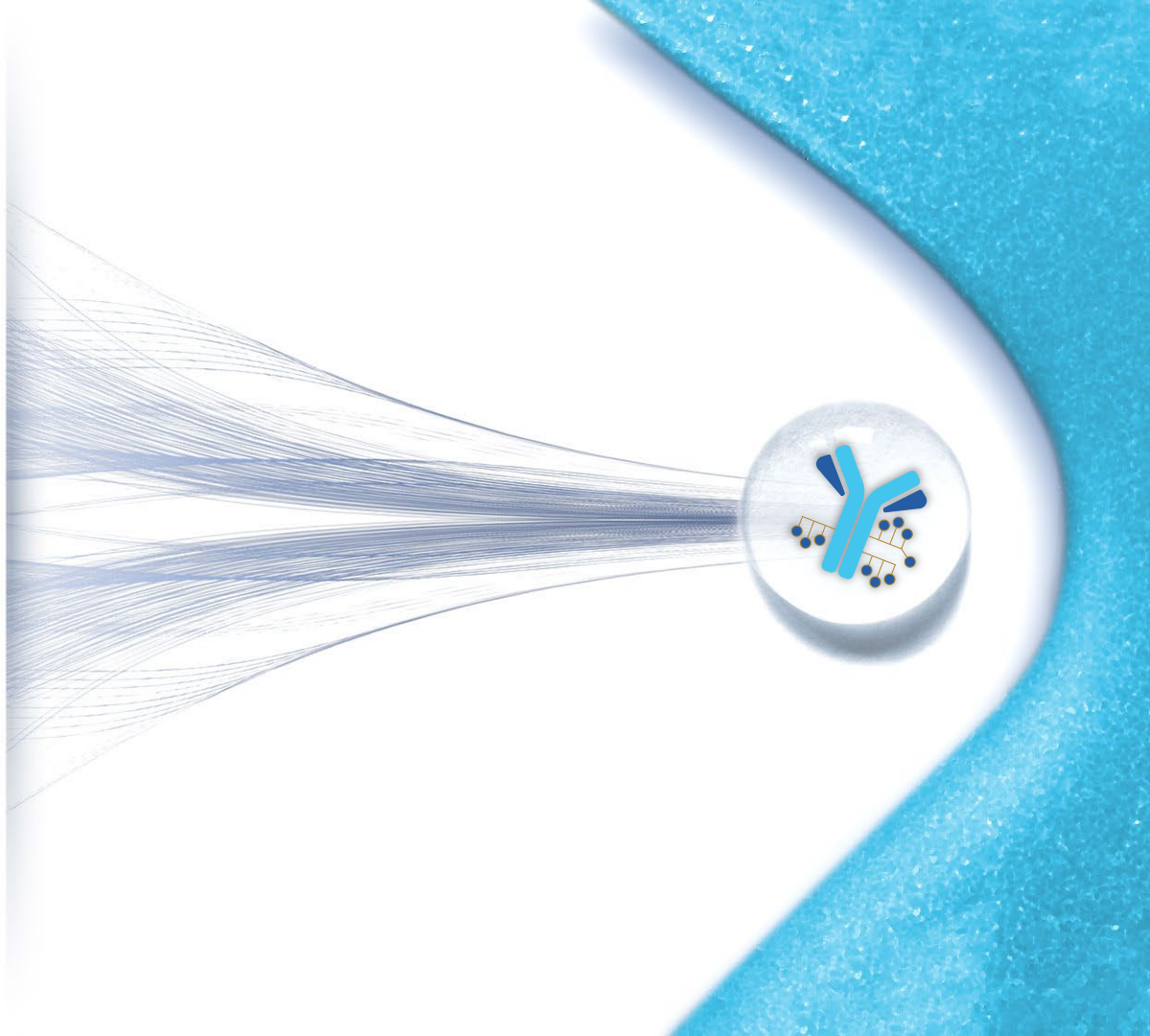
Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting

February 2022



Legal Disclaimer

This presentation contains “forward-looking” statements within the meaning of federal securities laws. These forward-looking statements are not statements of historical facts and are based on management’s beliefs and assumptions and on information currently available to management. Forward-looking statements include information concerning Mersana Therapeutics, Inc.’s (the “Company’s”) business strategy and the design, progression and timing of its clinical trials, including the Company’s UPLIFT, UP-NEXT and UPGRADE clinical trials, data from its ongoing trials, the ability of its current and planned clinical trials to generate registration enabling and/or supportive data and expectations regarding future clinical trial results based on data achieved to date.

Forward-looking statements generally can be identified by terms such as “aims,” “anticipates,” “believes,” “contemplates,” “continues,” “could,” “estimates,” “expects,” “goal,” “hypothesis,” “intends,” “may,” “on track,” “opportunity,” “plans,” “poised for,” “possible,” “potential,” “predicts,” “projects,” “promises to be,” “seeks,” “should,” “strategy,” “target,” “will,” “would” or similar expressions and the negatives of those terms. Forward-looking statements represent management’s beliefs and assumptions only as of the date of this presentation. The Company’s operations involve risks and uncertainties, many of which are outside its control, and any one of which, or combination of which, could materially affect its results of operations and whether the forward-looking statements ultimately prove to be correct. Factors that may materially affect the Company’s results of operations and whether these forward-looking statements prove to be correct include, among other things, that the results of our ongoing or future clinical trials may be inconclusive with respect to the efficacy of our product candidates, that we may not meet clinical endpoints with statistical significance or there may be safety concerns or adverse events associated with our product candidates, that preclinical testing or early clinical results may not be predictive of the results or success of ongoing or later preclinical or clinical studies, that we may not meet our goals for the timing of, or our ability to obtain and maintain, regulatory approvals for our product candidates, and that the development and testing of the Company’s or its partners’ product candidates and new platforms will take longer and/or cost more than planned, and that our clinical studies may not be initiated or completed on schedule, if at all, as well as those included in the Company’s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission (“SEC”) on November 9, 2021 and subsequent SEC filings. In addition, while we expect that the COVID-19 pandemic might adversely affect the Company’s preclinical and clinical development efforts, business operations and financial results, the extent of the impact on the Company’s operations and the value of and market for the Company’s common stock will depend on future developments that are highly uncertain and cannot be predicted with confidence at this time, such as the ultimate duration of the pandemic, the spread of variants of COVID-19, travel restrictions, quarantines, physical distancing and business closure requirements in the U.S. and in other countries, and the effectiveness of actions taken globally to contain and treat the disease. Except as required by law, the Company assumes no obligation to update these forward-looking statements publicly, or to update the reasons actual results could differ materially from those anticipated in the forward-looking statements, even if new information becomes available in the future.

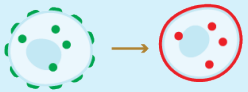
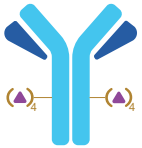
Copies of the Company’s Quarterly Report on Form 10-Q and our other SEC filings are available by visiting EDGAR on the SEC website at http://www.sec.gov.

Mersana Strategic Vision: Build ADC Leadership from Discovery to Commercial

1	**Build UpRi** into a Foundational Medicine in Ovarian Cancer	• UPLIFT • UP-NEXT • UPGRADE
2	**Build Out Pipeline** of Highly Impactful Cancer Medicines	• XMT-1592 • XMT-1660 • XMT-2056
3	**Build Innovation** and Scientific Leadership in ADCs	• XMT-2068 • XMT-2175 • New Innovations & Additional Molecules
4	**Build Mersana** with Top Talent and Strategic Partners	• Boston Globe 2021 Top Places to Work • Janssen Collaboration

Mersana Today: Leader in ADC Innovation

Platforms Serve as Efficient Product Engines

Platform		Proprietary Payload	Products	Benefits
	**Dolaflexin** High DAR* (~10)	**DolaLock** Controlled Bystander Effect 	UpRi XMT-1592 XMT-1660	• Clinically validated platform • POC demonstrated through clinically meaningful responses, including CRs, in high unmet need settings • Differentiated tolerability profile without severe neutropenia, peripheral neuropathy and ocular toxicities observed • Not a P-gp substrate
	**Dolasynthen** Precise DAR (2-24)			
	**Immunosynthen** Precise DAR (8)	**ImmunoLock** Non-Cell Permeable STING Agonist 	XMT-2056 XMT-2068 XMT-2175	• Targeted stimulation of the innate immune system • ImmunoLock designed for antibody-dependent delivery to tumor and tumor-resident immune cells (The One-Two Punch) • Preclinical data demonstrate potential for wide therapeutic index across multiple targets

*Drug-to-antibody ratio (DAR)

Upifitamab Rilsodotin (UpRi): Building a Foundational Medicine in Ovarian Cancer

ADC Program	Target	Indication	Platform	Discovery	Preclinical	P1 Dose Escalation	P1 Proof of Concept	P2/Pivotal	P3
Upifitamab Rilsodotin (UpRi)*	**NaPi2b**	**Platinum-Resistant Ovarian Cancer**	**Dolaflexin**	UPLIFT Single-Arm Registrational Trial					
		Platinum-Sensitive Ovarian Cancer	**Dolaflexin**	UPGRADE Phase 1-2 Combo					
		Recurrent Platinum-Sensitive Ovarian Cancer Maintenance	**Dolaflexin**	UP-NEXT Phase 3 – Target Initiation Q2 2022					
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Collaborator:									
Multiple janssen	Multiple	Undisclosed	Dolasynthen						
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ASN004 ASANA BioSciences	5T4	Undisclosed	Dolaflexin						

*NaPi2b antibody used in UpRi (formerly XMT-1536) and XMT-1592 is in-licensed from Recepta Biopharma. Recepta has rights to commercialize UpRi and XMT-1592 in Brazil.
**EMD Serono is an affiliate of Merck KGaA

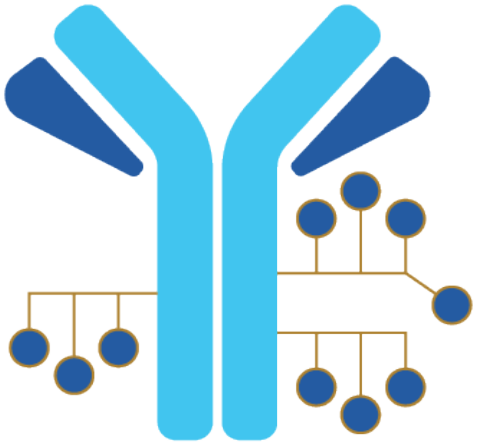
Building Mersana with Strategic Partners

February 3, 2022

Mersana Therapeutics Announces Research Collaboration and License Agreement with Janssen to Advance Novel Antibody-Drug Conjugates

- 3 Targets
- Dolasynthen platform with precise control of DAR and DolaLock payload
- $40M upfront payment
- More than $1B in total potential milestones
- Mid-single-digit to low double-digit royalties on net sales

UpRi is a First-In-Class Dolaflexin ADC Targeting NaPi2b



Upifitamab Rilsodotin (UpRi)

- NaPi2b is broadly expressed in ovarian cancer with limited expression in healthy tissues
- NaPi2b is a stable lineage marker (not an oncogene) that transports phosphate into the cell
- Initial clinical validation of target by Genentech MMAE ADC in era before introduction of bevacizumab and PARP
  - Genentech ADC not developable with platinum due to overlapping severe neutropenia and neuropathy

Expansion Cohort Data Support Potential of UpRi to Become a Foundational Medicine in Ovarian Cancer

UpRi Profile*

Meaningful and Durable Activity in Heavily-Pretreated Patients

34% ORR with CRs in NaPi2b High Ovarian Cancer and DOR 5 months

Consistent Tolerability Profile

Without Severe Neutropenia, Ocular Toxicity, or Peripheral Neuropathy

Robust, Predictive, and Reproducible Diagnostic

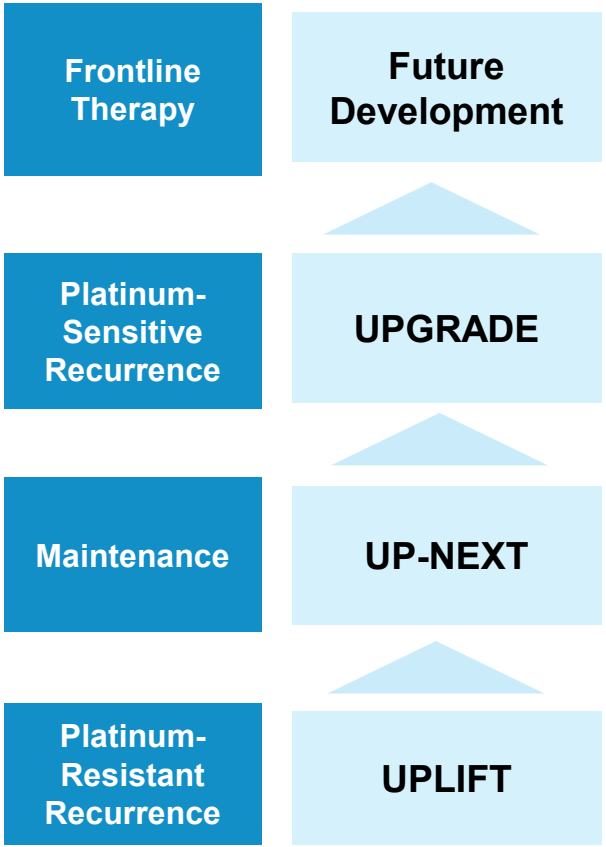
Tumor Proportion Score ≥ 75 Present in Two-Thirds of Patients Enriches for Improved Outcomes

36 mg/m^2 Up to a Total Dose of ~80 mg

Dose Optimized for UPLIFT

*Data as of June 10, 2021. Complete data disclosure from September 10, 2021 available here: https://ir.mersana.com/events-and-presentations

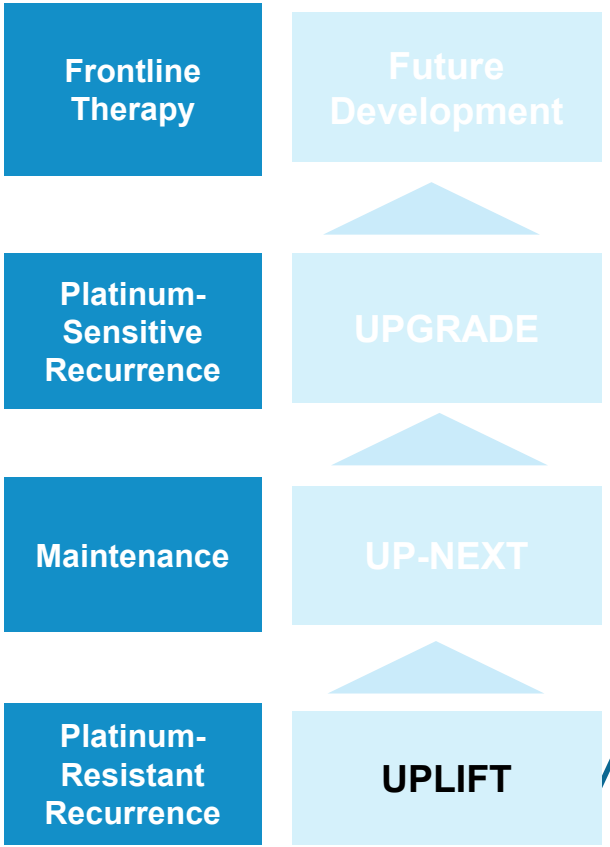
Comprehensive Development Plan to Build UpRi as a Foundational Medicine in Ovarian Cancer



- 22,000 newly diagnosed ovarian cancer patients annually[1]
- Plus, fallopian tube and primary peritoneal cancers treated in the same algorithm
- 80% relapse following frontline therapy
- Limited therapeutic options beyond platinum-based regimens
- PARP inhibitor efficacy limited outside of BRCAmut/HRD+ setting
- NaPi2b broadly expressed in ovarian cancer, with two-thirds of patients having high expression

[1]Source: U.S. incidence from SEER

UPLIFT: Designed to Establish UpRi as the Standard of Care in Platinum-Resistant Ovarian Cancer (PROC)



- 14,000 deaths per year in the U.S. primarily at the platinum-resistant stage of the disease
- Standard of care is single agent chemotherapy with limited efficacy and significant toxicity
- ORR 12%, DOR <4 mos, PFS ~3-4 mos, OS <12 mos
- UpRi has the potential to deliver meaningful clinical benefit
- Potential registration of UpRi in PROC represents a substantial market opportunity

Moore, ESMO Annals of Oncology 2021; 32:757-765; Corail ESMO 2018; Javelin 200 SGO 2019. Data based on conference presentation.
Banerjee et al, Annals of Oncology 29: 917–923, 2018

UPLIFT Design: Single-Arm Registrational Trial in Platinum-Resistant Ovarian Cancer

Patient Population:

Enrolling Regardless of NaPi2b Expression

Inclusion Criteria:
Platinum-Resistant Ovarian Cancer
1 – 4 Prior Lines
Regardless of Baseline Peripheral Neuropathy

Exclusion Criteria:
1 – 2 Prior Lines Bevacizumab-naïve
Primary Platinum-Refractory Disease

Primary Endpoint:
Confirmed ORR in high NaPi2b (N = ~100)

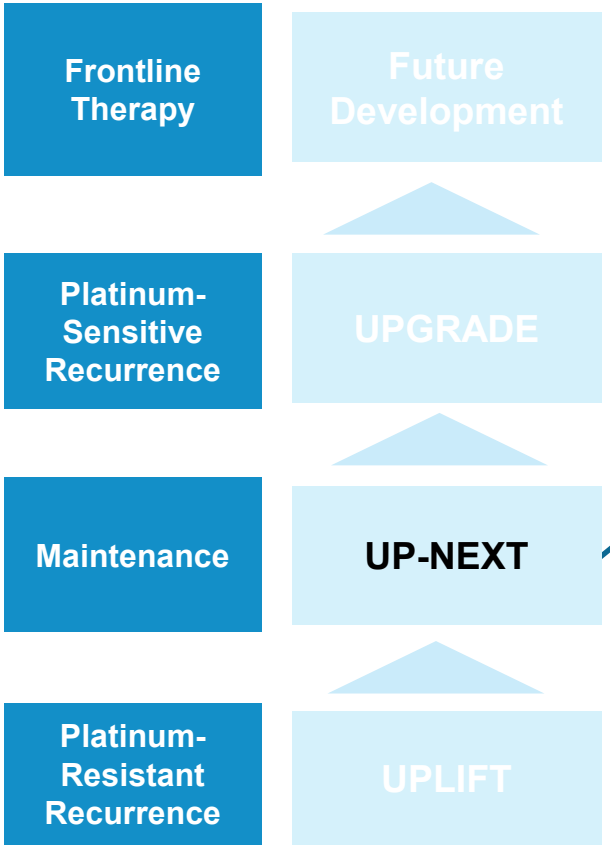
Key Secondary Endpoint:
Confirmed ORR in overall population
(N = up to ~180 including 100 high NaPi2b)

Other Secondary Endpoints:
- Duration of Response
- Safety

Enrollment Criteria Provide the Potential for UpRi to Benefit a Broad Group of Platinum-Resistant Ovarian Cancer Patients

UPLIFT Trial: NCT03319628 (GOG-3048/ENGOT-ov67)

UP-NEXT: Designed to Establish UpRi as the Preferred Agent for Maintenance Therapy in Recurrent Platinum-Sensitive OC



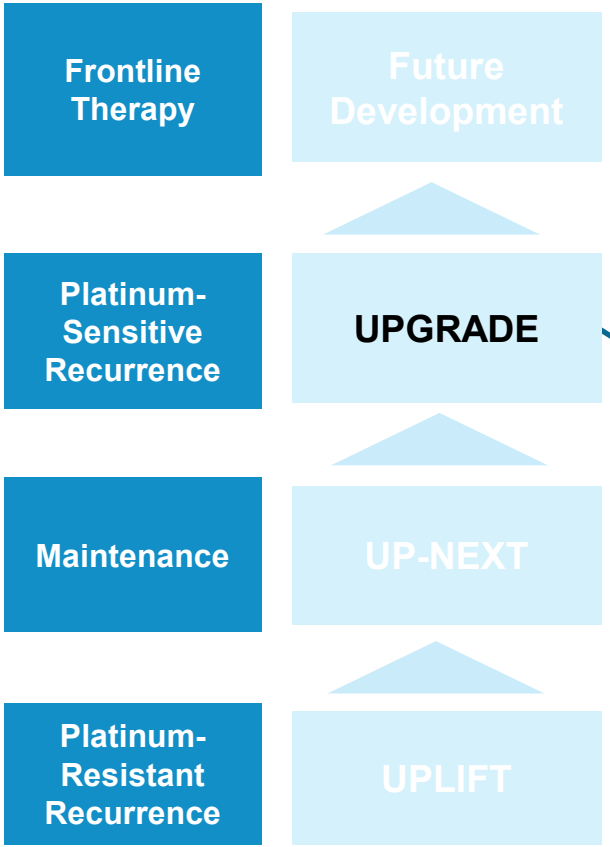
- UP-NEXT targets 3 patient groups with high unmet need post chemotherapy
  - **Responders who have been previously treated with PARPi and/or bevacizumab and have no standard of care**
  - **Responders who are not offered maintenance because benefit-risk of current options is not favorable**
  - **Patients with stable disease who have no approved treatment options**
- UP-NEXT has the potential to substantially increase the market opportunity for UpRi, expanding the patient pool and increasing the duration of treatment

UP-NEXT Design: Phase 3 Study of UpRi Monotherapy Maintenance vs Placebo in Recurrent Platinum-Sensitive OC

Informed by FDA Feedback and CHMP Scientific Advice
Plan to Initiate in Q2 2022

UP-NEXT Trial: GOG-3049

UPGRADE (Phase 1/2): Combination of UpRi with Platinum has Potential to Establish a New Standard of Care



- Combination of platinum and taxane is the standard of care in platinum-sensitive disease; used in multiple lines until disease progression
  - Limited to 6 cycles due to toxicities (e.g., alopecia, neuropathy, neutropenia)
- Replacing taxane with UpRi, a targeted and generally well-tolerated agent, could potentially
  - Minimize toxicities
  - Allow for continued treatment with UpRi after completing platinum
  - Improve clinical benefit
- PARP inhibitors, and other agents, have not been able to combine with platinum due to overlapping toxicities

UPGRADE Design: Phase 1/2 UpRi Combination in Platinum-Sensitive Ovarian Cancer

Key Enrollment Criteria:
- Recurrent, platinum-sensitive high-grade serous carcinoma, 1-2 prior platinum-based regimes
- Tissue for retrospective assessment of NaPi2b expression
- RECIST measurable disease
- ECOG PS = 0-1

Dose Escalation and Expansion

UpRi Q4W until PD

+

Carboplatin AUC 5 Q4W x 6

UpRi Has the Potential for Longer Treatment Durations Based on Lower Toxicities Observed to Date

UPGRADE Trial: NCT04907968

Building UpRi as a Foundational Medicine in Ovarian Cancer

Frontline Therapy	Future Development
Platinum-Sensitive Recurrence	UPGRADE
Maintenance	UP-NEXT
Platinum-Resistant Recurrence	UPLIFT

Comprehensive Development Plan Addressing the Needs of Ovarian Cancer Patients Waiting for New Options

Dolasynthen Platform: Next DolaLock Pipeline Candidates

ADC Program	Target	Indication	Platform	Discovery	Preclinical	P1 Dose Escalation	P1 Proof of Concept	P2/Pivotal	P3
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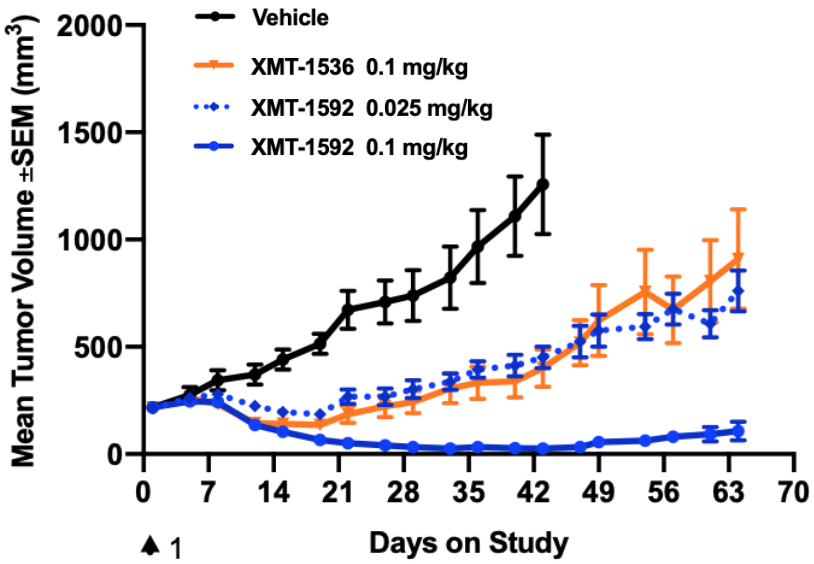
XMT-1592: Dolasynthen ADC Targeting NaPi2b

Phase 1 Dose Exploration Ongoing

Molecular Attribute	UpRi (XMT-1536)	XMT-1592
Platform (scaffold)	Dolaflexin	Dolasynthen
Bioconjugation method	Stochastic	Site-Specific
DAR average	10-12	6
DAR distribution	Controlled Heterogeneity	Homogeneous

4X Greater Activity in Preclinical Lung PDX

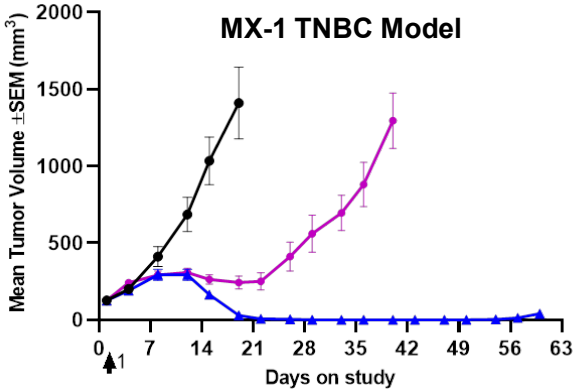


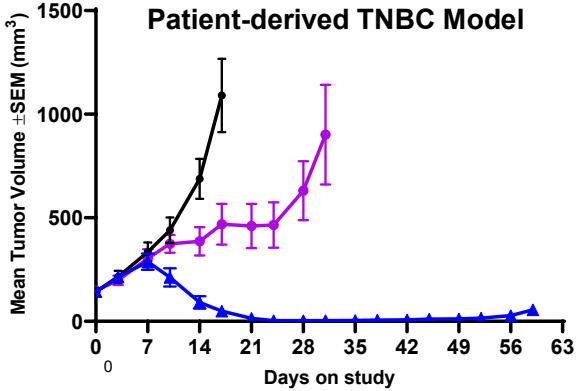
At least comparable tolerability at equal payload doses in NHP studies

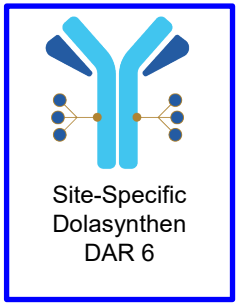
XMT-1660: A First-in-Class Dolasynthen ADC Targeting B7-H4

B7-H4 is a Target Well Suited for a DolaLock ADC

- Selectively expressed on tumors in major indications with high unmet medical need
  - Breast Cancer, Endometrial, Ovarian
- Site specific DAR 6 selected based on optimal therapeutic index in non-clinical studies
- Leveraging DolaLock payload with controlled bystander effect
  - Clinical experience to date has demonstrated no association with severe neutropenia, peripheral neuropathy or ocular toxicities
  - Not a P-gp substrate







Lines indicate approximately equivalent dose by payload; Non-binding control ADCs and unconjugated B7-H4 mAb were all inactive; Data omitted for clarity

Immunosynthen Platform: A Pipeline of First-in-Class Targeted Innate Immune Stimulating STING-Agonist ADCs

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STING is a Fundamental Pathway Leading to Innate Immune Activation in Both Tumor Cells and Tumor-Resident Immune Cells – a "One-Two Punch"

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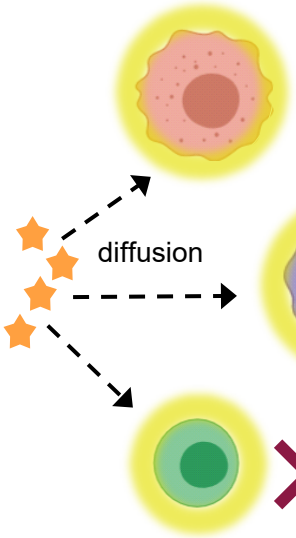
Localization of STING Activation Via a Targeted ADC is Designed to Increase Potency and Decrease Systemic Toxicity

Free STING Agonist

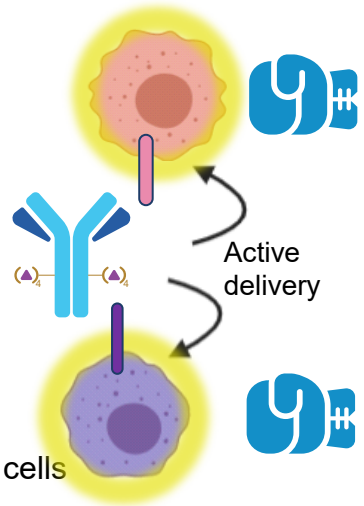


- ✗ Passive, indiscriminate diffusion
- ✗ Less efficient delivery to desired cell types
- ✗ Proapoptotic activation of T cells (Type I IFN independent)

Gulen et al. *Nature Comm.* 2017
Wu et al. *Immunity* 2020

Immunosynthen ADC

- ✓ Antigen-dependent, active delivery into tumor cells
- ✓ FcγR-mediated, active delivery into tumor-resident myeloid and dendritic cells
- ✓ No delivery to T cells

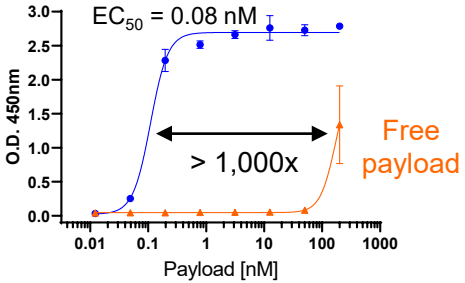


First Immunosynthen Candidate: XMT-2056 Targeting HER2

Preclinical Data Show Single Agent XMT-2056 is Highly Active with Wide Therapeutic Index

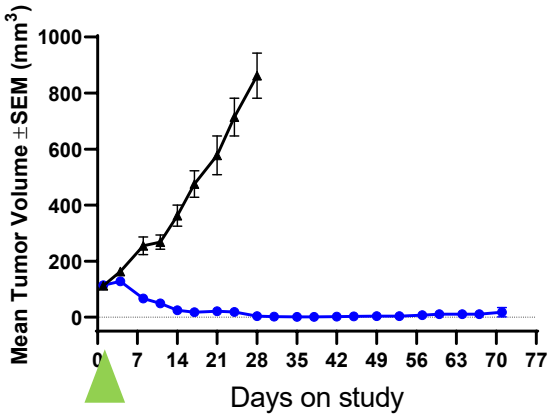
Highly Potent, Antibody-Dependent Immune Cell Activation in Vitro

Greater than 1000-fold increase in potency of ADC vs. free payload



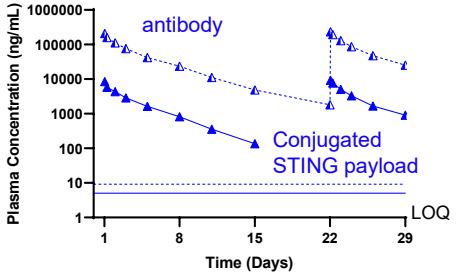
Robust In Vivo Efficacy in Multiple Human Tumor Models

0.96 mg/kg antibody / 0.033 mg/kg STING
Single dose IV

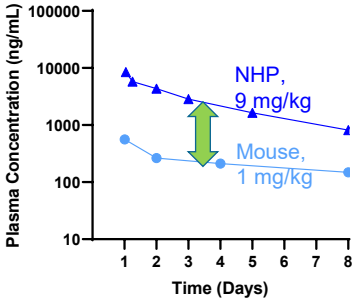


Black line = vehicle, Blue line = XMT-2056

Excellent PK and Tolerability in NHPs After Multiple Doses



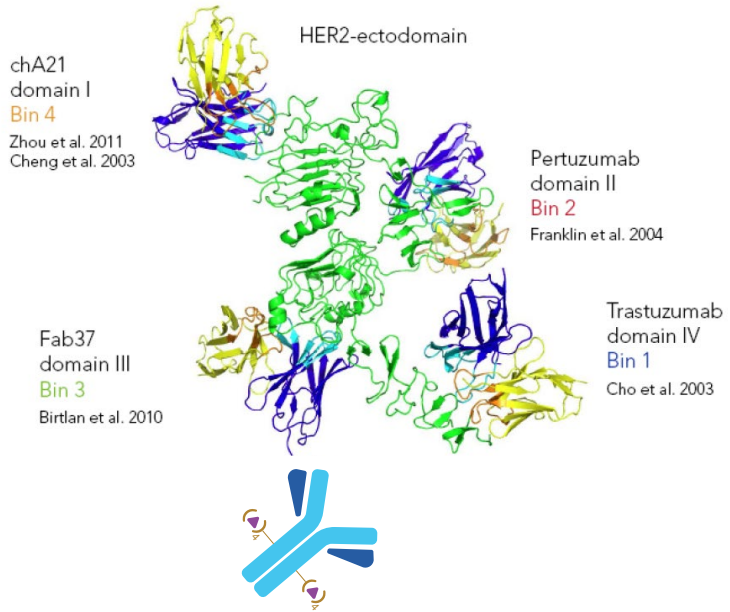
Wide therapeutic index based on exposure

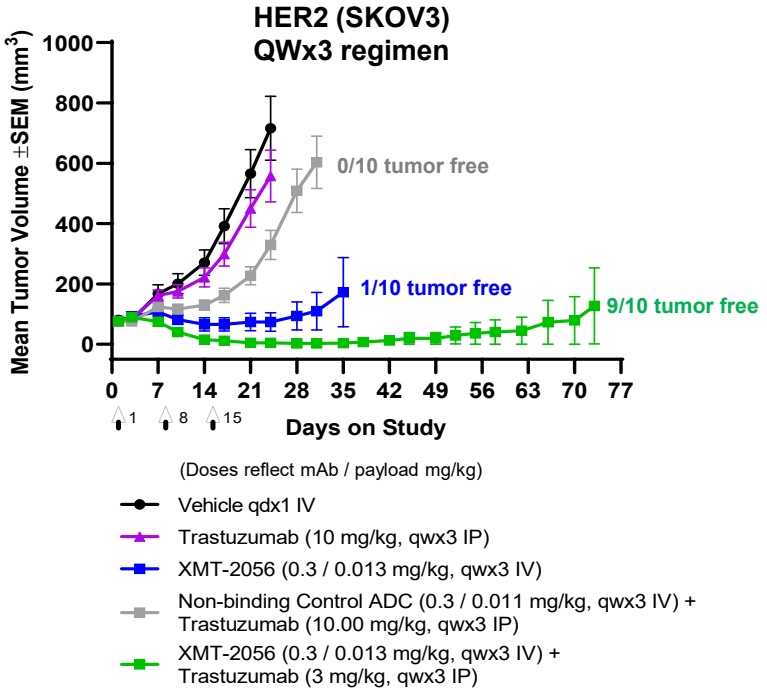


- No clinical signs, no mortality in repeat dose studies
- No adverse changes in clinical pathology
- No adverse findings in histopathology

XMT-2056 Targets a Novel HER2 Epitope Distinct from Trastuzumab and Pertuzumab Allowing for Combinability

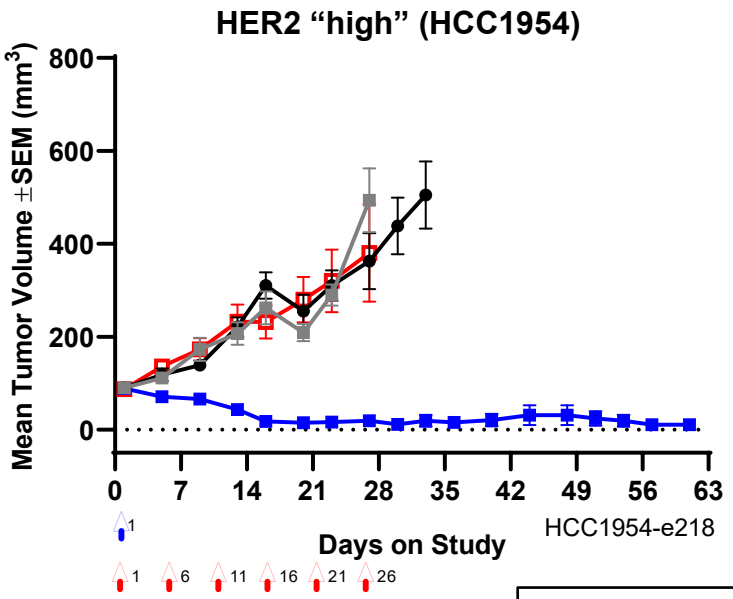
XMT-2056 Binds to a Novel Epitope

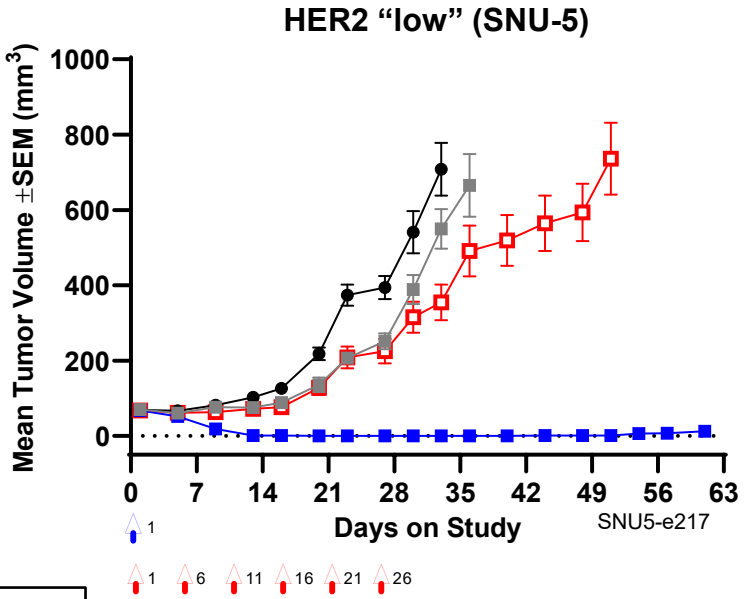




XMT-2056 Offers a Potentially Differentiated and Complementary Approach to the Treatment of HER2-Expressing Tumors

XMT-2056 Efficacy is Superior to Trastuzumab-TLR7/8 ADC in Both HER2 High and Low Preclinical Models





- Vehicle ddx1 IV
- Non-binding Control ADC (3 / 0.112 mg/kg, qdx1 IV)
- XMT-2056 (3 / 0.128 mg/kg, qdx1 IV)
- Trastuzumab TLR 7/8 ISAC (5 / 0.033 mg/kg, q5dx6 IP)

(Doses reflect mAb / payload mg/kg)

#TLR7/8 ISAC described in Ackerman *et al*, (2020) *Nature Cancer*

2022 Goals and Anticipated Milestones

Upifitamab Rilsodotin (UpRi)	• Q2 2022: Initiate UP-NEXT Phase 3 trial of UpRi monotherapy maintenance in recurrent platinum-sensitive ovarian cancer • Q3 2022: Complete enrollment in UPLIFT single-arm registrational trial in platinum-resistant ovarian cancer • 2H 2022: Report interim data from UPGRADE combination dose escalation umbrella trial in platinum-sensitive ovarian cancer
XMT-1592	• 2H 2022: Complete dose exploration and provide update on next steps
XMT-1660	• Mid-2022: Initiate Phase 1 dose escalation trial
XMT-2056	• Mid-2022: Initiate Phase 1 dose escalation trial
Early Pipeline	• 1H 2022: Disclose 2 new development candidates
Corporate	✓ Janssen Collaboration • Proactively evaluate potential for collaborations that maximize value

2025: ADC Leadership from Discovery to Commercial and Opportunity to Benefit Patients and Shareholders

Mersana Today	Mersana Vision for 2025
1 **Build UpRi**	**PATIENTS** Leading patient share in Platinum-Resistant OC and launching into Platinum-Sensitive OC
2 **Build Out Pipeline**	**PIPELINE** 5 first-in-class molecules advanced in the clinic
3 **Build Innovation**	**PRODUCT ENGINE** New molecules advanced and **c**ontinued leadership at the forefront of ADC science
4 **Build Mersana**	**PARTNERSHIPS & PEOPLE** Recognized partner and employer of choice in ADCs

Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting