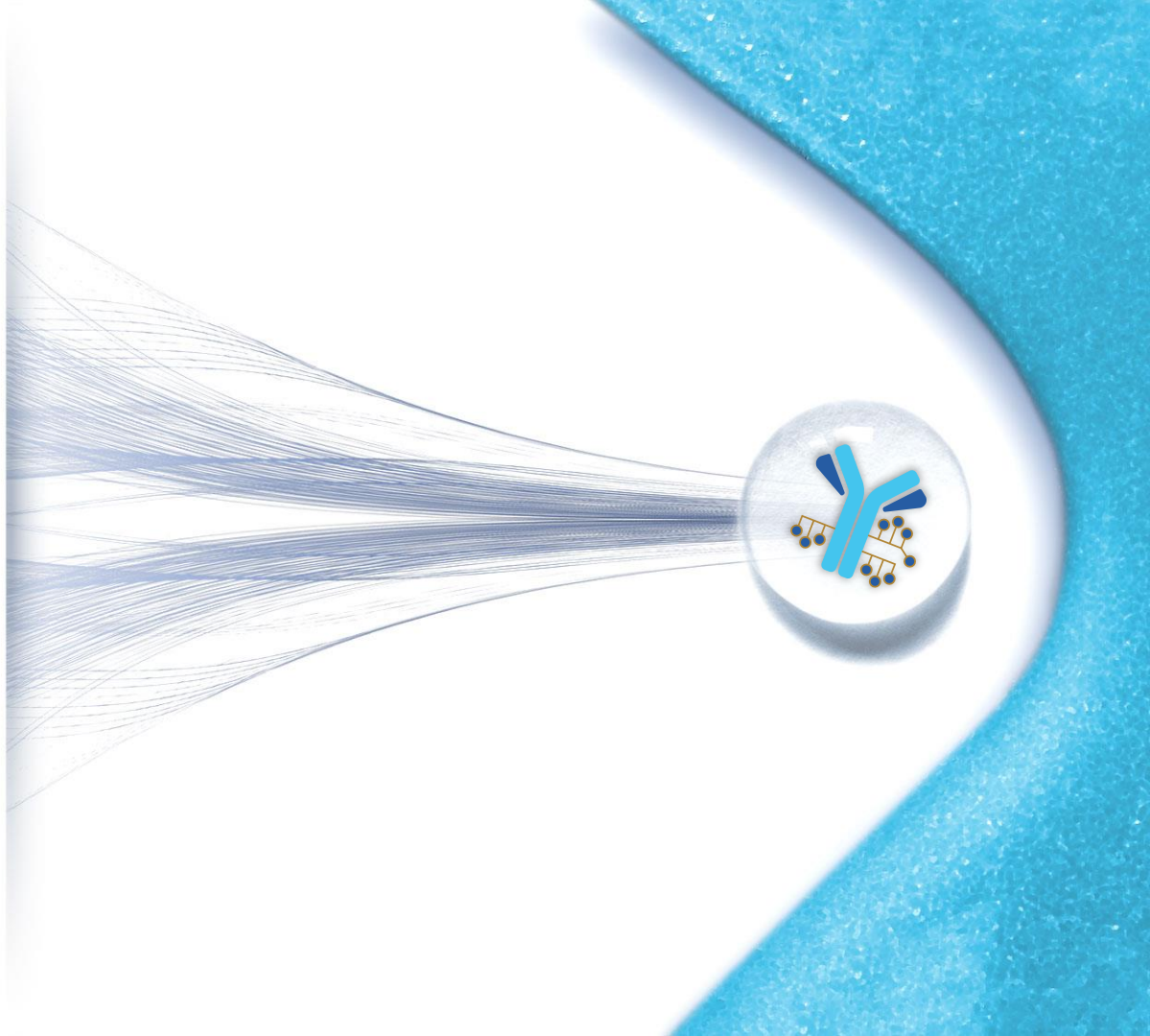
Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting

Stifel 2021 Virtual Healthcare Conference
November 17, 2021



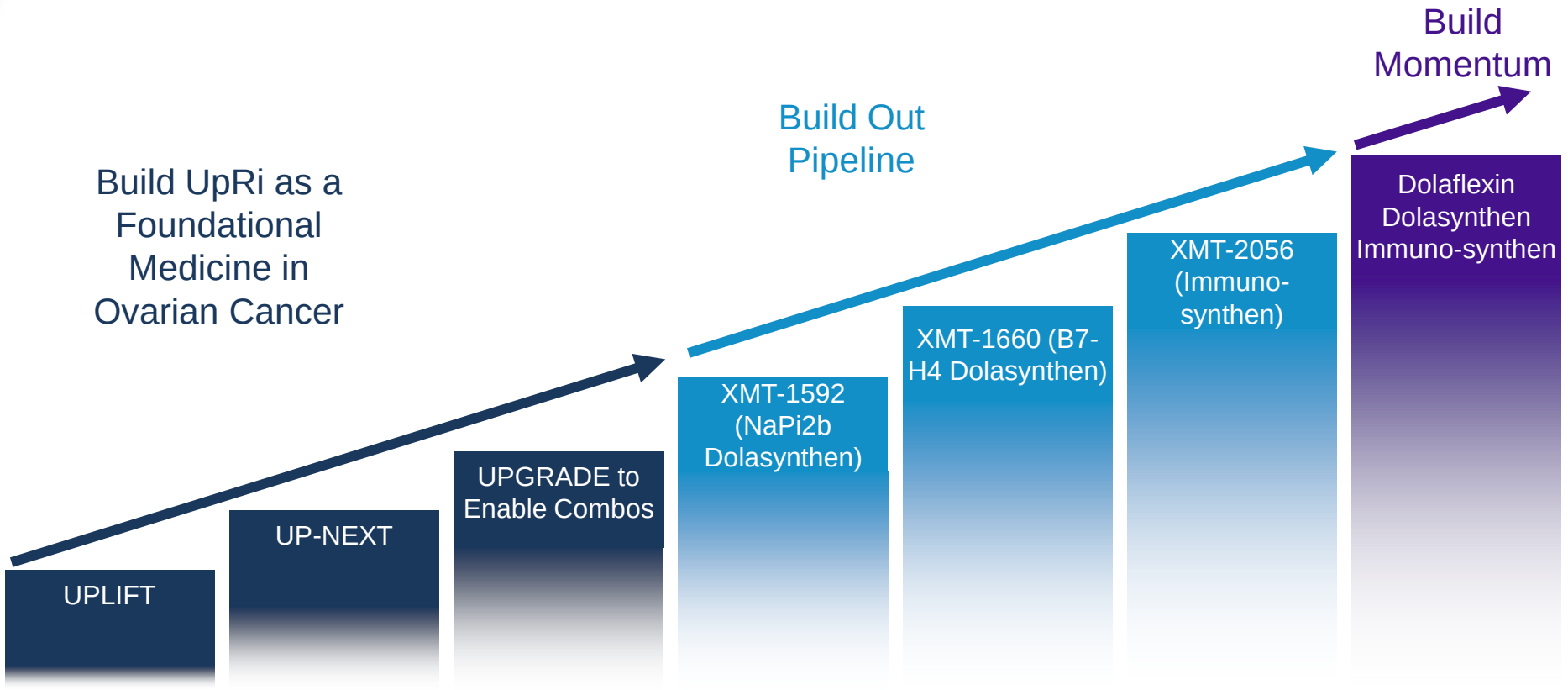
Legal Disclaimer

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 studies, including the Company’s UP-NEXT trial, and data from its ongoing clinical study, the ability of the single-arm UPLIFT cohort to enable registration, and expectations regarding future clinical trial results based on data achieved to date.

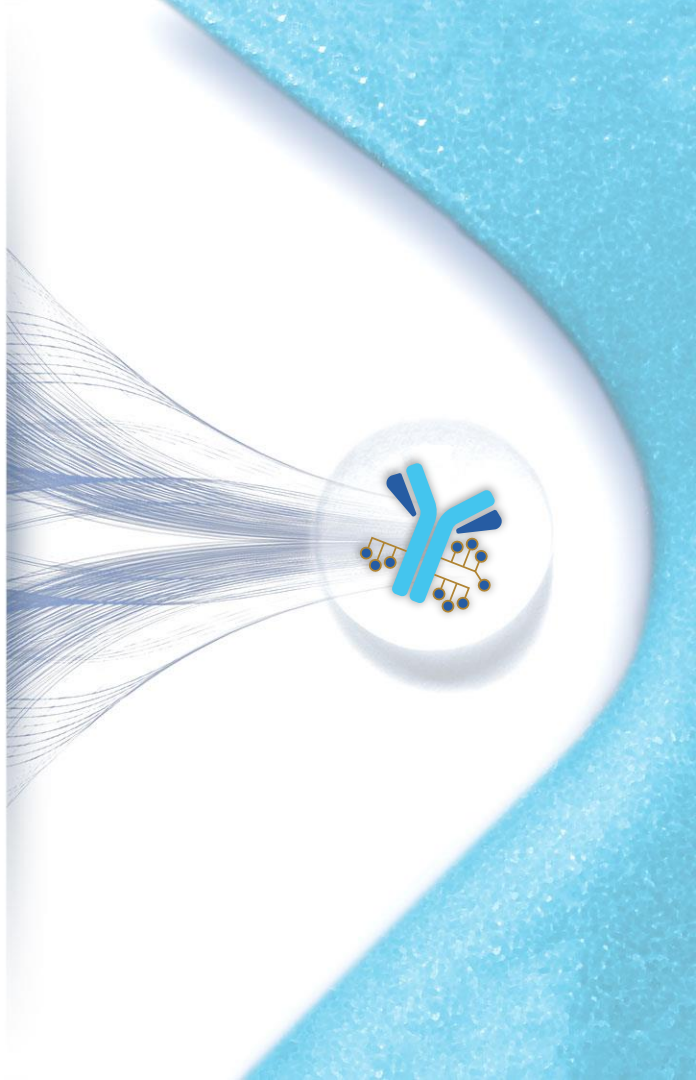
Forward-looking statements generally can be identified by terms such as “aims,” “anticipates,” “believes,” “contemplates,” “continues,” “could,” “estimates,” “expects,” “goal,” “hypothesis,” “intends,” “may,” “on track,” “opportunity,” “plans,” “poised for,” “possible,” “potential,” “predicts,” “projects,” “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 studies 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 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 listed 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, including the Delta Variant, 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's Mission: Discover and Develop Life-Changing Antibody Drug Conjugates for Patients Fighting Cancer



UpRi: First-in-Class Dolaflexin ADC Targeting NaPi2b



Consistent UpRi Profile in Expansion Cohort (N=97) Supports the Potential of UpRi

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

No Severe Neutropenia, Ocular Toxicity, or Peripheral Neuropathy

Robust, Predictive, and Reproducible Diagnostic

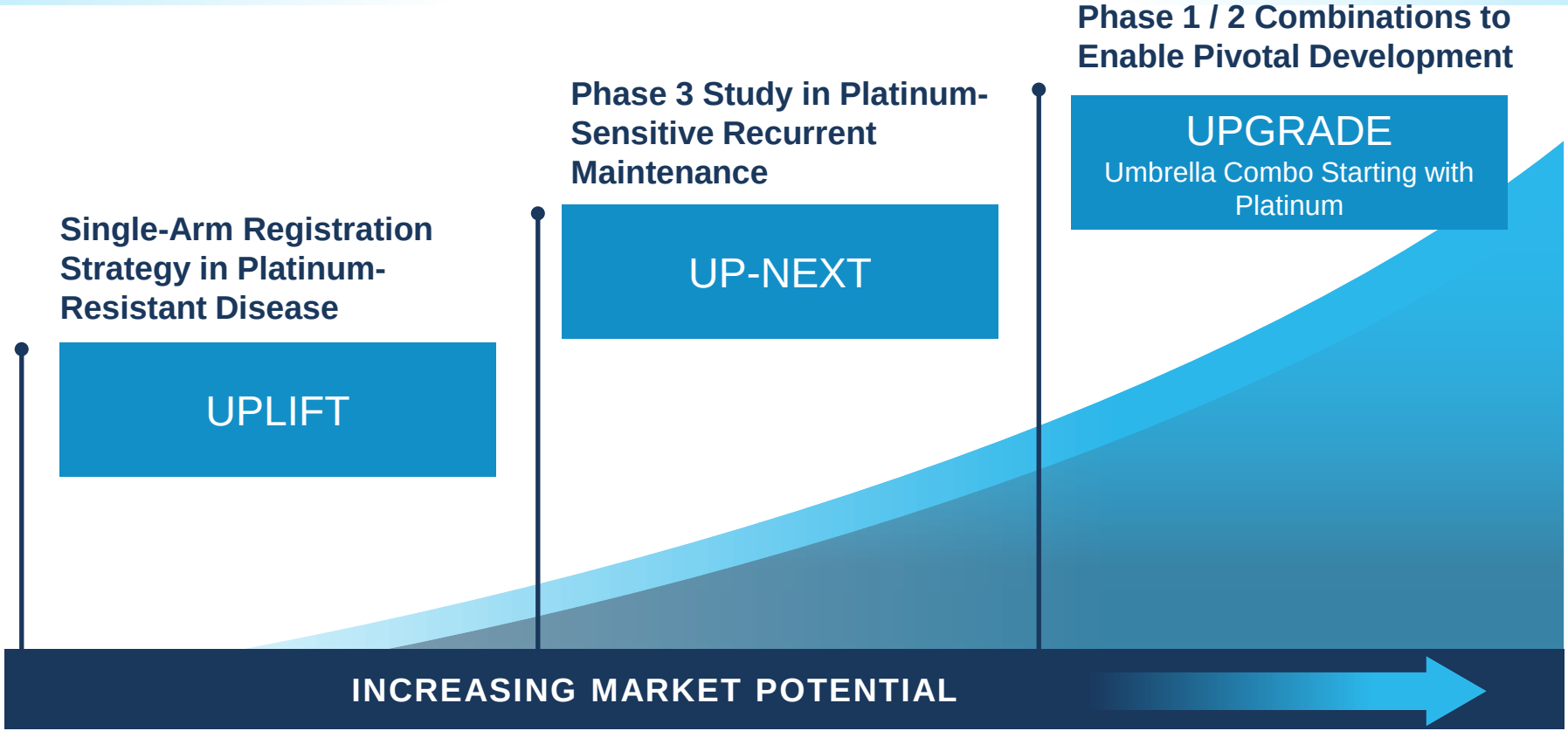
Tumor Proportion Score ≥ 75 Present in Two-Thirds of Patients Enriches for Improved Outcomes

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

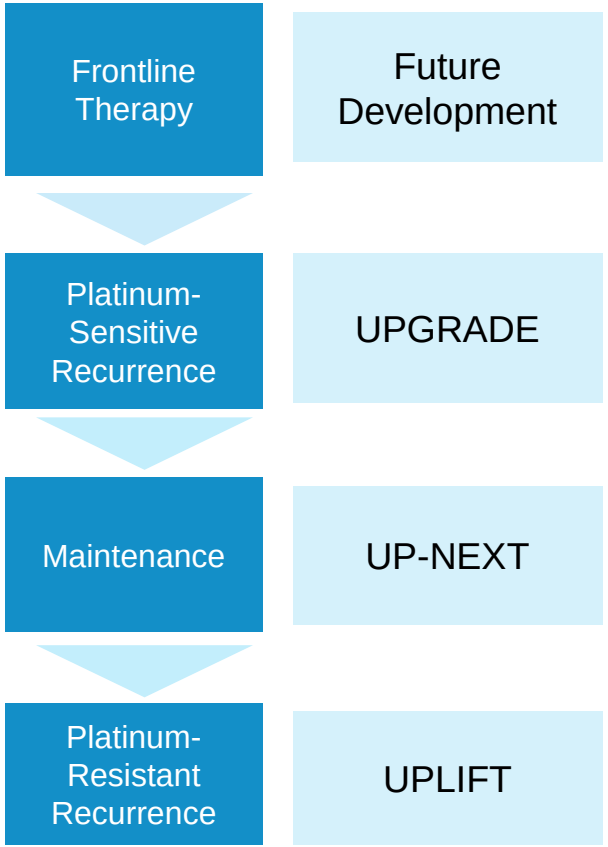
Potential to Further Improve Safety while Maintaining Efficacy

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

An Opportunity to Deliver a Potentially Foundational Medicine for Ovarian Cancer



Opportunities in Platinum-Sensitive, Platinum-Resistant, Monotherapy, Combination, Treatment, and Maintenance



- 22,000 newly diagnosed ovarian cancer patients annually
- Plus, fallopian tube and primary peritoneal cancers treated in the same algorithm
- With a median survival 5 years from diagnosis
- 80% relapse following frontline therapy
- And 14,000 deaths per year

Source: SEER

UPLIFT: Single-Arm Registration Strategy 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 Bev-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

Current standard of care is single agent chemotherapy with an ORR of no more than 12%, mDoR of less than 4 months, and mOS of ~1 year

Two Shots on Goal: NaPi2b High and Overall Population

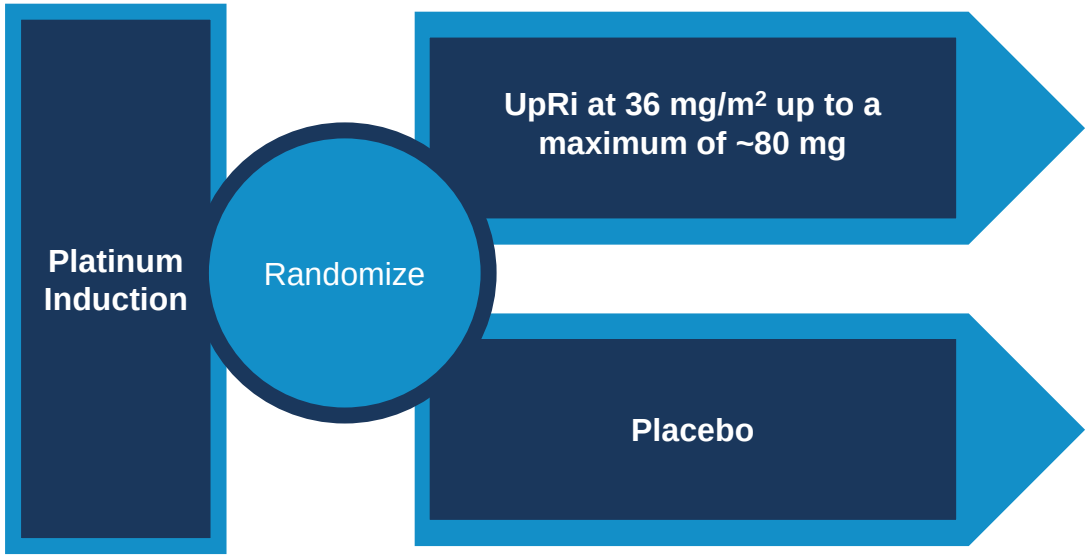
Source: Moore, ESMO Annals of Oncology 2021; 32:757-765; Corail ESMO 2018; Javelin 200 SGO 2019. Data based on conference presentation.
Banerjee et al, Annals of Oncology 29: 917–923, 2018

Despite Bevacizumab and PARPi Options, Significant Unmet Need Remains for New Maintenance Agents

		UpRi Differentiation
Bevacizumab and PARP Moving into Earlier Lines and Combinations	• A population previously treated with bevacizumab and PARPi maintenance sequentially or in combination is emerging, with no standard of care upon relapse	Activity against Bev and PARPi Pre-Treated Disease
Watch & Wait Remains a Standard of Care for Some Patients	• Patients poorly served by current maintenance agents need additional options. Watch & wait remains an option in guidelines – 80% of patients without BRCA mutation (e.g., HRP, HRD) – Co-morbidities (e.g., hypertension, risk for bowel obstruction) – Tolerability (e.g., thrombocytopenia)	Optimized Dose with Differentiated Tolerability Profile and Biomarker Enrichment
PARPi Maintenance not Indicated for Stable Disease following Platinum	• PARPi activity is predicted by platinum responsiveness, patients that achieve stable disease to platinum were not included in PARPi maintenance studies • Emerging evidence of poor outcomes with platinum following PARPi may increase proportion achieving SD	Activity, including CRs, in Heavily Pre-Treated Patients

Source: Product labels; KOL interviews; NCCN Guidelines Aug 2021 OV-8; 813 MO ESMO 2020; Abstract 824P ESMO 2020; Abstract 828P ESMO 2020

UP-NEXT/GOG-3049: Phase 3 Study of UpRi Monotherapy Maintenance vs Placebo in Platinum-Sensitive Recurrent OC



Key Enrollment Criteria:

- Platinum-sensitive recurrence, following platinum induction
- NaPi2b High biomarker selection by TPS≥75
- 1 – 3 prior platinum-based regimens
- Prior PARPi therapy allowed, but only required for BRCAmut
- SD in addition to CR/PR as best response following platinum induction

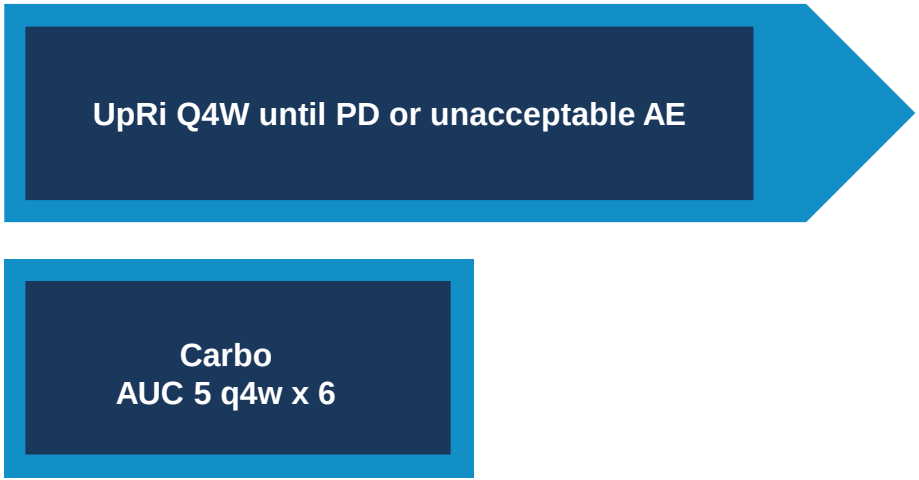
Primary Endpoint:

- PFS

Informed by FDA Feedback, Final Design Pending CHMP Scientific Advice
Plans to Initiate in 2022

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

Dose Escalation and Expansion



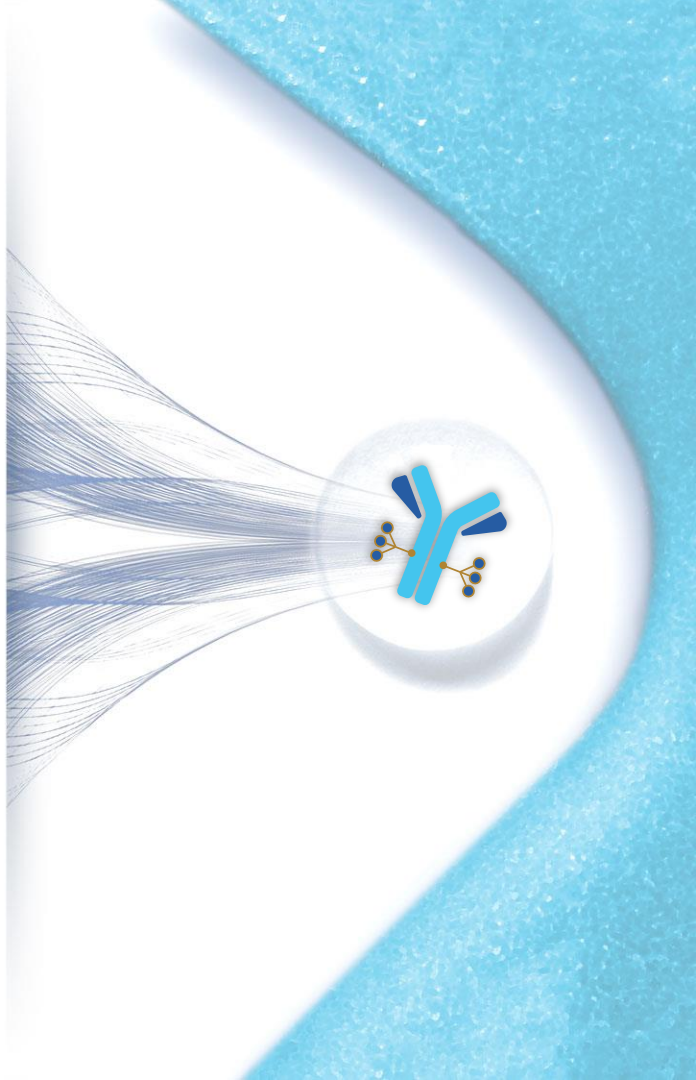
Key Enrollment Criteria:

- 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

Current standard of care is fixed duration (usually 6 cycles) of carbo and paclitaxel due to cumulative toxicity

UpRi Has the Potential for Longer Treatment Durations Due to Lower Toxicity

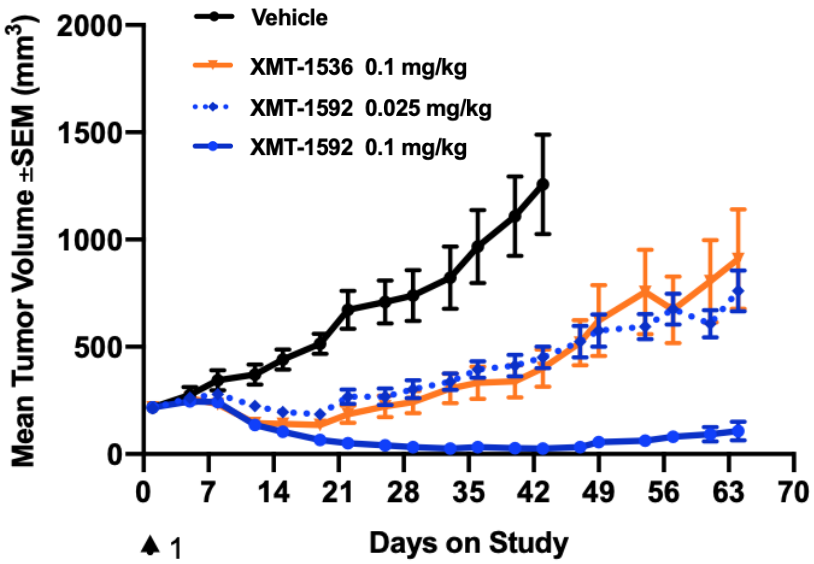
Dolasynthen Pipeline



Phase 1 Clinical Evaluation of XMT-1592 Preclinical Differentiation Proceeding as Planned

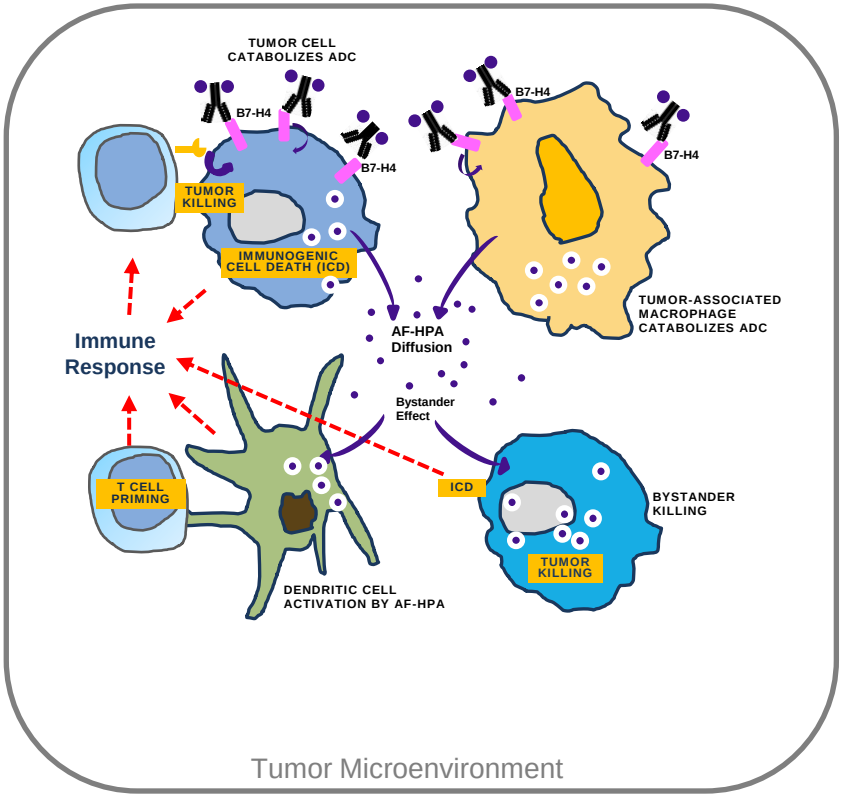
Molecular Attribute	XMT-1536	XMT-1592
Platform (scaffold)	Dolaflexin	Dolasynthen
Bioconjugation method	Stochastic	Site-Specific
DAR average	10-12	6
DAR distribution	Controlled Heterogeneity	Homogeneous

4X Greater Activity in Preclinical Lung PDX



At least comparable tolerability at equal payload doses in NHP studies

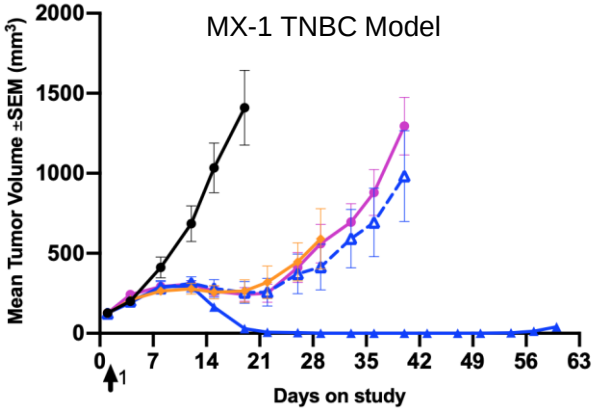
XMT1660: B7-H4 Dolasynthen ADC
B7-H4 Expression Well-Suited for a DolaLock ADC

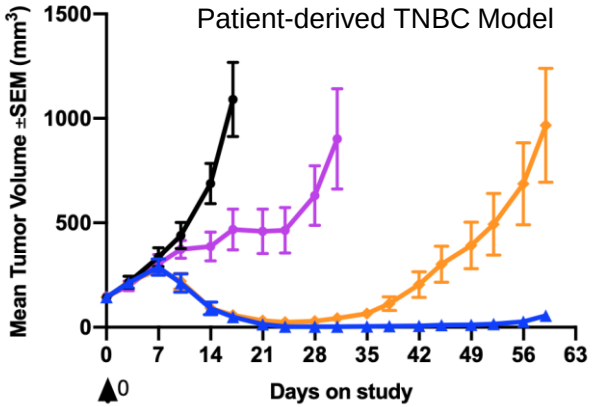


“The Perfect Storm”

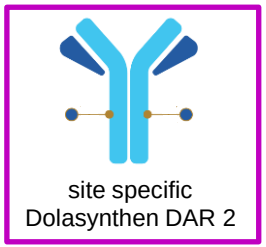
- B7-H4 is selectively expressed on tumor cells and also expressed in tumor-associated macrophages
  - Potential for both targeted cell types to contribute to the effect
- Expressed in multiple indications with high unmet medical need
  - Breast, Lung Squamous, other
  - No co-expression of PD-L1 and B7-H4
  - Limited expression in normal tissues
- XMT-1660 leveraged DAR ranging capabilities to select candidate based on greatest potential therapeutic index demonstrated in preclinical studies

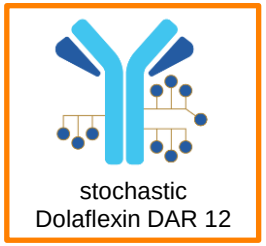
XMT-1660 Selected Candidate Based on Direct Comparison Across Multiple In Vivo Models, including PDX Models



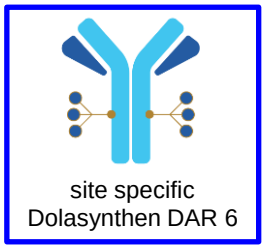


Solid lines indicate equivalent dose by payload; dashed line = 0.5x dose
Non-binding control ADCs and unconjugated B7-H4 mAb were all inactive; data omitted for clarity

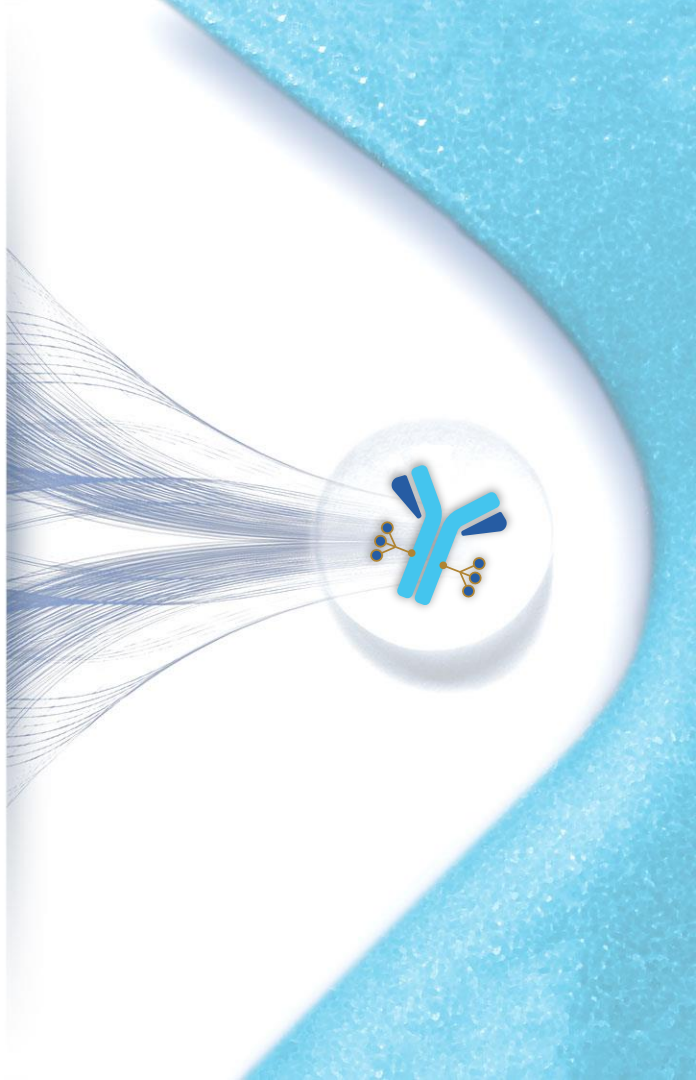




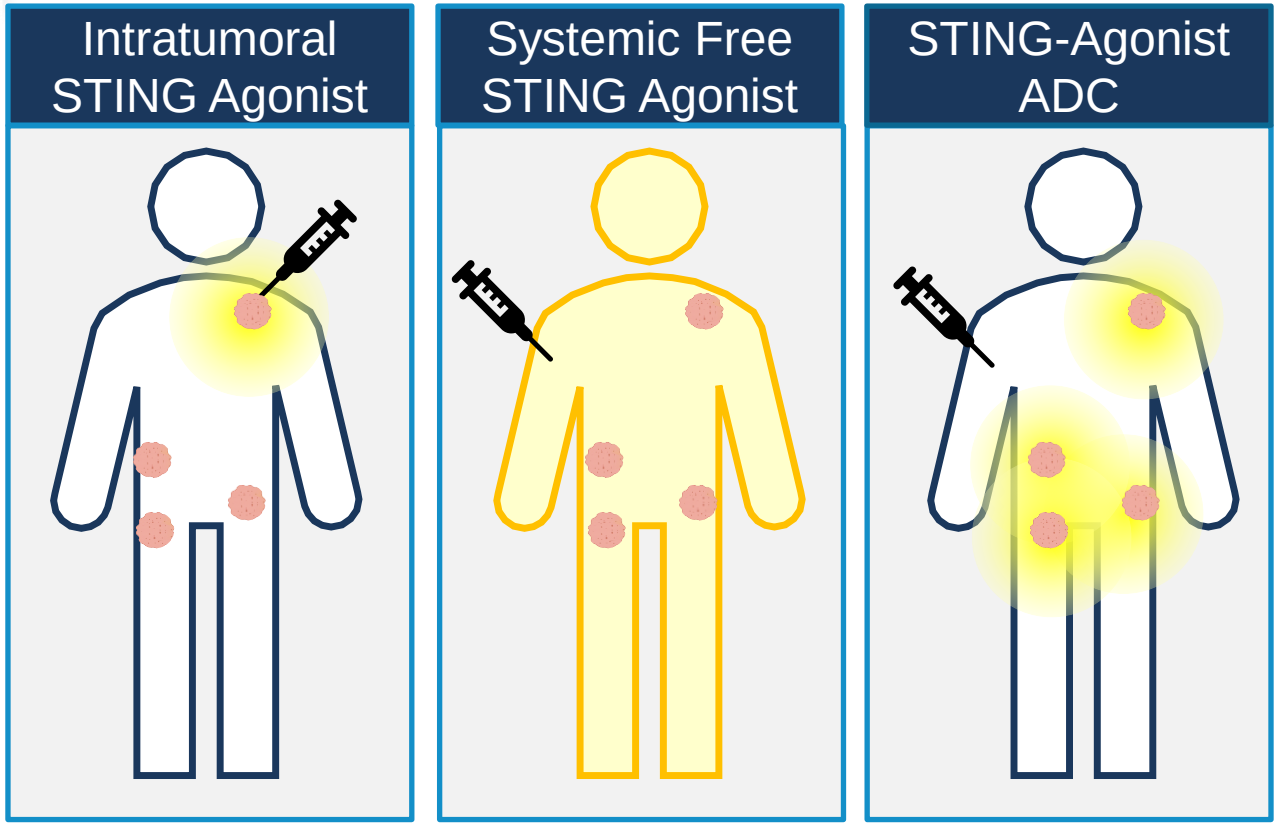
XMT-1660



XMT-2056: First-In-Class HER2-Targeted Immunosynthen STING-agonist ADC



Hypothesis: An ADC Approach Could Address Administration Issues, Systemic Tolerability, and Activity



- Systemic administration with targeted delivery to the tumor
- Improved anti-tumor activity compared to free agonist
- Improved tolerability compared to free agonist

Systemic immune activation

Tumor, no immune activation

Tumor with STING-Mediated Innate Immune Activation

STING: The One-Two Punch
Presented at SITC 2020

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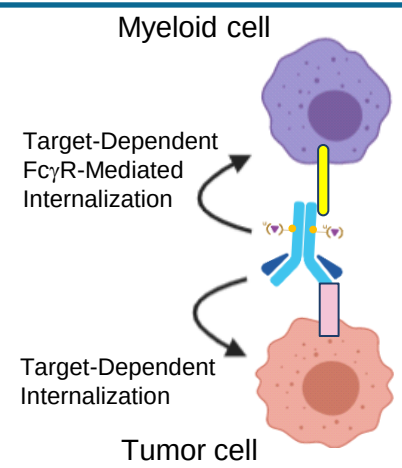
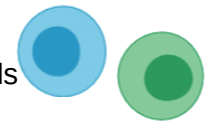
Tumor

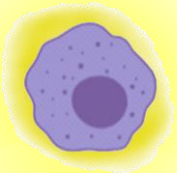


No internalization into undesired immune cells (T, B)

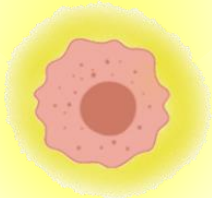


Hit the tumor-resident immune cells

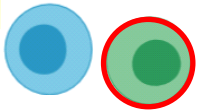
Hit the tumor cells



STING Activated in Myeloid Cell



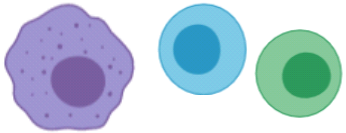
STING Activated in Tumor Cell



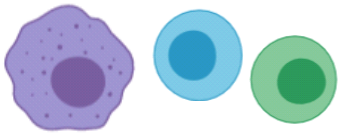
Stimulated T Cells

Periphery

No internalization into immune cells



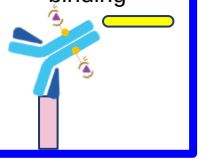
No stimulation of immune cells



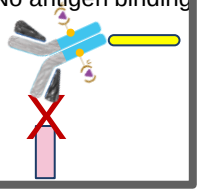
Immunosynthen ADCs Active Against Diverse Tumor Antigens and Tumor-Associated Antigens in Multiple Models After Single, Low IV Dose

Vehicle

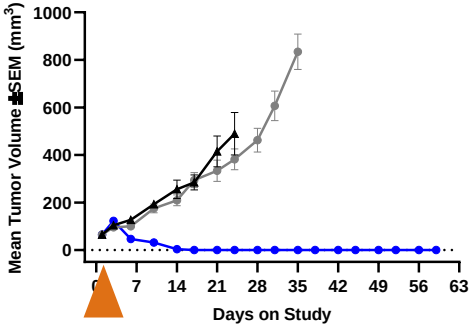
Targeted
Antigen and FcγR binding



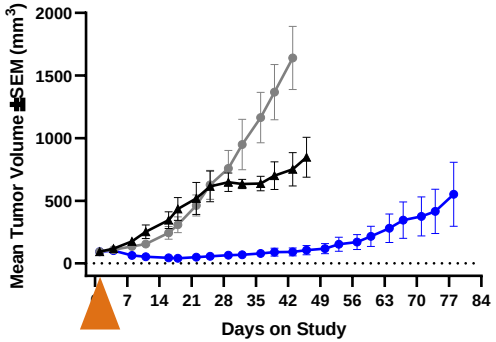
Control ADC
No antigen binding



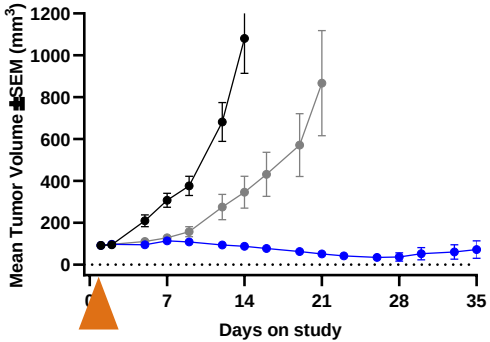
Tumor Antigen A
3.0 mg/kg



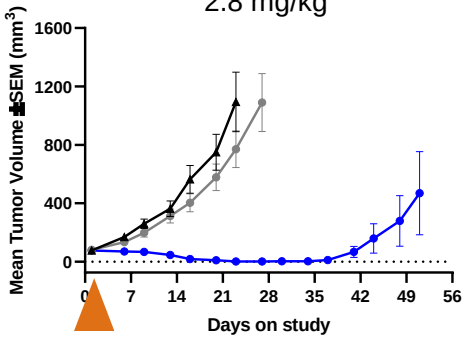
Tumor Antigen B
3.0 mg/kg



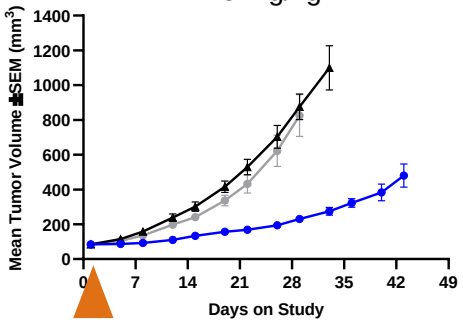
Tumor-Associated Antigen A
2.2 mg/kg



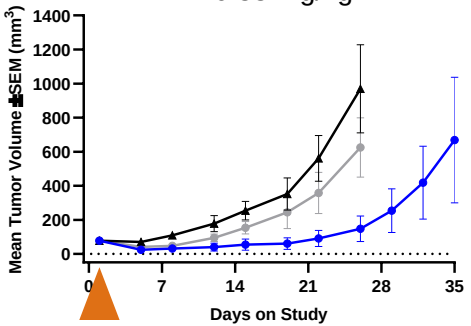
Tumor Antigen C
2.8 mg/kg



Tumor Antigen D
2.5 mg/kg



Tumor-Associated Antigen B
0.88 mg/kg



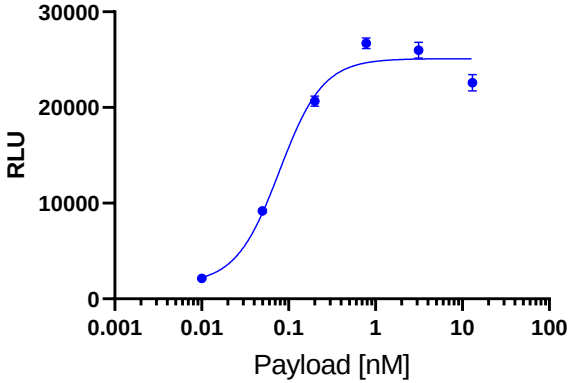
XMT-2056: First Immunosynthen Development Candidate

Summary of Data

Fc-mediated uptake and THP1 cell activation

IRF3 Reporter (THP1)

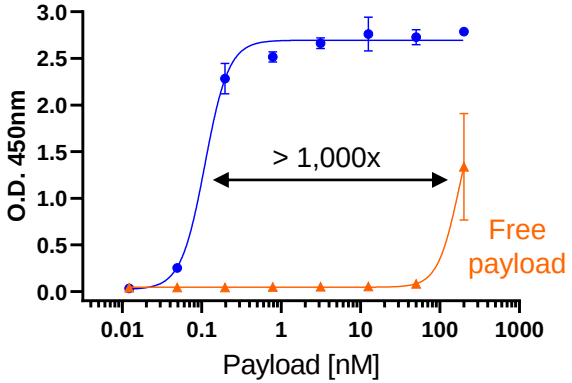
EC_{50} = 0.08 nM



Tumor cells with PBMCs

CXCL10 ELISA

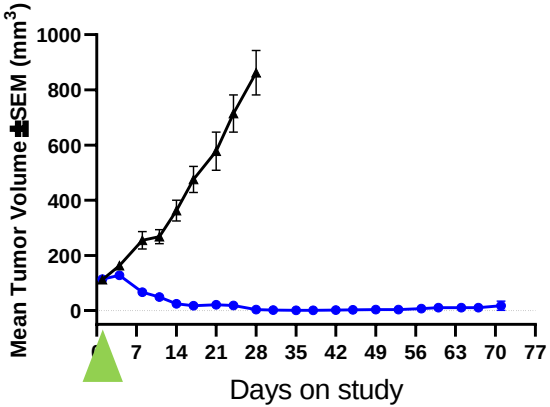
EC_{50} = 0.11 nM



***In vivo* Activity**

0.96 mg/kg antibody / 0.033 mg/kg STING

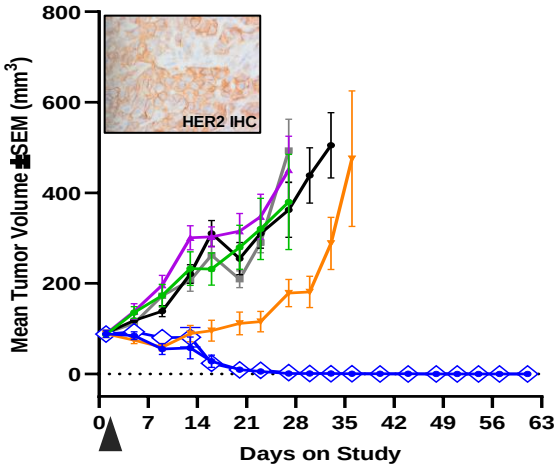
Single dose IV



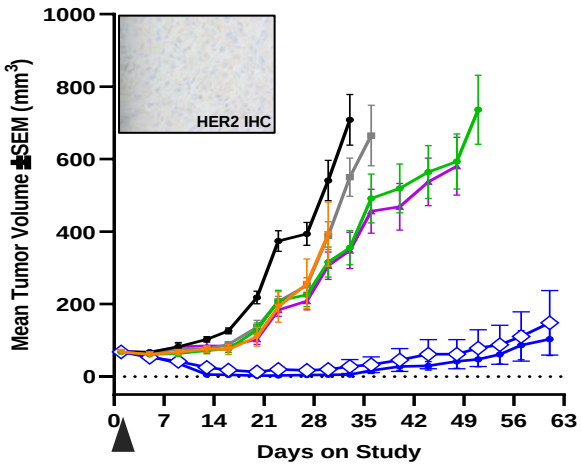
NHP Results	
Single-dose and repeat-dose studies at 9 mg/kg antibody Intravenous administration	• No clinical signs, no mortality • High exposure, high ADC stability in circulation • Transient elevation of 5 cytokines out of 24 tested • No adverse changes in clinical pathology • No adverse findings in histopathology

XMT-2056 Outperforms diABZI IV STING Agonist and Trastuzumab TLR7/8 ISAC in HER2 High and Low Models

HCC1954 (HER2 "high")
SCID Beige
(RNAseq[&]: 11.90)



SNU-5 (HER2 "low")
CB.17 SCID
(~22,000 receptors/cell; RNAseq[&]: 5.30)



Vehicle

diABZI IV STING agonist (1.5 mg/kg; q3dx3, IV)*

Trastuzumab (10 mg/kg; qdx1, IP)

Non-binding Control STING ADC (3 / 0.112 mg/kg; qdx1, IV)

Trastuzumab TLR7/8 ISAC (5 / 0.033 mg/kg; q5dx6, IP)#

XMT-2056

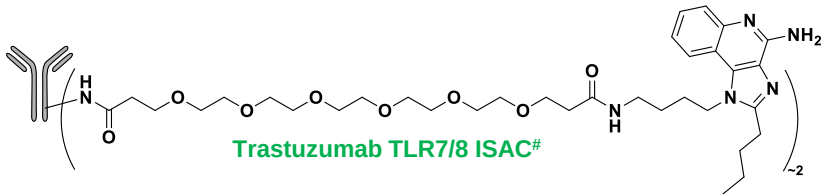
- **(1 / 0.043 mg/kg; qdx1, IV)**
- ◇ **(0.3 / 0.013 mg/kg; q5dx6, IP)**

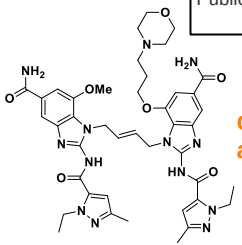
(Doses reflect mAb / payload mg/kg)

*agonist described in Ramanjulu *et al.* (2018) *Nature* (compd 3 in reference)

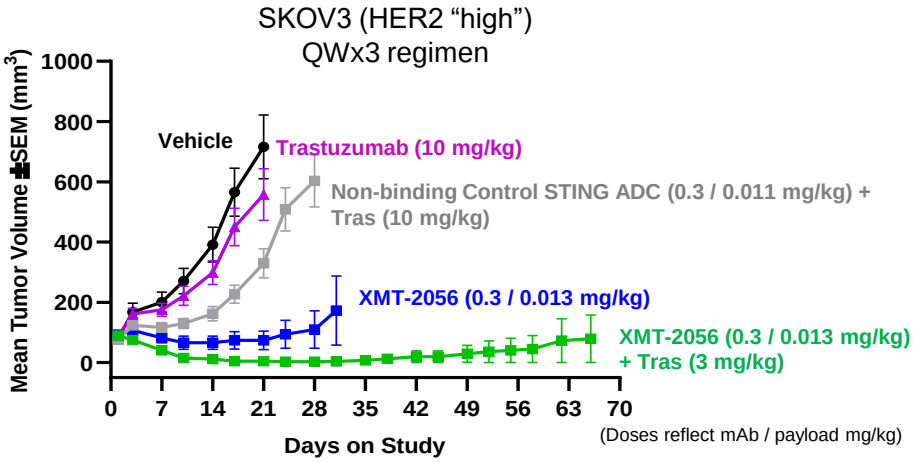
#TLR7/8 ISAC described in Ackerman *et* al, (2020) *Nature Cancer*

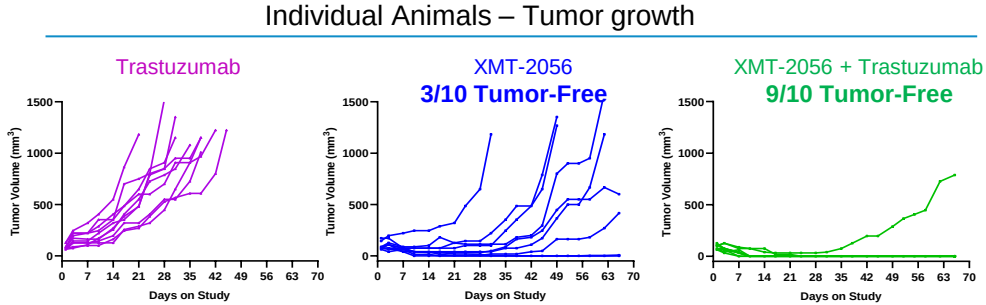
[&]CCLE RNAseq data from DepMap, Broad (2021): DepMap 21Q3 Public

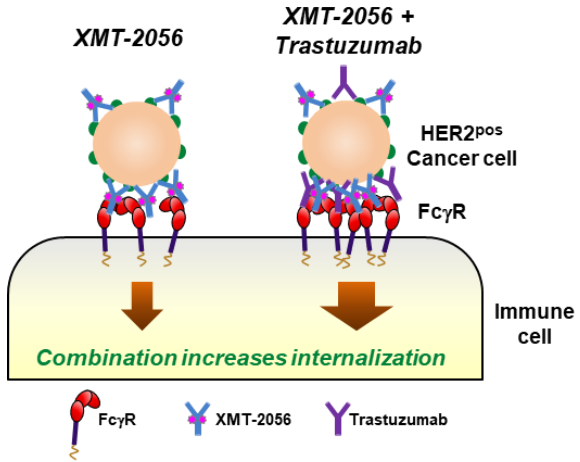




XMT-2056 plus Trastuzumab Combination Shows Benefit In Vivo







XMT-2056 and trastuzumab have non-overlapping epitopes

We are Leveraging our Novel ADC Platforms to Generate Differentiated Product Candidates

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 Registration Study					
		Platinum-Sensitive Ovarian Cancer	Dolaflexin	UPGRADE Combo Study					
XMT-1592*	NaPi2b	Ovarian Cancer NSCLC Adenocarcinoma	Dolasynthen						
XMT-1660	B7-H4	Multiple Solid Tumors	Dolasynthen						
XMT-2056	HER2	Undisclosed	Immunosynthen						
Multiple Programs	Undisclosed	Undisclosed	Immunosynthen						
Multiple Programs	Undisclosed	Undisclosed	Dolasynthen or Dolaflexin						
Multiple EMD SERONO	Multiple	Undisclosed	Dolaflexin						
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.

Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting