHIFTBIO
THE NEXT PARADIGM SHIFT

My story

남 기 훈 MD/PhD

▶ 세부전공

NBIT 융합전공(Nano-Bio-Information-Technology)

▶ 연구분야

항암면역치료 전략 개발 연구

엑소좀 포함 천연 나노입자 기반 약물 모달리티 개발 연구

희귀난치성치료제 개발 연구

▶ 학력사항

2008.03 - 2014.02 고려대학교 의과대학 의학과 학사

2014.03 - 2019.02 KU-KIST, 석사-박사 통합과정

▶ 교육 및 경력사항

2019.03 - 2021.09 한국과학기술연구원, Postdoctoral Fellow

2020.09 - 2021.08 미국 보스턴 다나파버 암센터 암생물학 부서, Research Fellow

2020.09 - 2021.08 미국 하버드 의과대학, Research Fellow

2021.09 - 2022.08 **주식회사 시프트바이오 공동창립**, 수석부대표

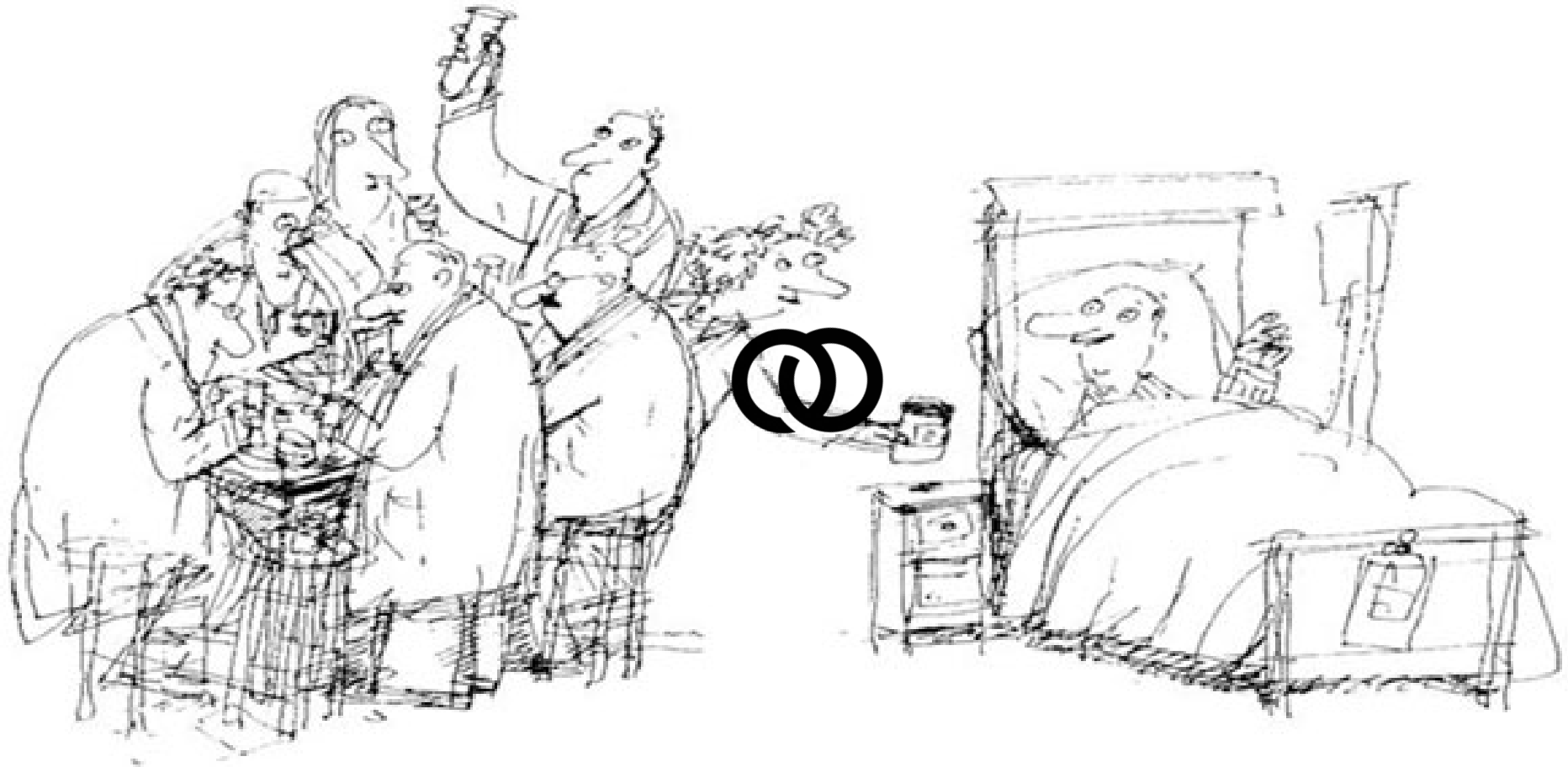
2022.09 - 2023.05 주식회사 시프트바이오, 최고과학책임자

2023.05 - **주식회사 시프트바이오, 공동대표이사**

2022.09 - **고려대학교 의과대학 생화학분자생물학교실 조교수**

Bench to Bedside transition of innovative medicine

신약개발에 있어 의사과학자의 역할



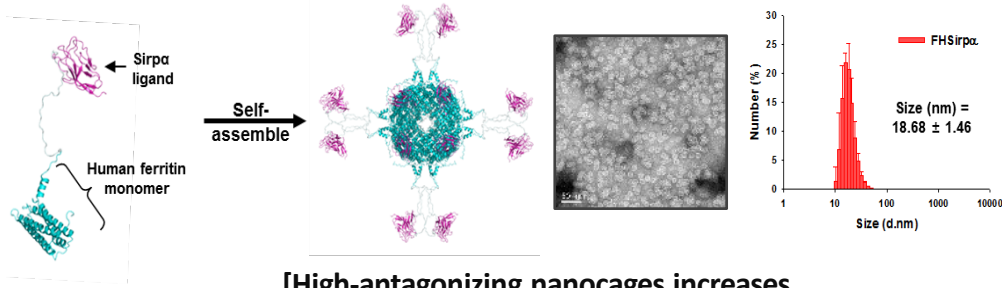
높은 의료미충족 수요 (→ MD)를 해결할 수 있는
새로운 신약 개발 플랫폼 (→ phD) 기술

My Research

SIRP-Ferritin + ICD inducer

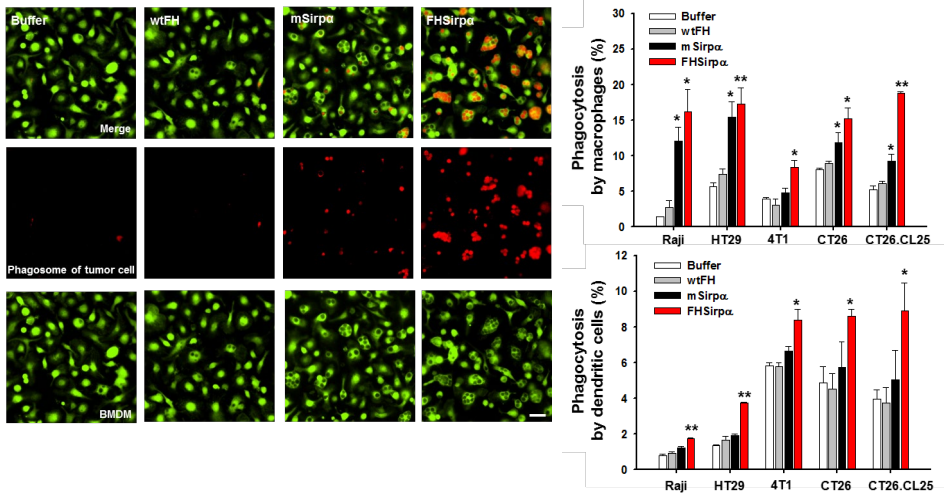
"Don't eat me" signal과 "Eat me" signal pathway 제어를 통한 식세포 탐식작용 제어

[Ferritin-nanocages for cancer immunotherapy]

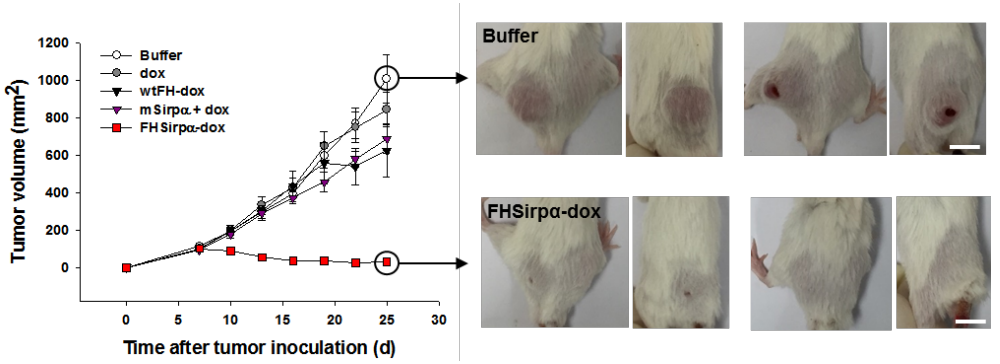


[High-antagonizing nanocages increases cancer cells phagocytosis by BMDCs & BMDMs]

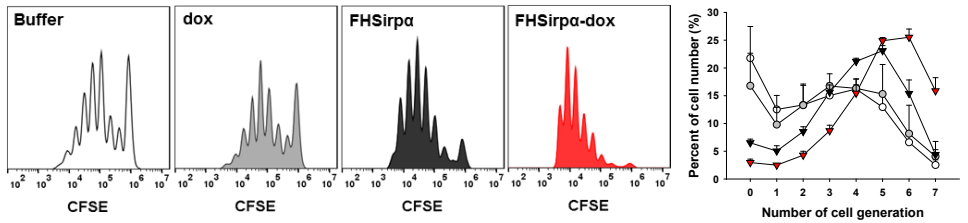
Molecule	Human CD47			Mouse CD47		
	k_a, $M^{-1}\cdot s^{-1}$	k_d, s^{-1}	K_D, M	k_a, $M^{-1}\cdot s^{-1}$	k_d, s^{-1}	K_D, M
FHSirpα	5.0×10^{6}	2.4×10^{-7}	4.8×10^{-14}	1.1×10^{6}	4.1×10^{-4}	3.7×10^{-10}
mSirpα^{Ref}	7.0×10^{6}	3.7×10^{-5}	5.4×10^{-12}	1.8×10^{6}	1.1×10^{-2}	6.2×10^{-9}



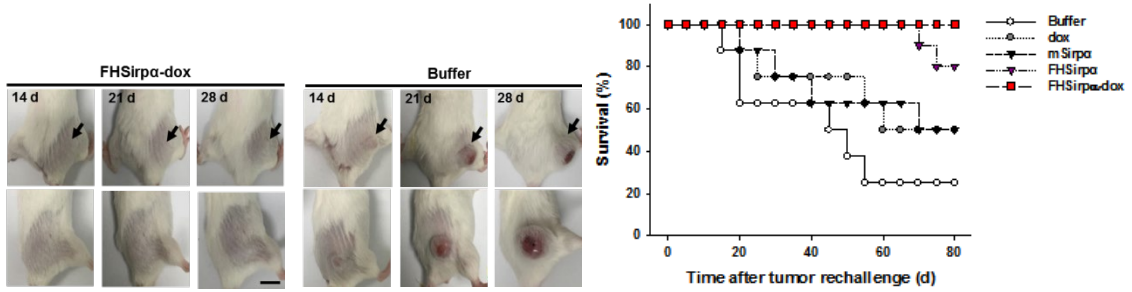
[Anti-tumor effect of FHSIRPα + Dox]



[Priming tumor antigen specific effector CD8+ T cells]



[Durable anti-tumor responses by FHSIRPα after treatment finished]

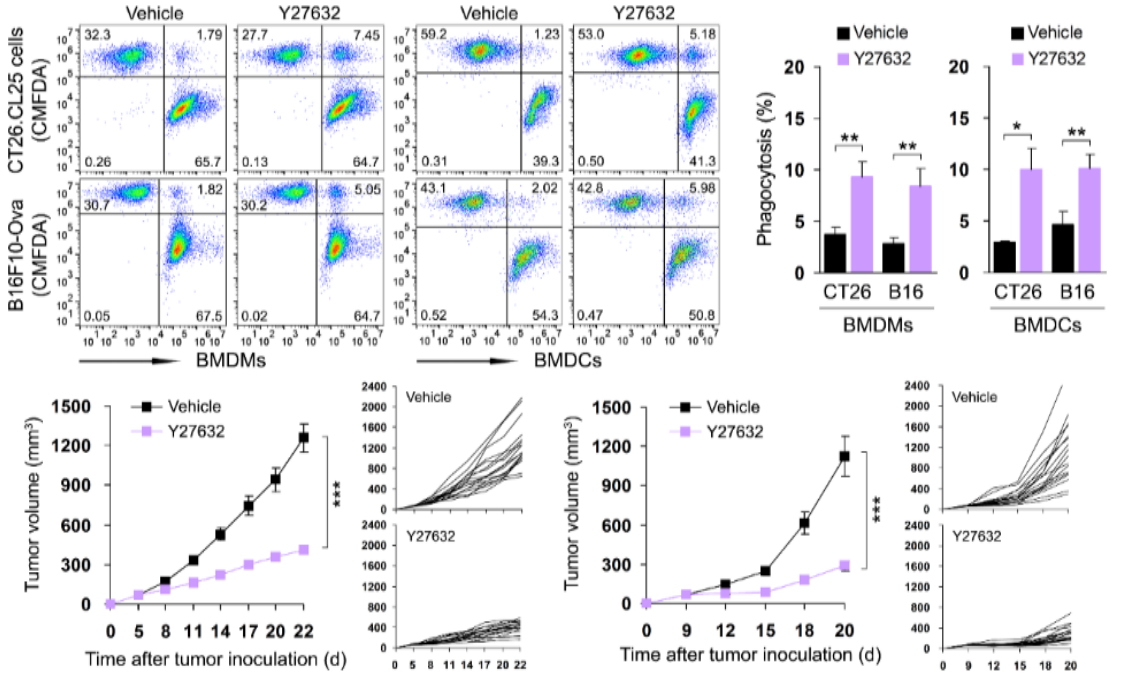


Advanced Materials, 2018

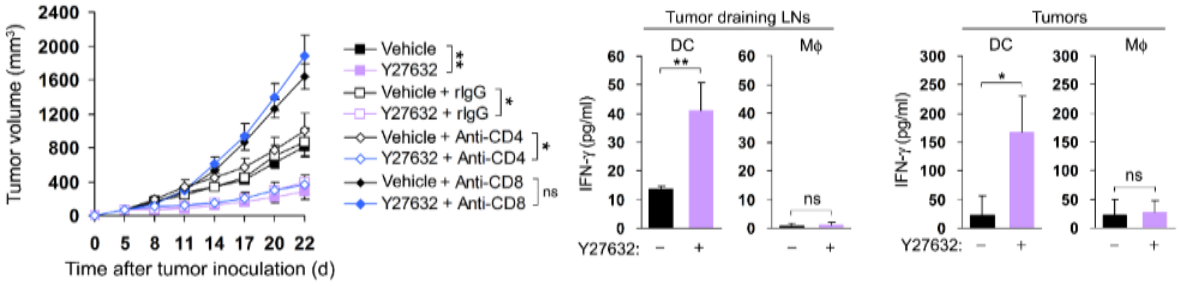
ROCK inhibitor + ICD inducer

“Tickling” signal pathway 제어를 통한 식세포 탐식작용 제어

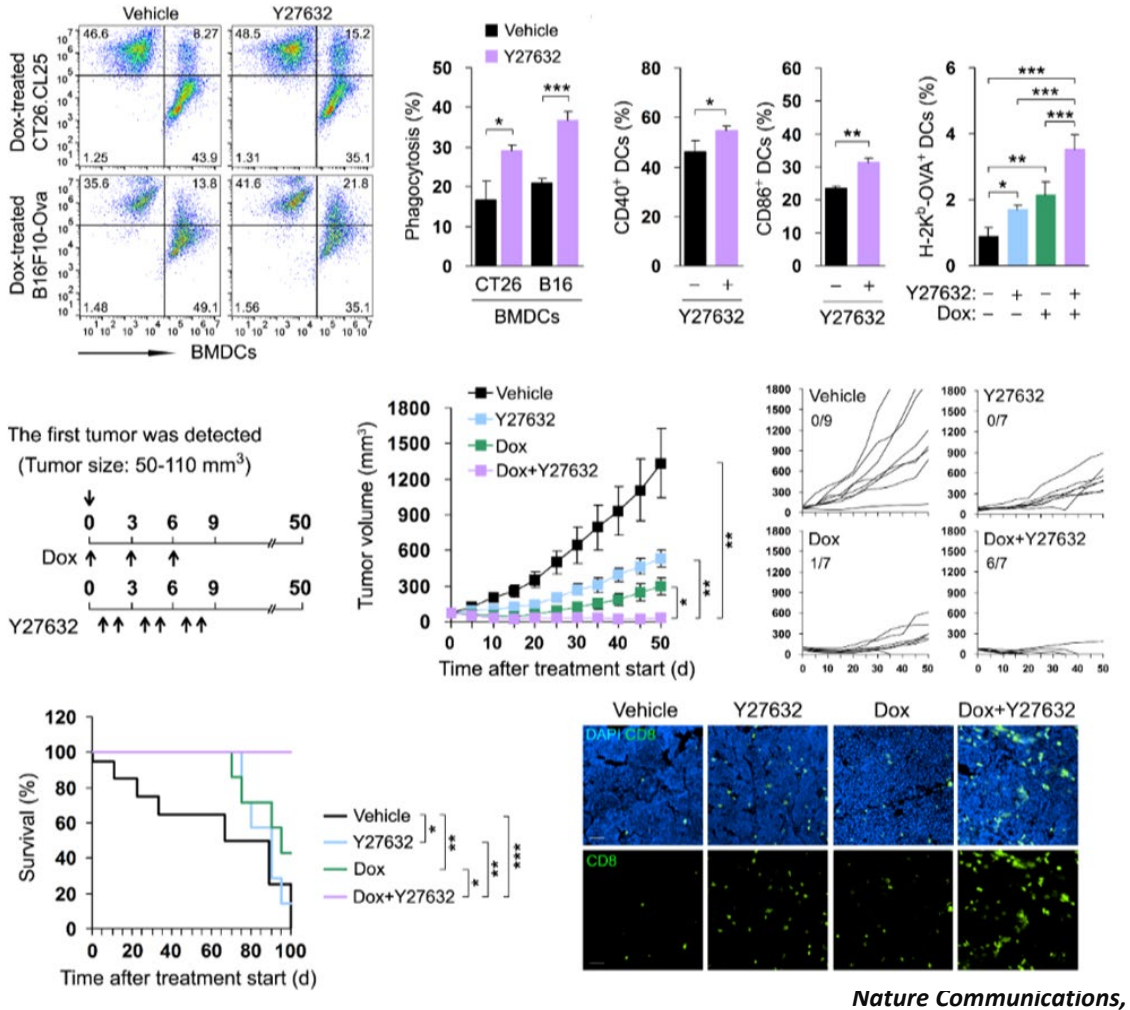
[ROCK blockade enhances tumor cell clearance by phagocytes and suppresses tumor growth]



[DC-mediated T-cell priming is important for antitumor immunity by ROCK blockade]



[Combination with Y27632 and an ICD inducer efficiently inhibit tumor growth through induction of antitumor immunity]

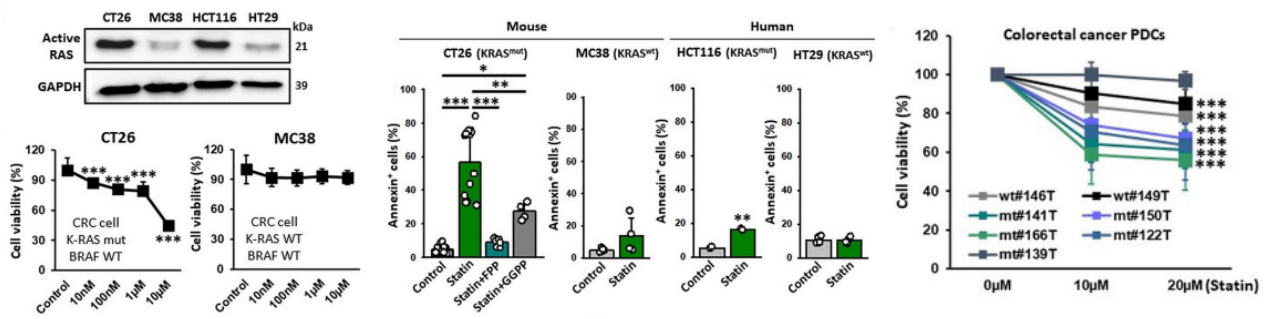


Nature Communications, 2018

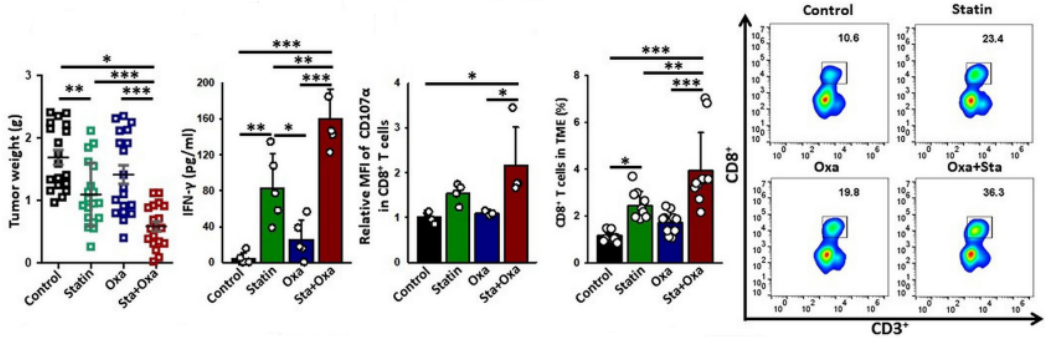
Statin + ICD inducer + PD-1 blockade

"RAS" signal pathway 억제를 통한 항암면역치료 전략

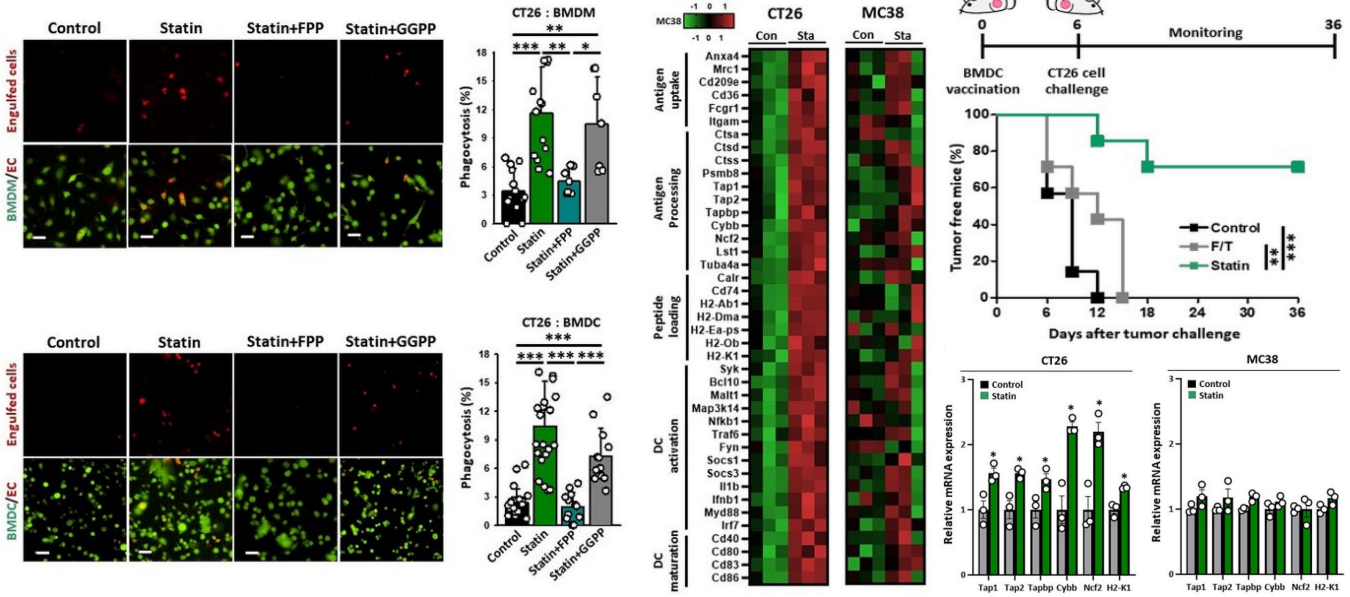
[KRAS mutation renders tumors susceptible to statin]



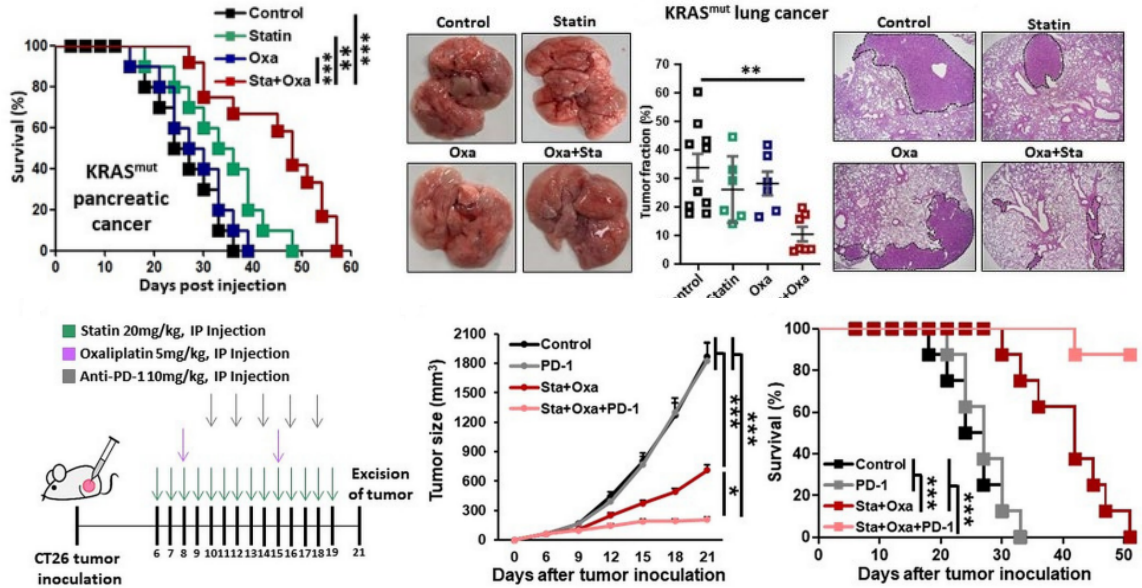
[Statin triggers CD8 T-cell-mediated eradication of KRAS mutant tumors]



[Statin induces immunogenic cell death of cancer cells]



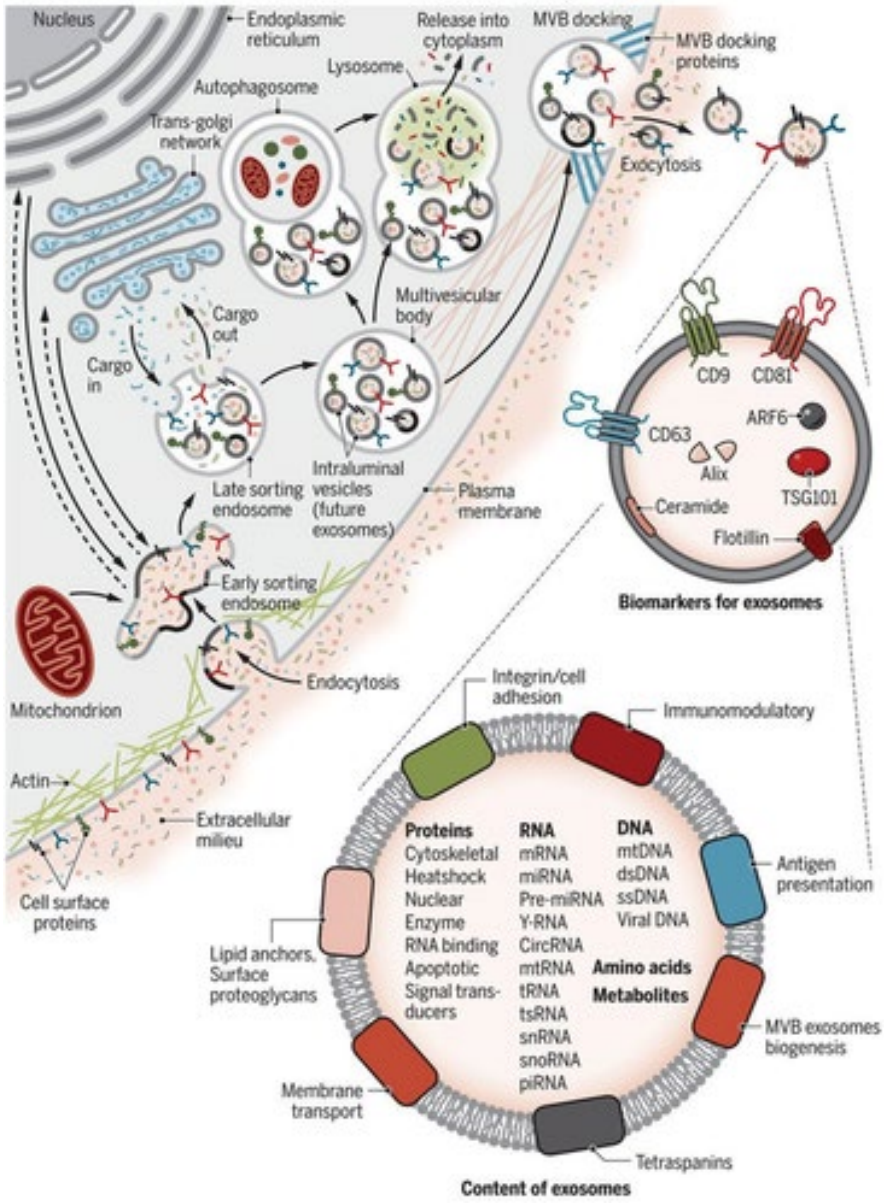
[Combination of statin and oxaliplatin effectively induces antitumor immunity]



Journal For Immunotherapy of Cancer, 2021

Why Extracellular Vesicles?

세포밖소포체 (Extracellular Vesicle)



Exosome:

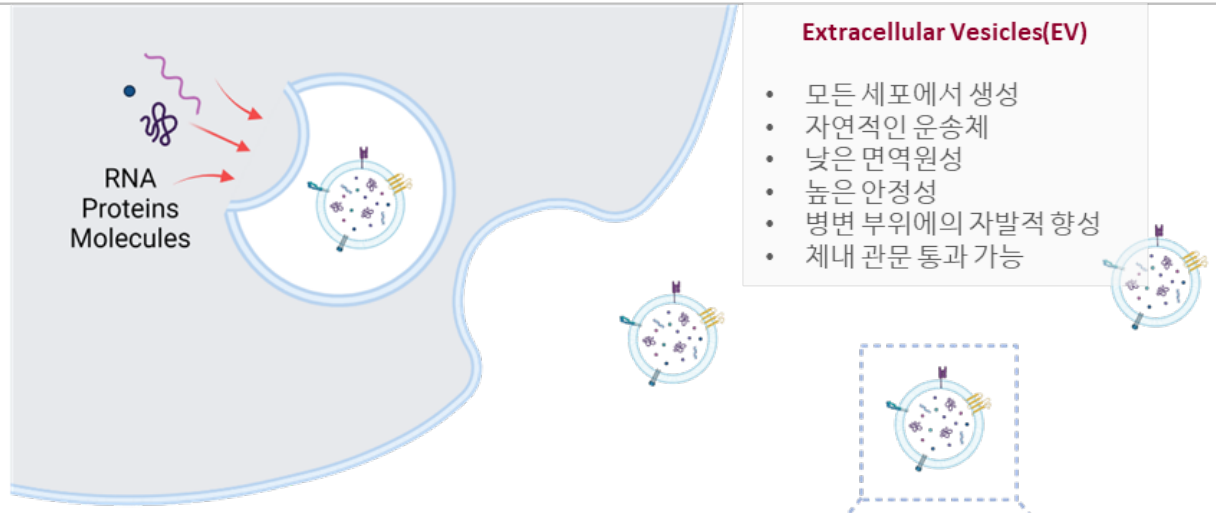
- **50 ~ 150 nm** sized extracellular vesicles
- Contain **nucleic acids, proteins and lipids**
- Secreted by most cell types
- Found in body fluids

Biological functions of exosomes:

- Eliminate useless molecules
- Maintain physiological conditions
- Suppress or enhance immune system
- Delivering macromolecule messages

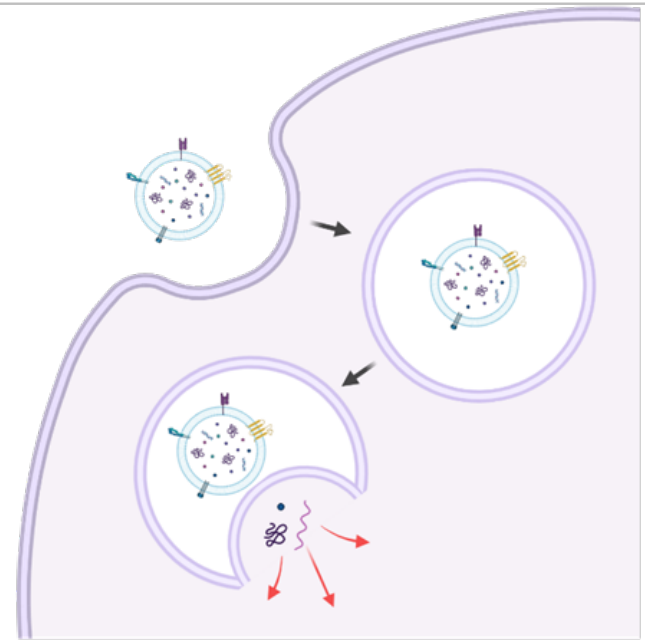
  → enabling cell-to-cell communication

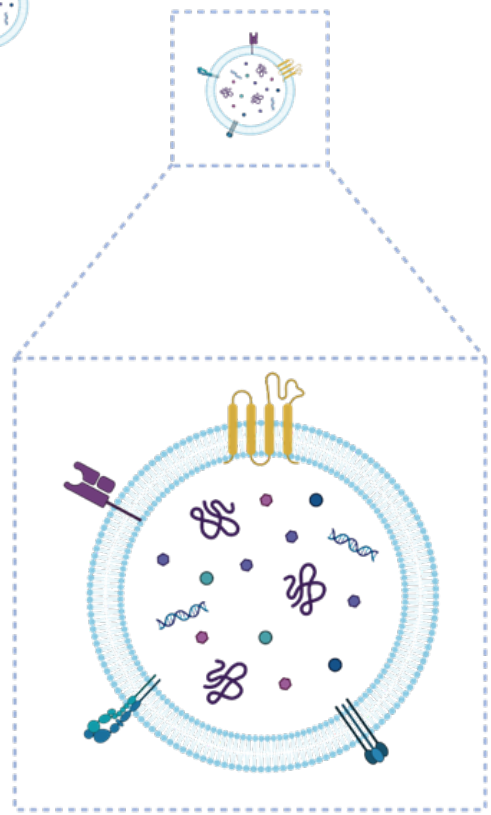
세포밖소포체의 막강한 잠재력



Extracellular Vesicles(EV)

- 모든 세포에서 생성
- 자연적인 운송체
- 낮은 면역원성
- 높은 안정성
- 병변 부위에의 자발적 향성
- 체내 관문 통과 가능





세포 수준의 복합기능성

EV는 유전자/단백질/지질 등
다기능성 인자들을 포함하여
복잡한 세포치료제를 대체할 수 있습니다.

세포 내 높은 전달 효율

EV는 진화적으로 보존된 고유한 특성에 의해 효
과적인 세포 내 기능성 인자 전달이 가능하여
유전자 치료제의 한계를 극복할 수 있습니다.

SHIFTBIO

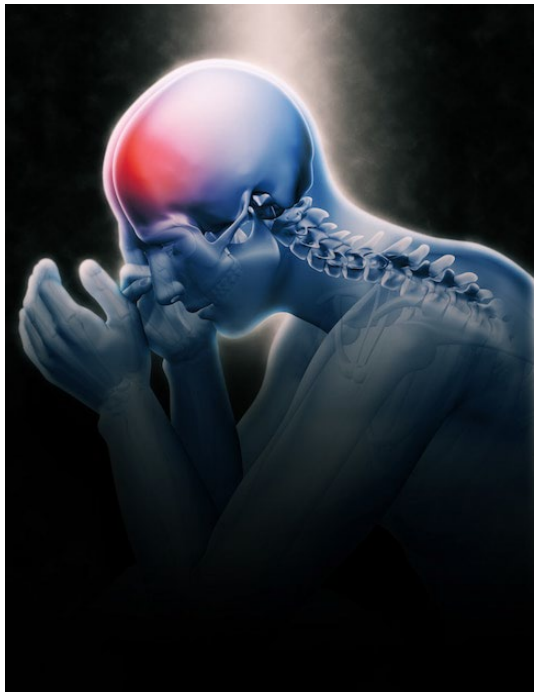
THE NEXT PARADIGM SHIFT

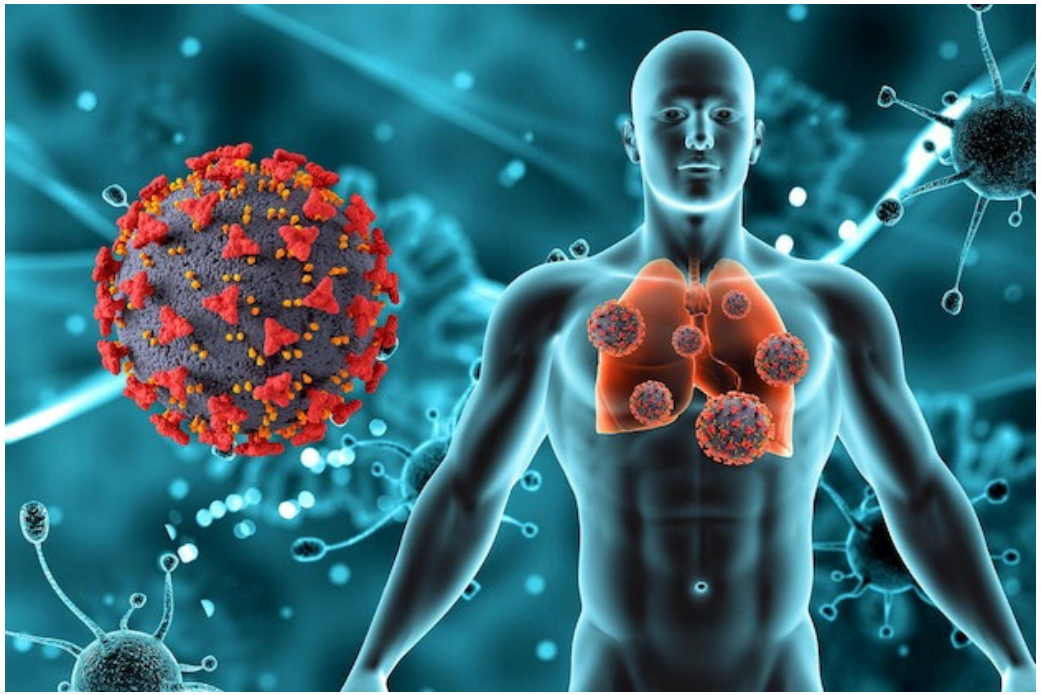
Giving Second Chance to Life,
Cure The Incurables

High Unmet Medical Needs

‘Acute’ Organ Failure

Even a young person without any pre-existing diseases can succumb to acute organ failure, resulting in a tragic death.



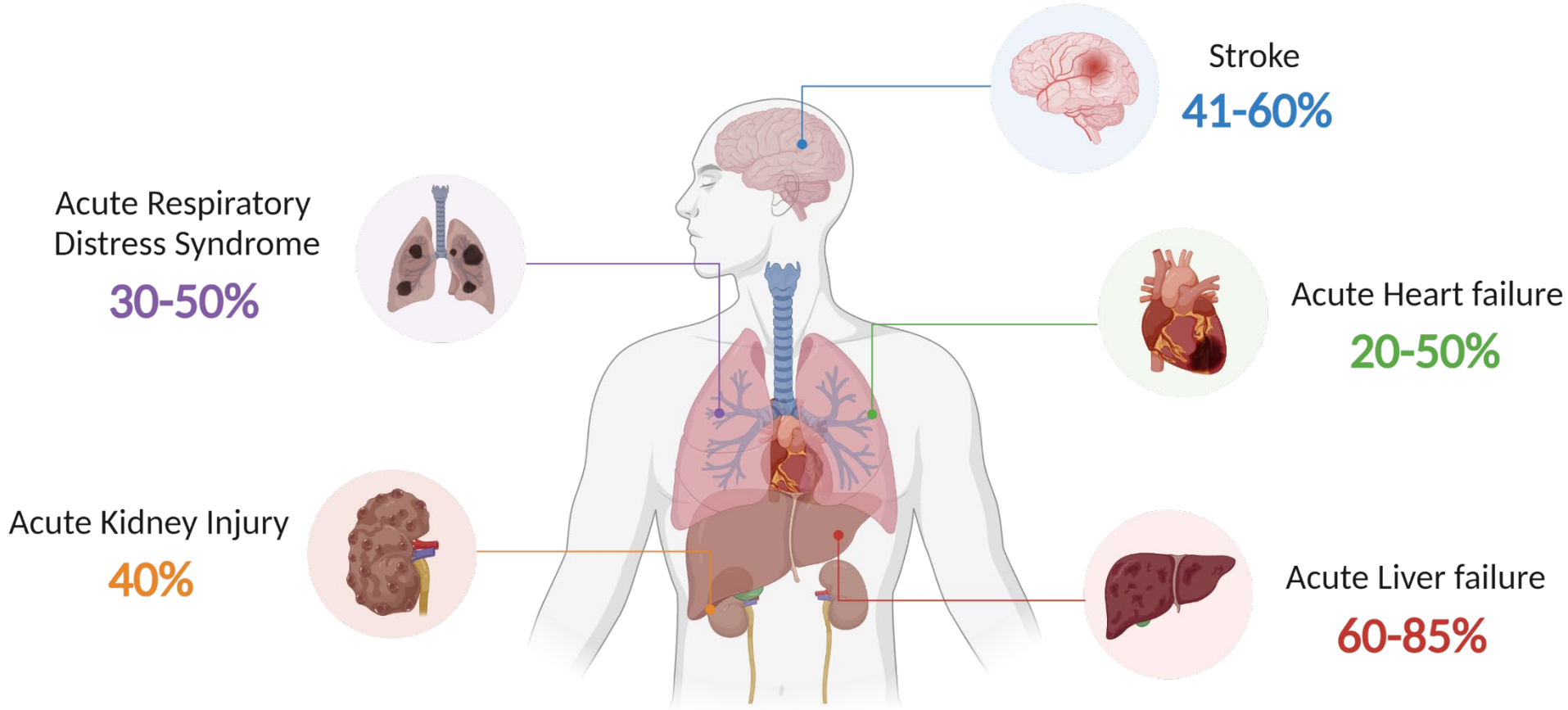


High Unmet Medical Needs

‘Acute’ Organ Failure

Developing innovative solutions for acute organ failure is crucial, considering the high mortality rates and lack of treatment options.

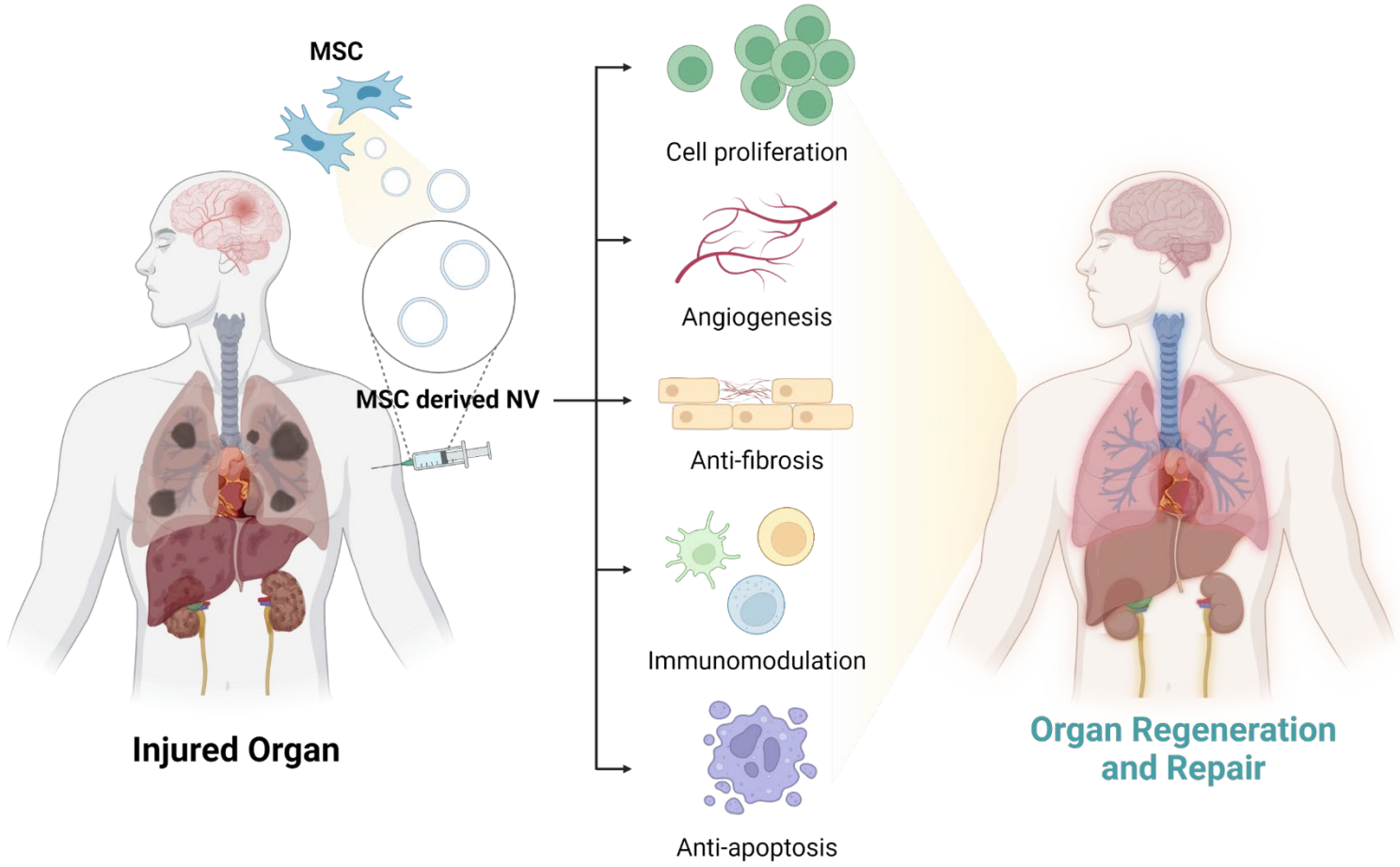
Mortality in Acute Organ Failure



Mesenchymal Stem Cell-derived Nanovesicle (MSC-NV)

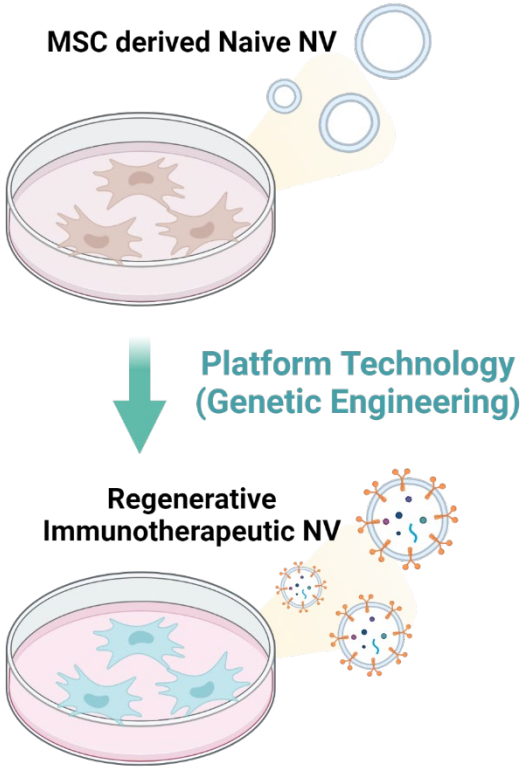
Stem cell-derived NVs possess the potential to surpass stem cell therapies in efficacy and impact.

	MSC	VS	MSC-NV
Size	μM		nM
Therapeutic Effect	Regeneration		Comparable to MSC
Immune rejection	Yes		No
Tumor formation	Yes		No
Stability	Low		High
Storage	Hard		Relatively Easy
Transportation	Hard		Relatively Easy



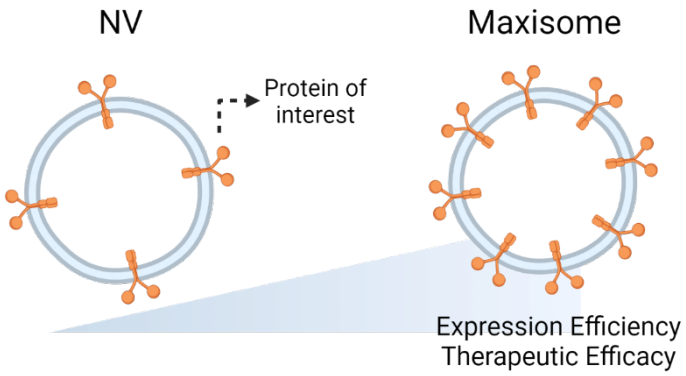
Cell-Free Nanotherapy Platform Technology

SHIFTBIO's Cell-Free Nanotherapy Platform empowers potent engineered NVs by displaying or loading therapeutics onto or into NVs.



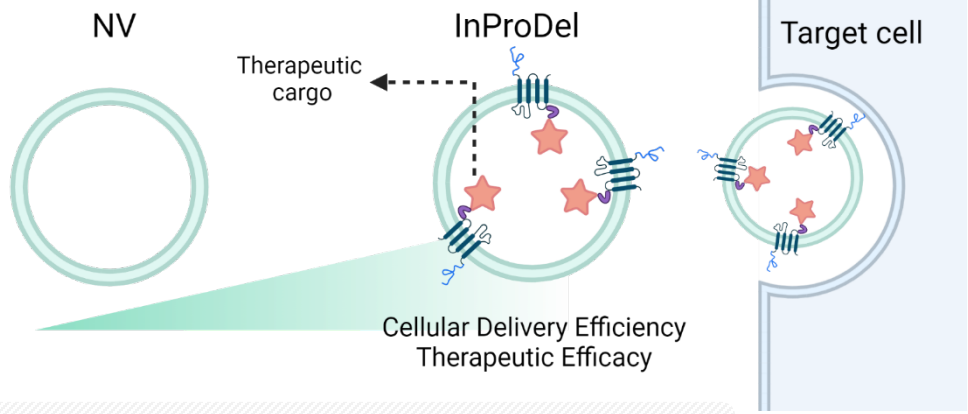
SHIFTBIO's Cell-Free Nanotherapy Platform Technologies

Maxisome



Maximizing Protein Expression on NVs

InProDel



Optimizing Cargo Loading in NVs

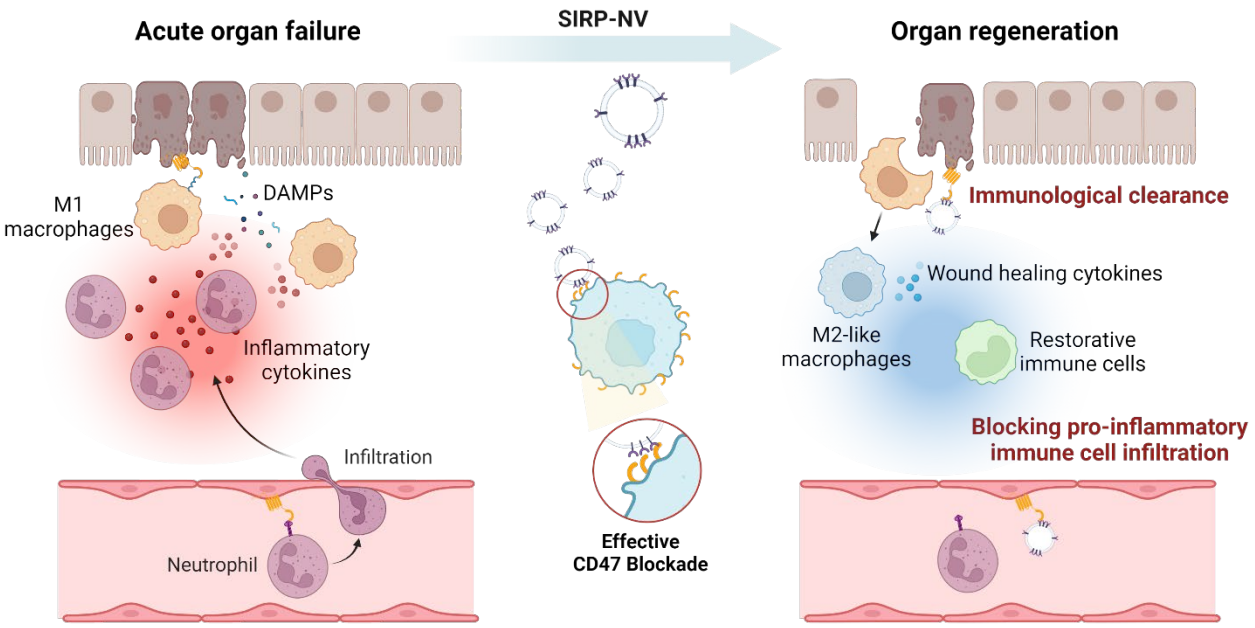
Engineered MSC-derived SIRP-NV (SBI-102)

Removing Pathological CD47 signal for Regenerative Immunotherapy

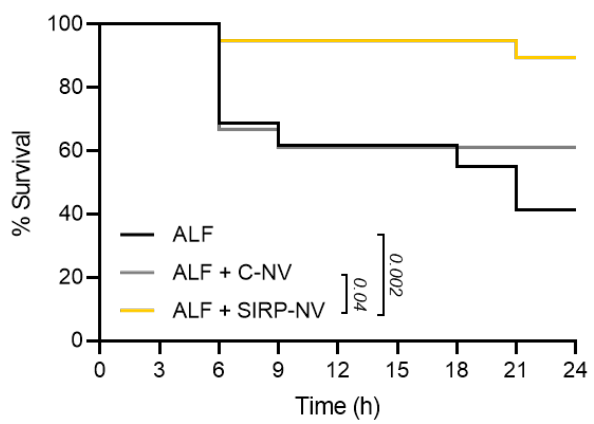
SHIFTBIO

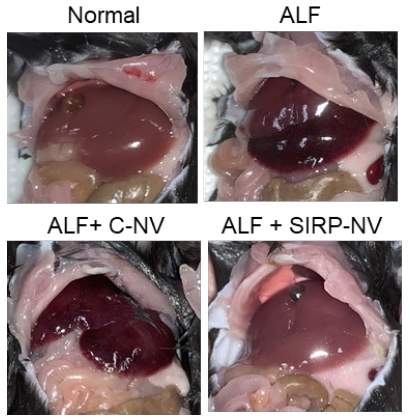
Utilizing Maxisome platform, we've redefined regenerative immune responses for acute organ failure patients with the potent SIRP-NV, effectively degrading CD47.

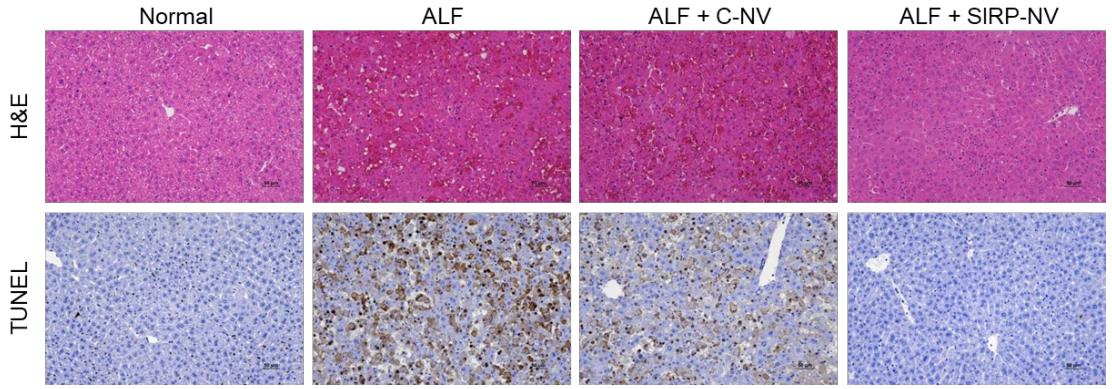
CD47 degradation for regenerative immunotherapy



Remarkable survival enhancement







Superiority of Engineered MSC-derived SIRP-NV (SBI-102)

SHIFTBIO

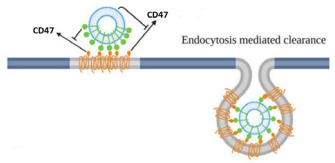
SIRP-NV can be the game changer of the CD47 blockade.

First in Class

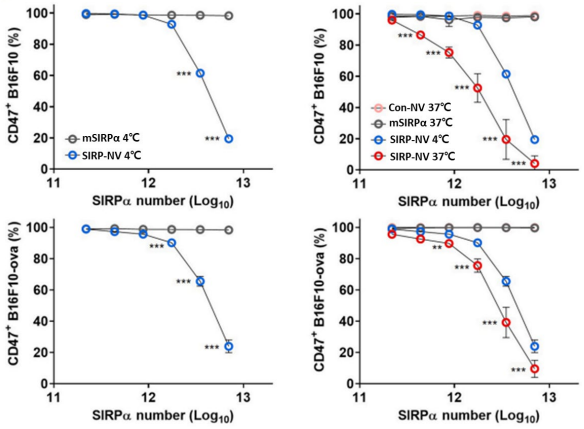
SIRP-NV (SBI-102)

Best in Class

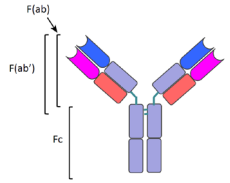
Enhanced effect by CD47 degradation



SIRP-NV induces endocytosis-mediated clearance of CD47 proteins.



High safety

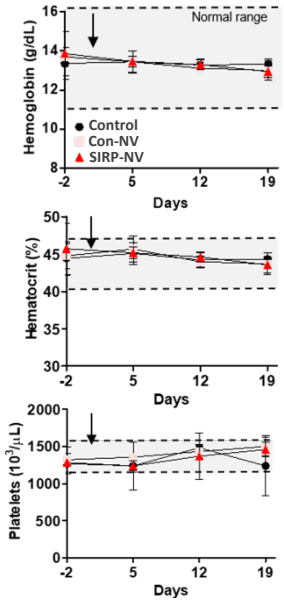


ADCP
Antibody-dependent cellular phagocytosis

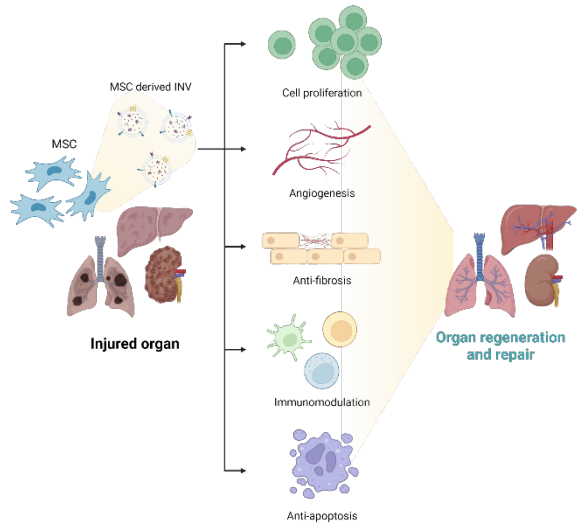
ADCC
Antibody-dependent cell-mediated cytotoxicity

CDC
Complement-dependent cytotoxicity

Severe anemia
Pancytopenia



Stem cell effect

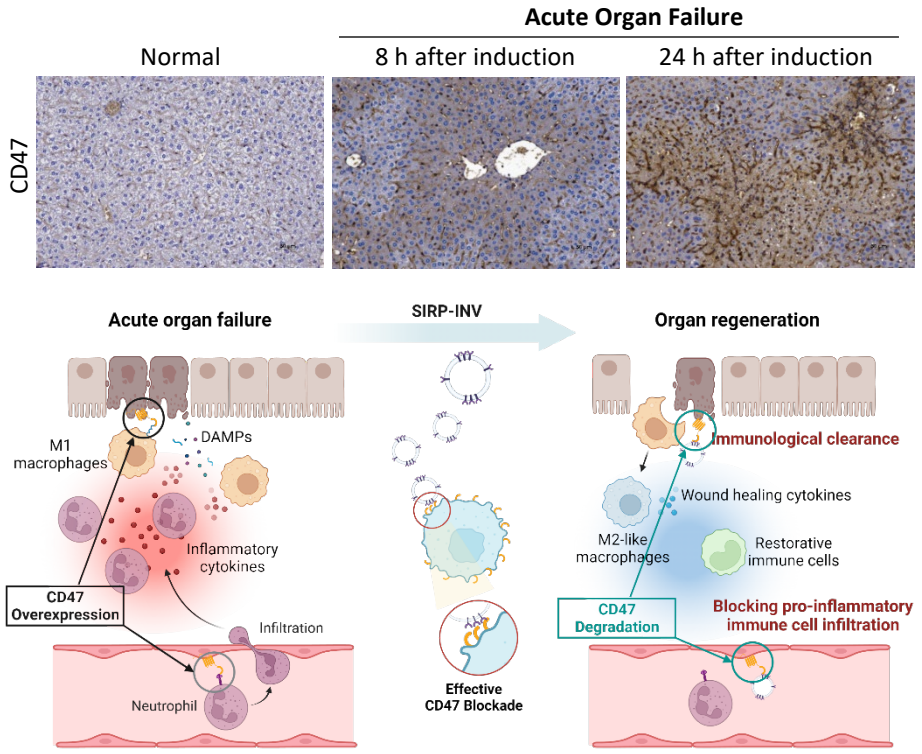


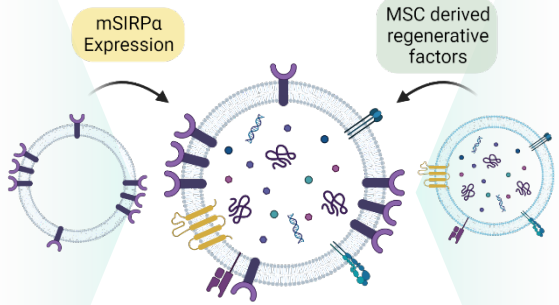
The NV modality, unlike other drug modalities, possesses the inherent ability to generate therapeutic effects on its own.

Lead Program,
Engineered stem cell-derived SIRP-NV (SBI-102)

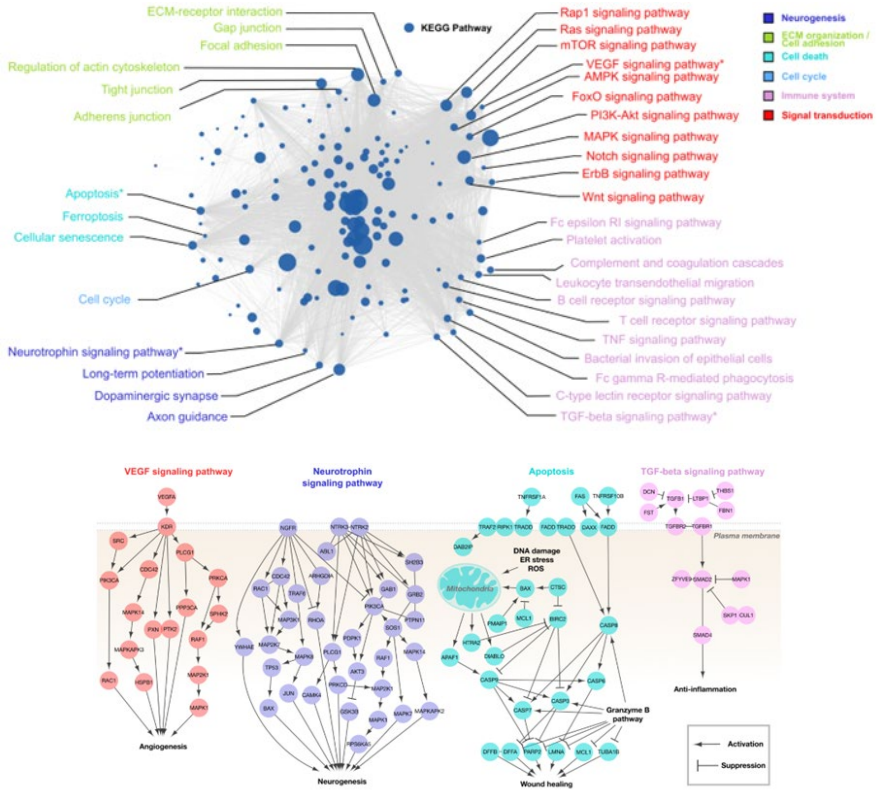
Engineered stem cell-derived SIRP-NV pioneers the concept of regenerative immunotherapy, awakening the body's innate immune system to amplify its regenerative potential.

CD47 degradation by SIRP-NV



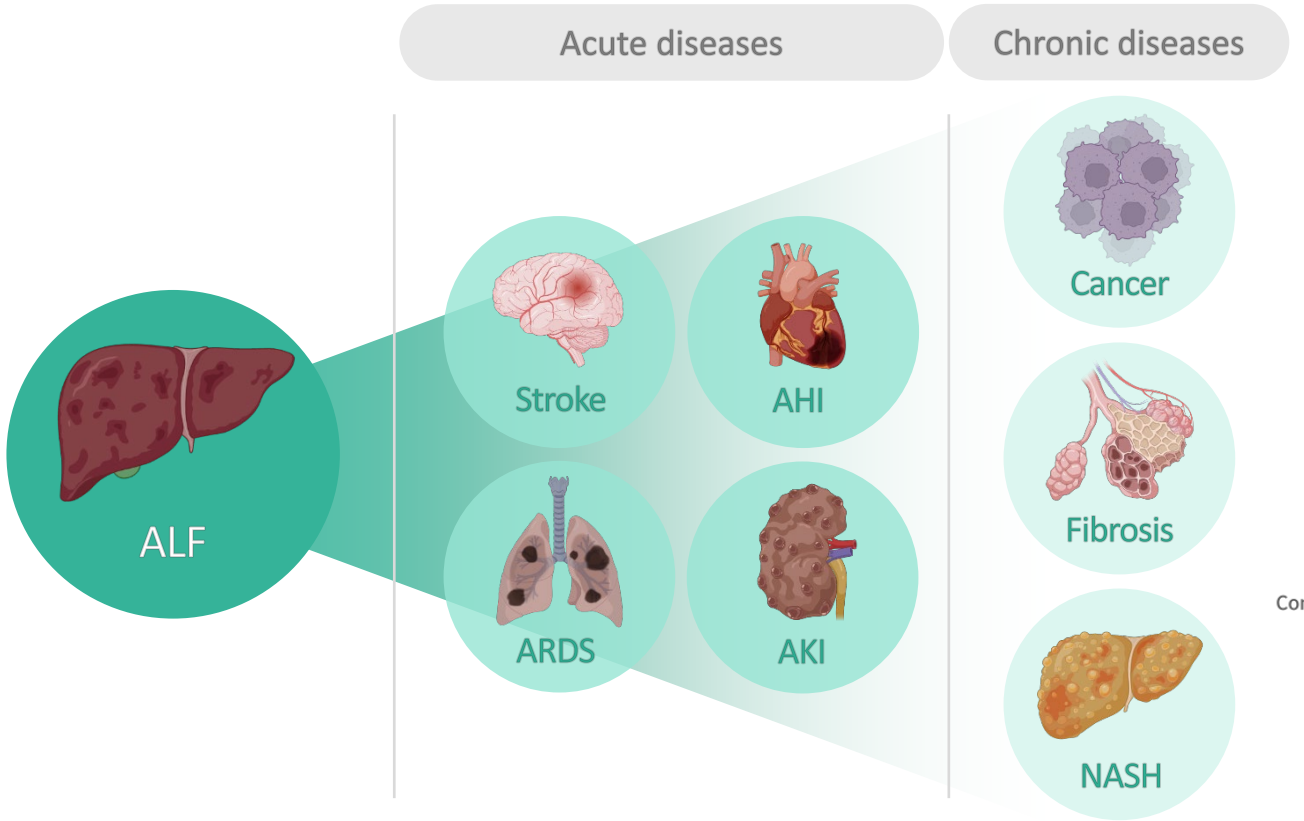


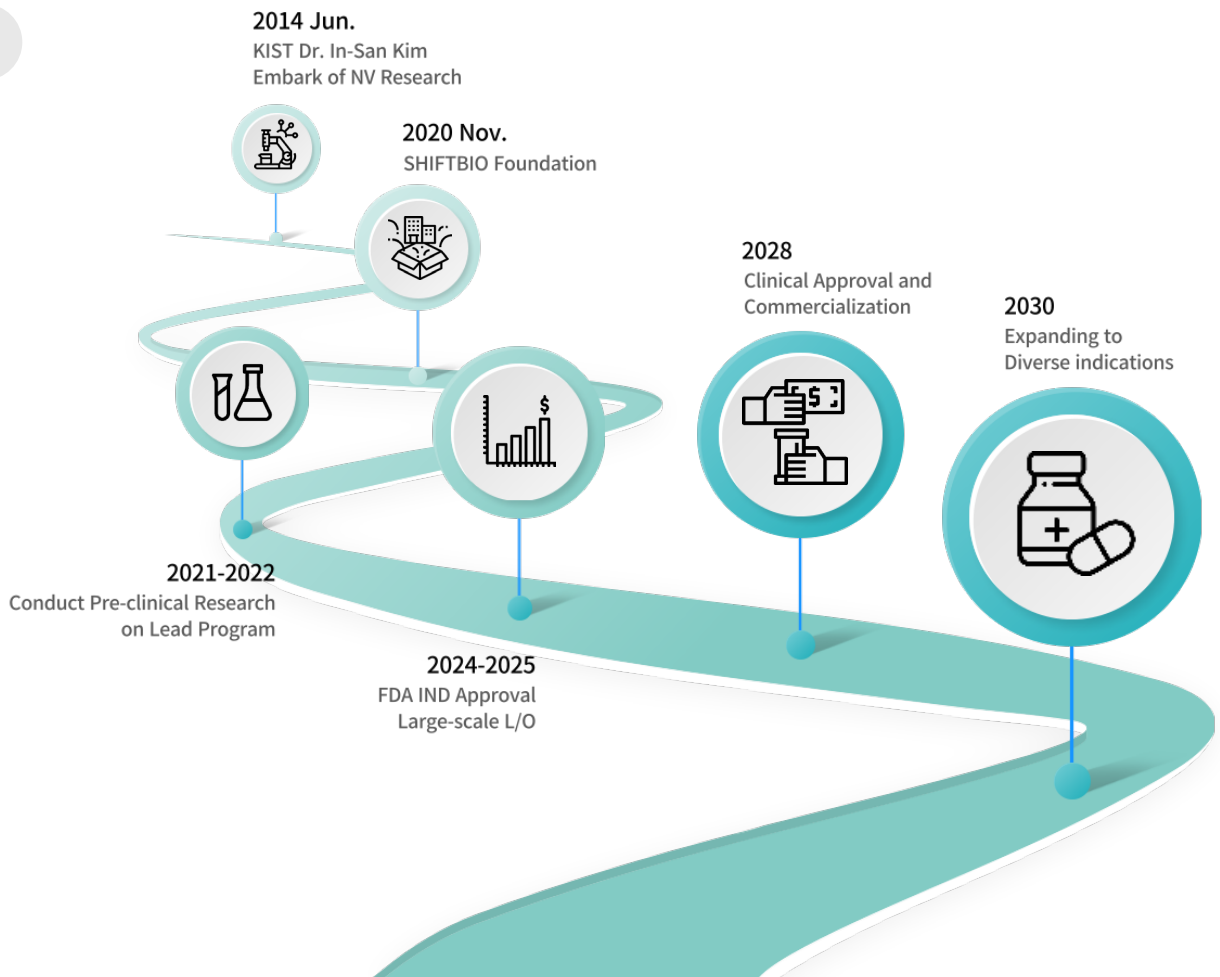
Paracrine effects of stem cells



High Market Value of Lead Program (SIRP-NV, SBI-102)

Our lead program, SIRP-NV, carries transformative potential, expanding therapeutic indications from acute organ failures to chronic diseases including cancer, fibrosis, and NASH.

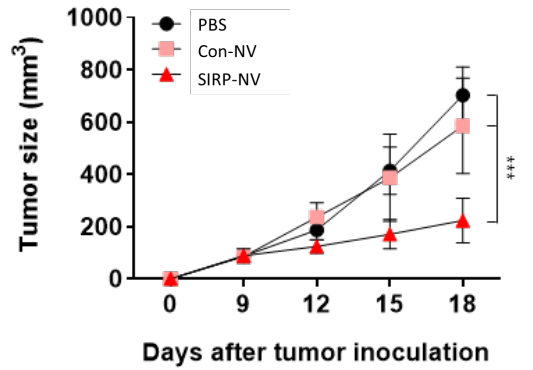


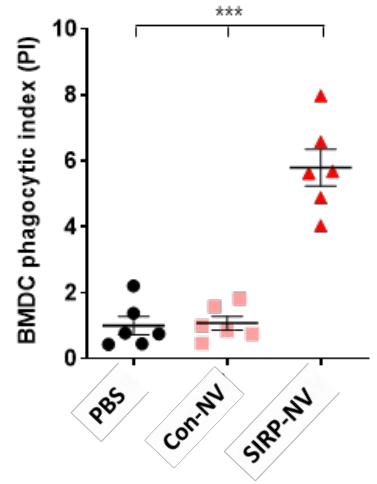


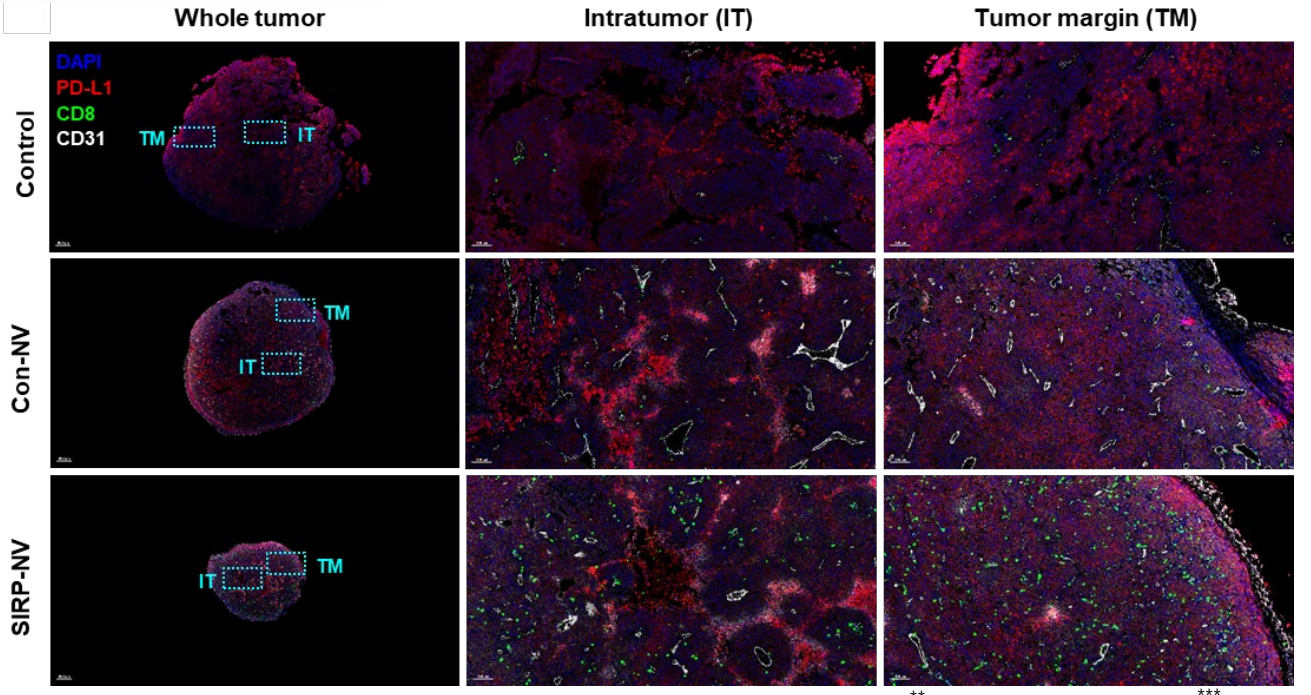
Expanding SIRP-NV's versatility for a wide range of applications.

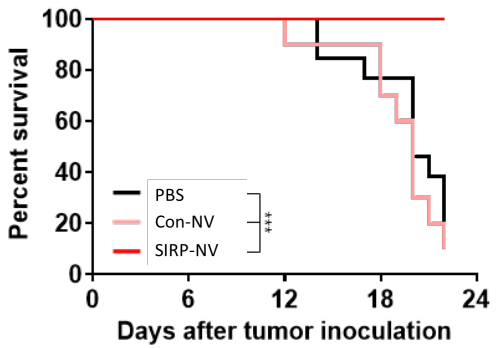
SIRP-NV, Anti-Cancer Immunotherapy

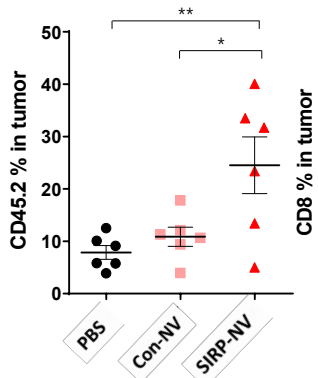
SIRP-NV shows excellent anticancer immunotherapeutic efficacy.

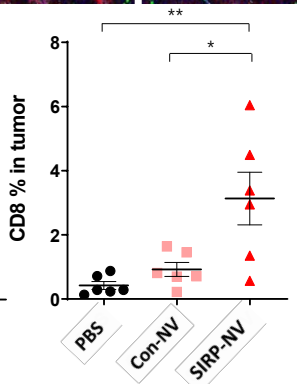


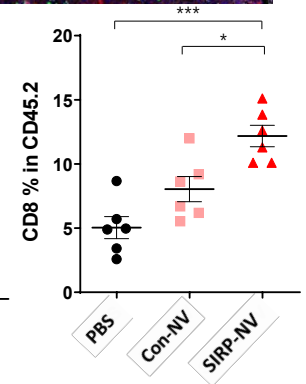












SHIFTBIO Pipeline for Rare and Intractable Diseases

SHIFTBIO's Cell-Free Nanotherapy Platform Technologies and Programs aim to treat rare and intractable diseases with high unmet medical needs.

- Lead program
- Pre-clinical
- IND Filing
- Clinical data

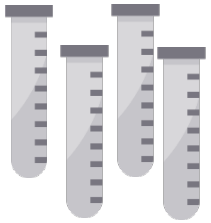
Platform	Program	Indication	Mechanism	Expected Clinical Milestones			Rights
				2024	2025	2026	
Maxisome	**SBI-101 [SIRP-NV]**	Immunotherapy Resistant Solid Tumor	CD47 Degradation-Induced Anti-tumor Immunity	●	●	● ●	SHIFTBIO
	SBI-102 [SIRP-NV, MSC] ✓	Acute Organ Failure Fibrosis/NASH	CD47 Degradation-Induced Regenerative Immunity	●	●	●	SHIFTBIO
	SBI-104 [Apelin-NV, MSC]	Pulmonary Arterial Hypertension	Anti-proliferation and Vasodilation	●	●	● ●	SHIFTBIO /KIST
InProDel	**SBI-201 [HIF1α-NV, MSC]**	Undisclosed	Activating Resolutive Immunity	●	● ●	●	SHIFTBIO
Fusosome	**SBI-301 [mVSVG-NV]**	Immunotherapy Resistant Solid Tumor	Cancer Cell Membrane Editing				SHIFTBIO
	SBI-302 [RSVF-NV]	Immunotherapy Resistant Solid Tumor	Immunogenic Cancer Cell Death				SHIFTBIO
	SBI-303 [Undisclosed]	Personalized Cancer Vaccine	mRNA Delivery		●	●	SHIFTBIO

Clinical Manufacturing of SIRP-NV (SBI-102)

SHIFTBIO, in collaboration with US-based RoosterBio, has already set up large-scale SIRP-NV manufacturing, targeting FDA IND approval.

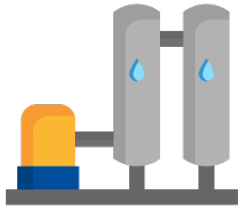
Upstream Process | **Downstream Process** | **Formulation & Fill**

Genetic Engineering
By SHIFTBIO Platform Technology



Genetically
Modified Cell Bank

200L
3D bioreactor



4-step
Purification

Drug Product
+QC Release Testing

Increase Yields | Decrease Manufacturing Time | Reduce Cost of Goods

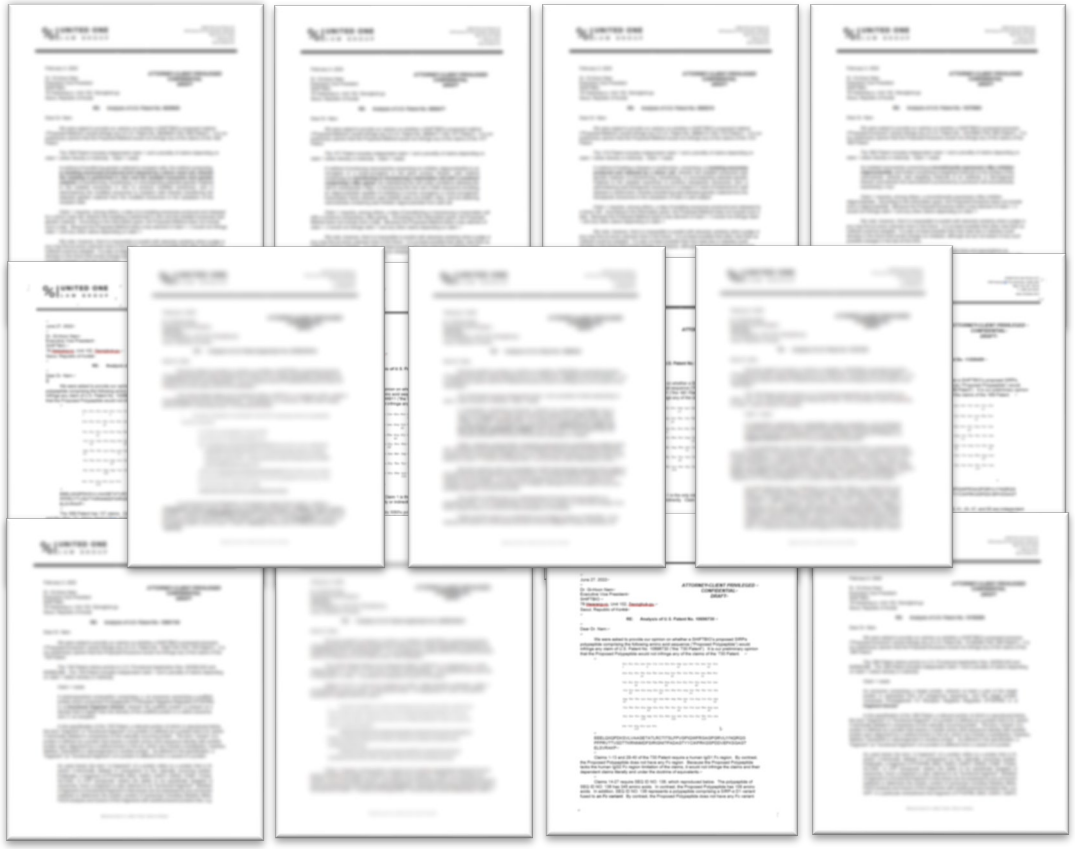
SHIFTBIO × RoosterBio®

Patent Portfolio Establishment

A quarterly 「FTO reports」 are established to secure rights through U.S. patent attorney.
「Patent Portfolio Strategy」 is also established for potent protection of IP rights

[Secure FTO Reports]

「Extensive rights can be guaranteed without patent competition and patent infringement」



[SHIFTBIO Patent Portfolio]

Patent Maxisome

"NV Sorting Motif" that maximizes the expression of therapeutic proteins on the NV membrane.

Patent InProDel

Automatic loading of macromolecules in NVs and maximizing intra-cellular delivery efficiency.

Patent Fusosome

NVs that fuse and edit specific cell membranes and deliver therapeutic cargos without damage.

Patent Pipelines

Entry into each country and build a patent portfolio.

Trademark SHIFTBIO

Letters / Logo trademarks entered 22 countries including the US

Creating a Top-Rated Drug Development Team

In-San Kim
MD. Ph.D.
Co-Founder

- M.D. and Ph.D. from Kyungpook National University
- KIST Fellow Researcher
- Professor at KU-KIST Graduate School
- Expertise in Cancer Immunology and EV Therapy
- Published over 300 papers (h-index: 80)

Gi-Hoon Nam
MD. Ph.D.
Co-Founder

- MD. from Korea University
- Ph.D. from KU-KIST Graduate School
- Professor at Korea University College of Medicine
- Research on Cancer Immunotherapy and EV engineering at KIST and Harvard Medical School

Won-Yong Lee
MD. Ph.D.
Co-Founder

- MD. from Seoul National University
- Ph.D. from Sungkyunkwan University
- Fellow at Seoul National University Hospital
- Otolaryngologist at Samsung Medical Center
- Assistant professor at Busan National University

World-Class Scientific Advisory Board

Thomas M. Roberts, PhD

Former Chairman of Department of Cancer Biology at the Dana-Farber Cancer Institute

Former Dean of Graduate Education at Harvard Medical School

Contributed to the research of Ciba-Geigy, key role in the development of Gleevec, which is one of the first molecular-targeted cancer therapies.

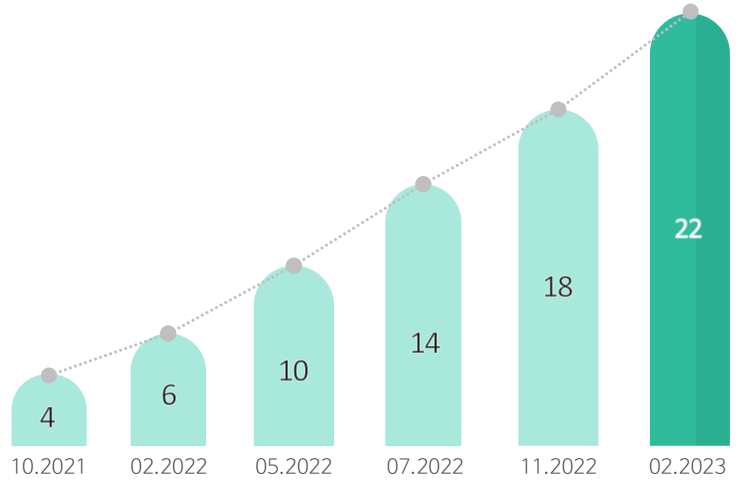
Kenneth W. Witwer, Ph.D.

Associate Professor, Johns Hopkins University School of Medicine

President-Elect, International Society for Extracellular Vesicles

World-Class Scientist in EVs

Current status of SHIFTBIO employees



SHIFTBIO Journey

Tracing Our Past, Charting Our Future

2016.07
Prof. In-San Kim's research team at KIST developed NV platform technology.

2020.10
SHIFTBIO corporation established with KIST's investment in technology.

2021.11
- Grand Prize, Start-up Competition.
- Minister of Science and ICT Award, IR Competition.

2022.04
- Secured $5M in investment.
- Secured $2M in business funds. (Selected for First Penguin program, KODIT)

2023.03
Completed development of NV large scale manufacturing with strategic partner, U.S.-based RoosterBio.

2023.04
Included in President Yoon Suk-yeol's business delegation to the United States.

2023.09
Began GMP production of the lead program, **SIRP-NV**.

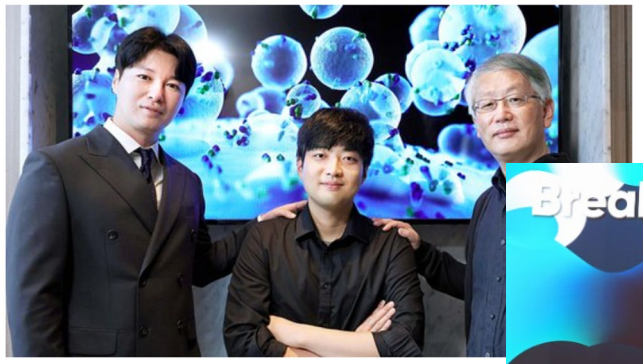
2023.12
SIRP-NV designated under the FDA's **Orphan Drug Designation**.

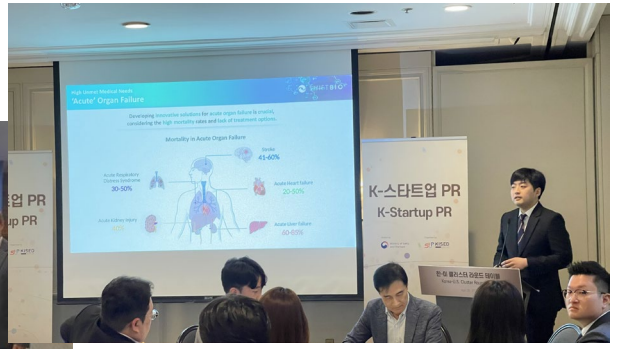
2024.02
Proceeded with **GLP Tox** beyond mouse trials as necessary after the Pre-IND meeting.

2024.06
Promoting collaborative research and **preclinical stage L/O** with global Big Pharma.

2024.12
SIRP-NV,
FDA IND submission

2025.12
Completed Phase 1 clinical trial with FDA and **global L/O**.





THE NEXT PARADIGM SHIFT

Our goal is to create innovative therapeutics that offer a second chance to patients by developing a new class of medicines through our cell-free nanotherapy platform technology.

SHIFTBIO

Thank you