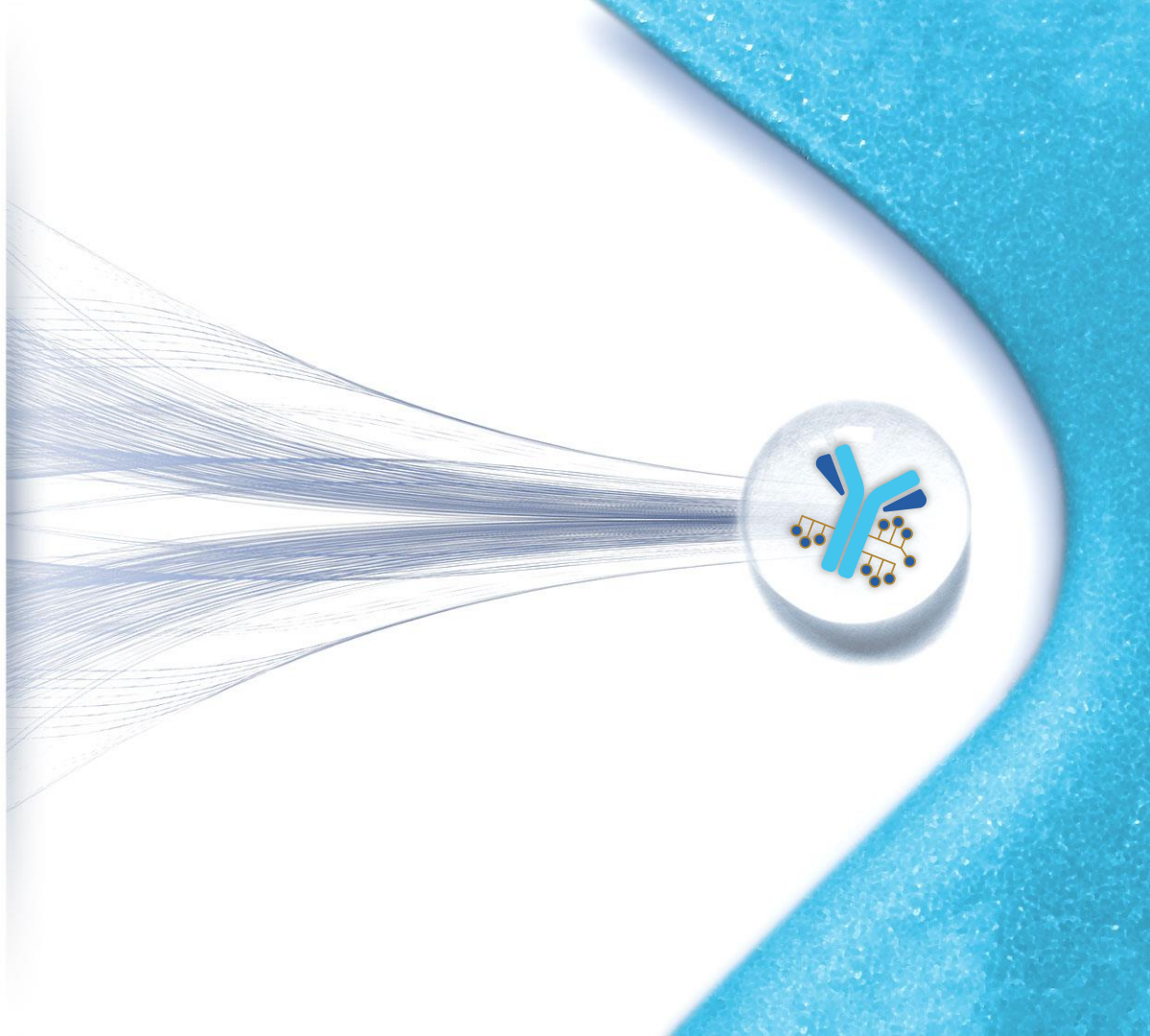
Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting

September 2021



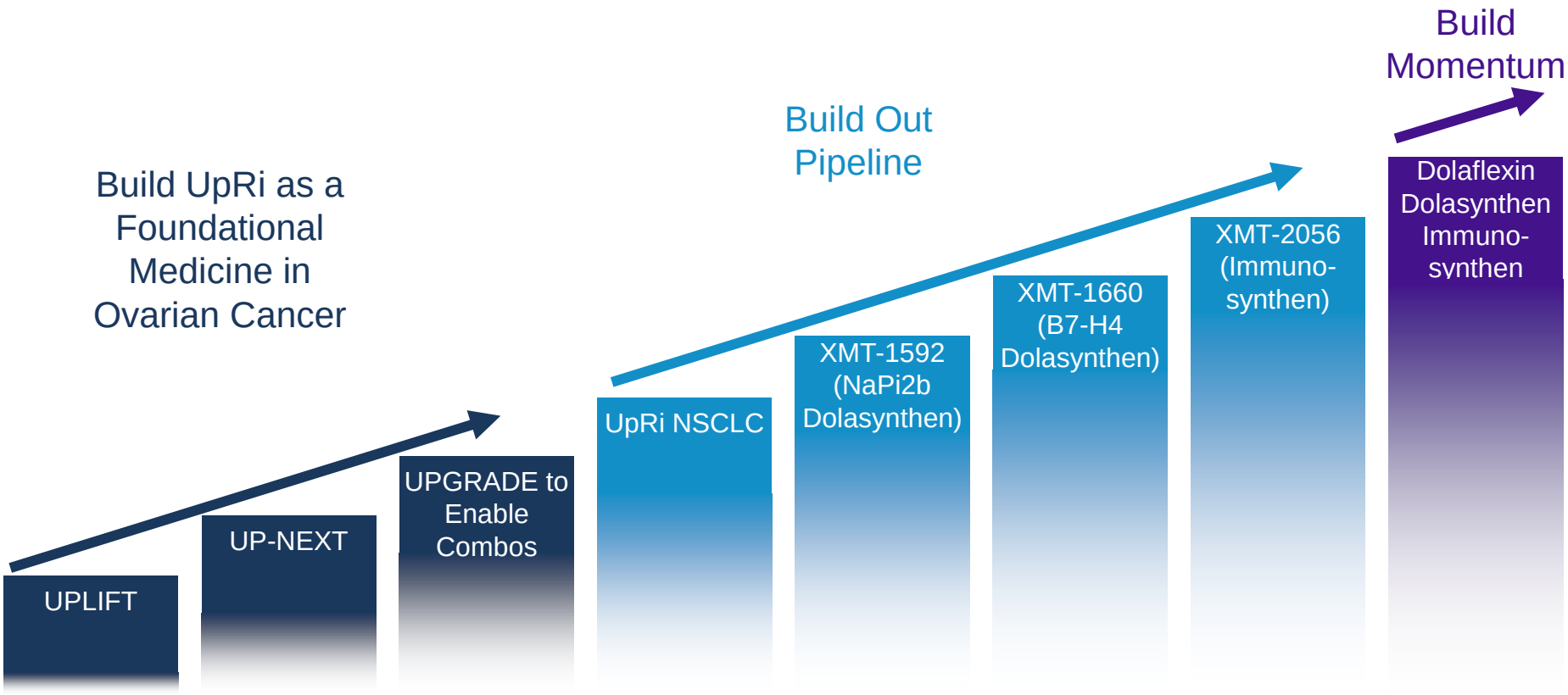
Legal Disclaimer

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.

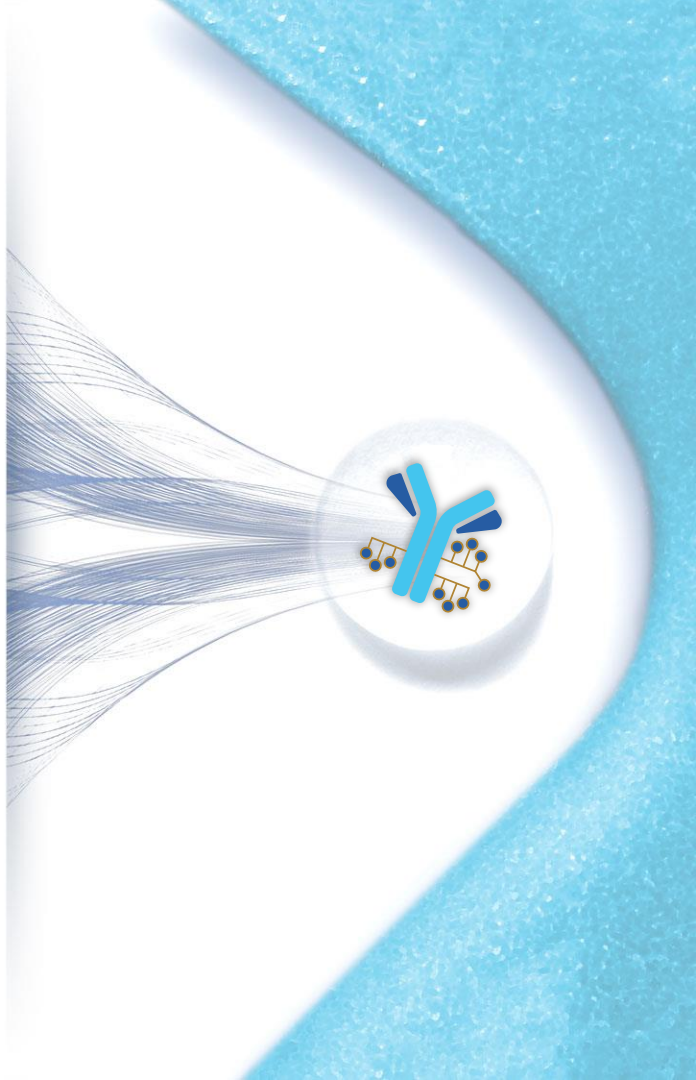
Forward-looking statements generally can be identified by terms such as “aims,” “anticipates,” “believes,” “contemplates,” “continues,” “could,” “estimates,” “expects,” “goal,” “hypothesis,” “intends,” “may,” “on track,” “opportunity,” “plans,” “poised for,” “possible,” “potential,” “predicts,” “projects,” “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 August 6, 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 (XMT-1536): First-in-Class Dolaflexin ADC Targeting NaPi2b



Consistent UpRi Profile in Expansion Cohort (N=97) Supports UPLIFT Registration Strategy

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

Patient Demographics and Disease Characteristics

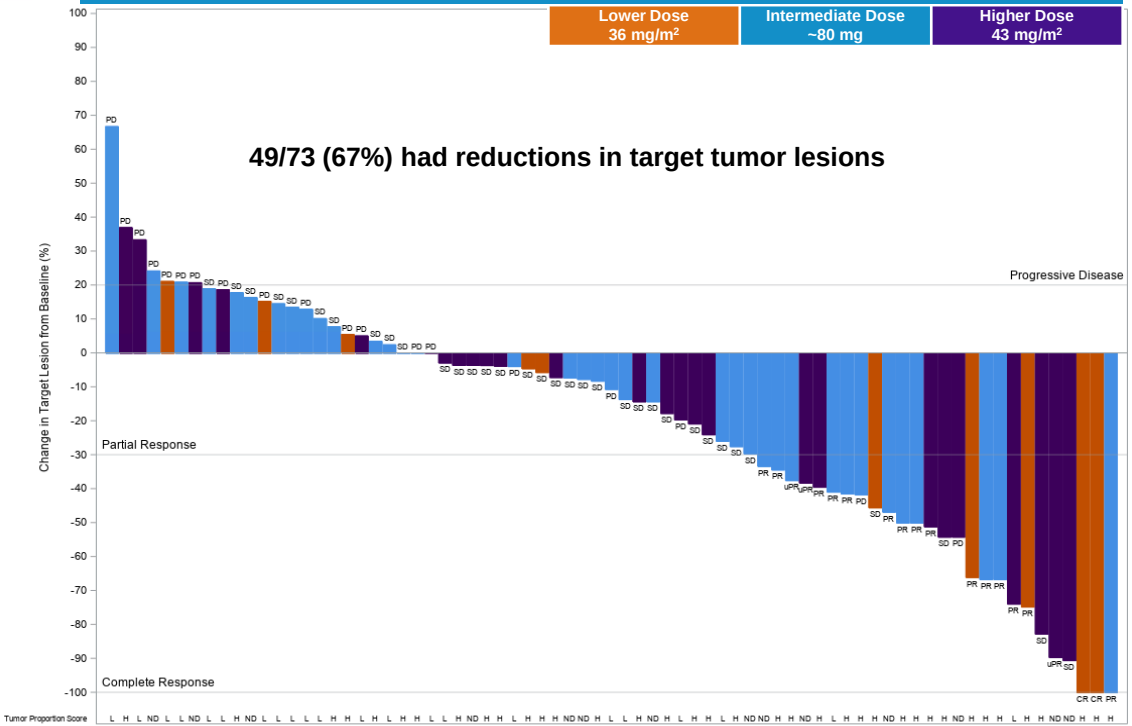
Data Cut: June 10, 2021

Ovarian Cancer Expansion Patients (N = 97)		
Age; years	Median (range)	68 (33, 87)
ECOG Performance Status; n (%)	0 1	33 (34) 64 (66)
Baseline BSA	≥ 1.8 m^2 ≥ 2.2 m^2	51 (53) 5 (5)
Primary Tumor Type; n (%)	Ovarian Fallopian Tube Primary Peritoneal	72 (74) 15 (15) 8 (8)
Prior Lines of Therapy; n (%)	1-3 4+[a]	65 (67) 32 (33)
Prior Therapy; n (%)	Bevacizumab PARP inhibitor	68 (70) 57 (59)
Platinum-free Interval[b]; n (%)	0-3 mos >3-6 mos >6 mos[c] Unknown[d]	34 (35) 46 (47) 10 (10) 7 (7)
BRCA1/2 Mutation; n (%)	Yes No Unknown[e]	15 (15) 65 (67) 17 (18)
NaPi2b TPS[f]; n (%)	Determined High Low Not Yet Determined (ND)	78 (80) 50 (64) 28 (36) 19 (20)

[a] Three patients enrolled with 5 prior lines of systemic therapy. [b] Platinum-free interval defined as the time between the last cycle of most recent platinum-containing regimen and evidence of disease progression; determined from treatment dates and/or clinic notes. [c] All patients had received 4 or 5 lines of prior therapy. [d] Treatment dates missing/not provided; unable to determine. [e] BRCA1/2 mutation status not available/not reported. [f] High NaPi2b Expression: Tumor Proportion Score (TPS) ≥75; Low NaPi2b Expression: TPS <75; ND = NaPi2b Expression not yet determined or tissue not available

Clinically Meaningful Efficacy with Deep Responses, Consistent Across Multiple Data Disclosures

Maximum % Change from Baseline in Target Lesions in Evaluable Patients with Ovarian Cancer (n=73**)



Best Response in Evaluable Patients with Ovarian Cancer (n = 75*)

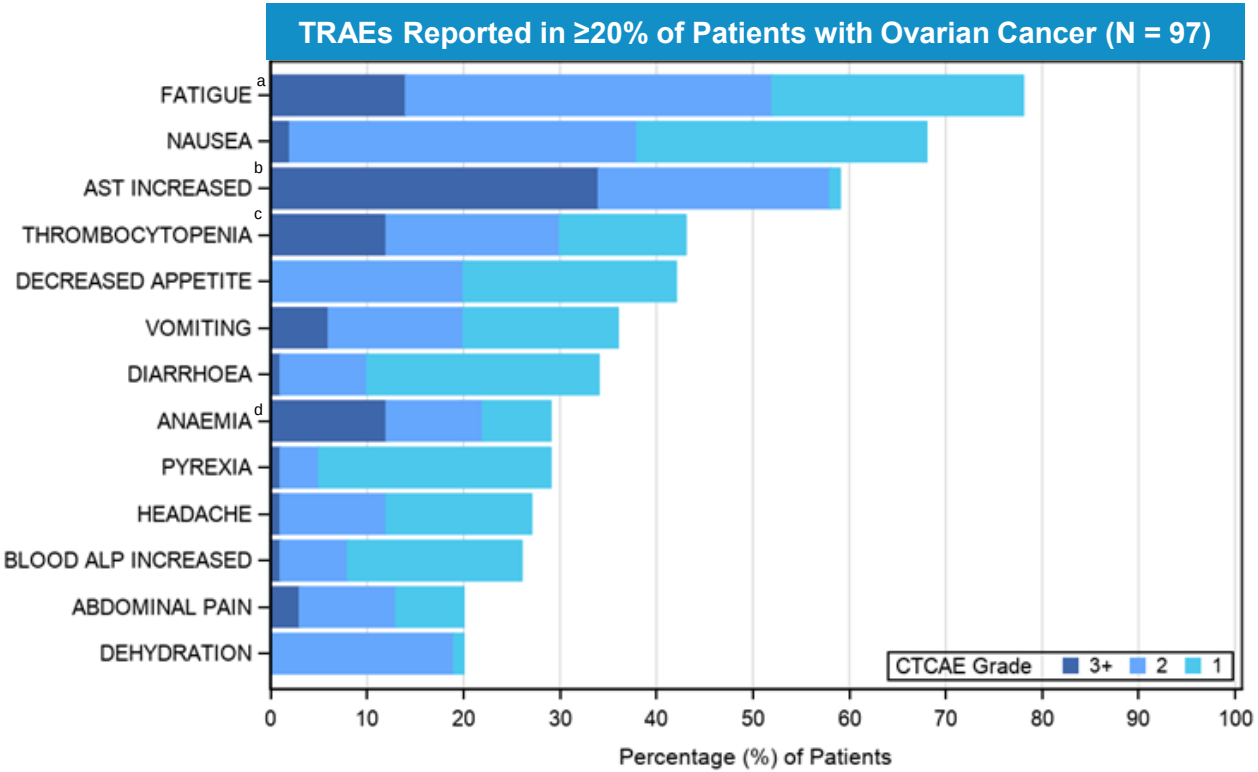
	NaPi2b High (TPS≥75)	NaPi2b Low (TPS<75)	Not Yet Determined NaPi2b	All Patients
N	**38**	**23**	**14**	**75**
CR	2 (5)	0	0	2 (3)
PR	11 (29)	2 (9)	2 (14)	15 (20)
uPR	1 (3)	0	2 (14)	3 (4)
SD	19 (50)	8 (35)	7 (50)	34 (45)
PD	5 (13)	13 (57)	3 (21)	21 (28)
Confirmed ORR	**13 (34)**	**2 (9)**	**2 (14)**	**17 (23)**
DCR	**33 (87)**	**10 (43)**	**11 (79)**	**54 (72)**

Median Duration of Response in NaPi2b High: ~5 months

Data cut June 10, 2021
Abbreviations: CR = complete response; PR = partial response; uPR = unconfirmed PR; H = High NaPi2b Expression; L = Low NaPi2b Expression; ND = NaPi2b Expression not yet determined or tissue not available; ORR = Objective Response Rate; DCR = Disease Control Rate
*22 patients were not evaluable by RECIST 1.1: 10 deaths (4 disease progression, 2 pneumonitis, 2 sepsis, 1 viral pneumonia, 1 unknown); 5 patient withdrawals; 1 enrolled in hospice; 1 clinical progression; 4 discontinued treatment; 1 had not yet reached first scan
**2 pts in waterfall plot excluded as post-baseline tumor measurement shows "Not Measurable", yet "PD" was assigned by Investigator in the response dataset

UpRi Continues to Have a Consistent Tolerability Profile

No grade ≥ 3 (severe) TRAEs of neutropenia, peripheral neuropathy, or ocular toxicity have been reported



Represents AEs from Patients Treated Across All Doses

Data Cut: June 10, 2021

[a]Fatigue includes preferred terms of asthenia and fatigue; [b]AST increase is transient in nature, recovers to baseline or to Grade 1 prior to the next dose, no instances are associated with elevated bilirubin or cases of Hy's law; [c]Thrombocytopenia includes preferred terms of platelet count decreased and thrombocytopenia. Thrombocytopenia is transient in nature, nadirs at Day 8 and recovers prior to the next dose; [d]Anaemia includes preferred terms of anaemia of chronic disease, blood loss anaemia and iron deficiency anaemia

Expect Improved Safety Profile and Similar Efficacy at Lower Dose

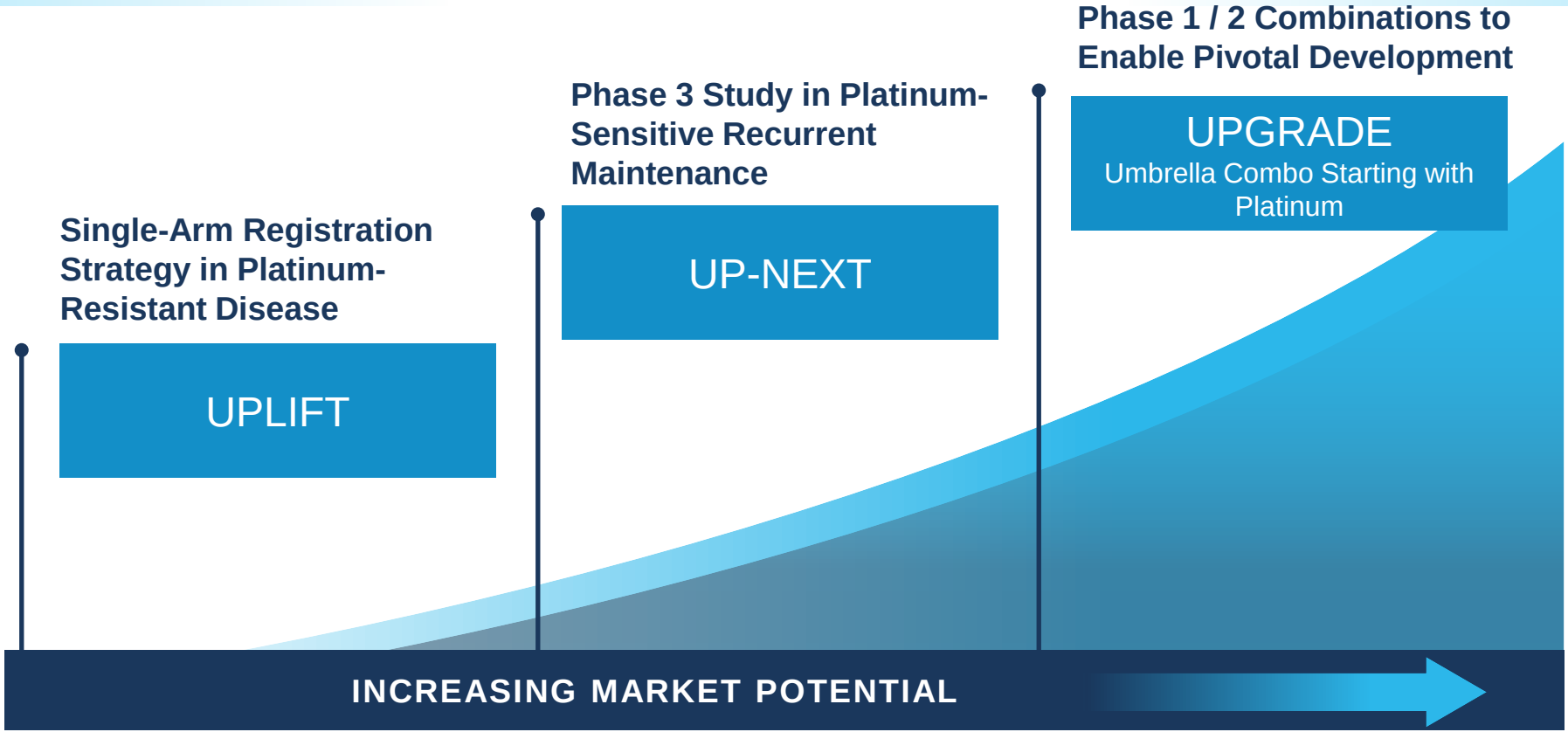
- Population PK modeling performed with data from ~200 patients for safety, 130+ patients for efficacy
  - Demonstrates exposure-safety relationship much steeper than exposure-efficacy relationship
- Expansion cohort data indicate trends consistent with population PK modeling:
  - Lower dose had fewer grade 3+ TRAEs
  - Lower dose had fewer treatment-related dose reductions
  - Lower dose had similar ORR
  - Lower dose had longer treatment duration
  - Lower dose had fewer patients discontinue before first scan

	Lower Dose 36 mg/m^2 N=12	Inter-mediate Dose ~80 mg N=46	Higher Dose 43 mg/m^2 N=39
≥ Grade 3 Fatigue	1 (8%)	6 (13%)	9 (23%)
≥ Grade 3 Increased AST	1 (8%)	16 (35%)	16 (41%)
≥ Grade 3 Pneumonitis	0 (0%)	0 (0%)	4 (10%)

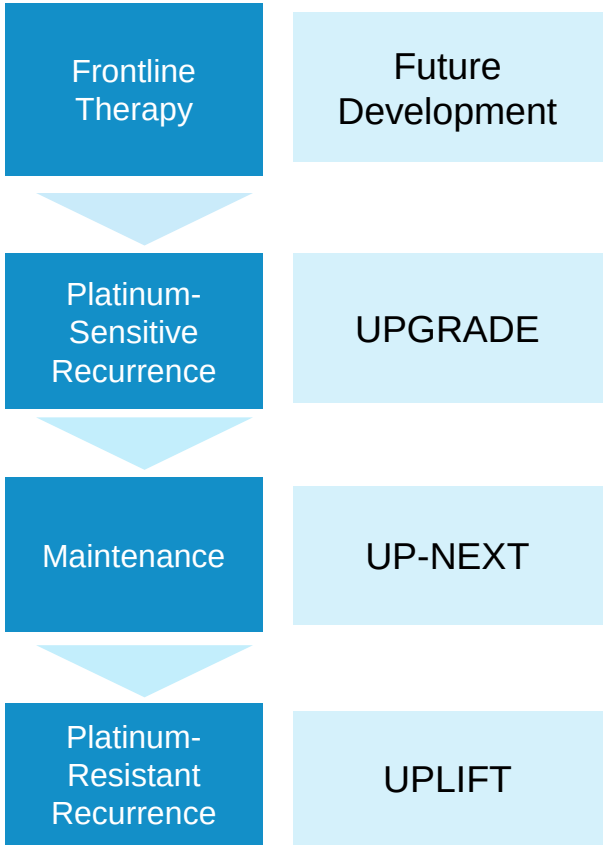
Dose Modified to 36 mg/m^2 up to a Maximum of ~80 mg for UPLIFT

Data Cut: June 10, 2021

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

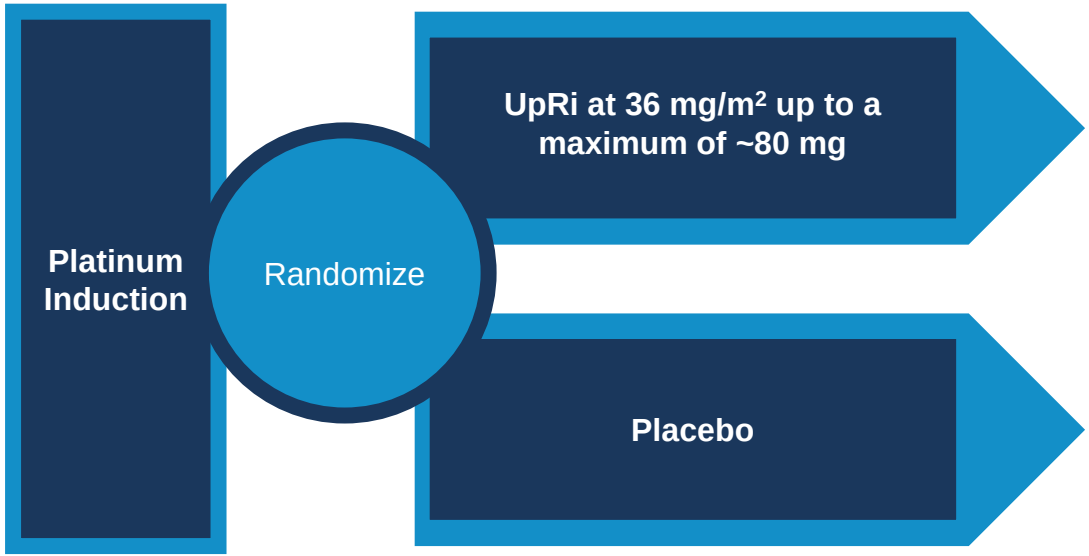
Source: Moore, ESMO Annals of Oncology 2021; 32:757-765; Corail ESMO 2018; Javelin 200 SGO 2019. Data based on conference presentation.
Banerjee et al, Annals of Oncology 29: 917–923, 2018

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:

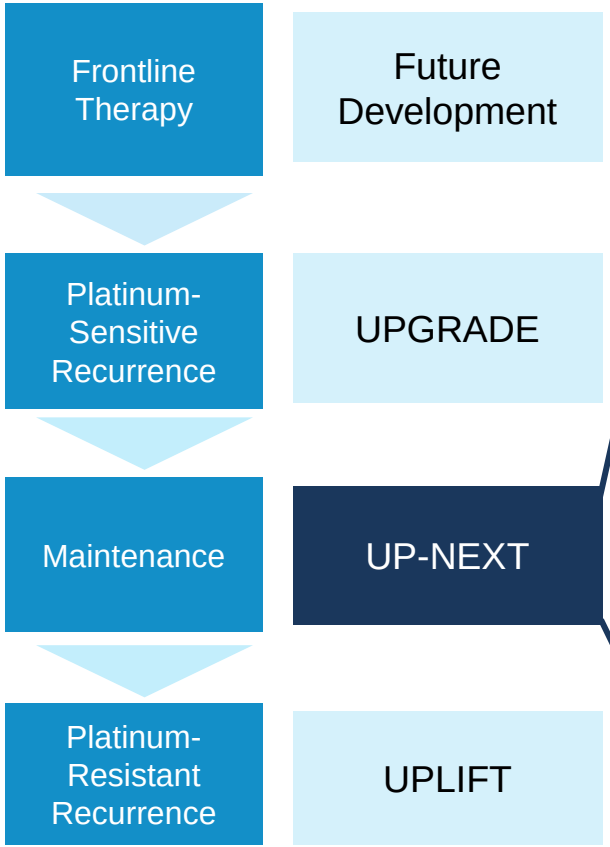
- Platinum-sensitive recurrence, following platinum induction
- NaPi2b High biomarker selection by TPS≥75
- 1 – 3 prior platinum-based regimens
- Prior PARPi therapy allowed, but only required for BRCAmut
- SD in addition to CR/PR as best response following platinum induction

Primary Endpoint:

- PFS

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

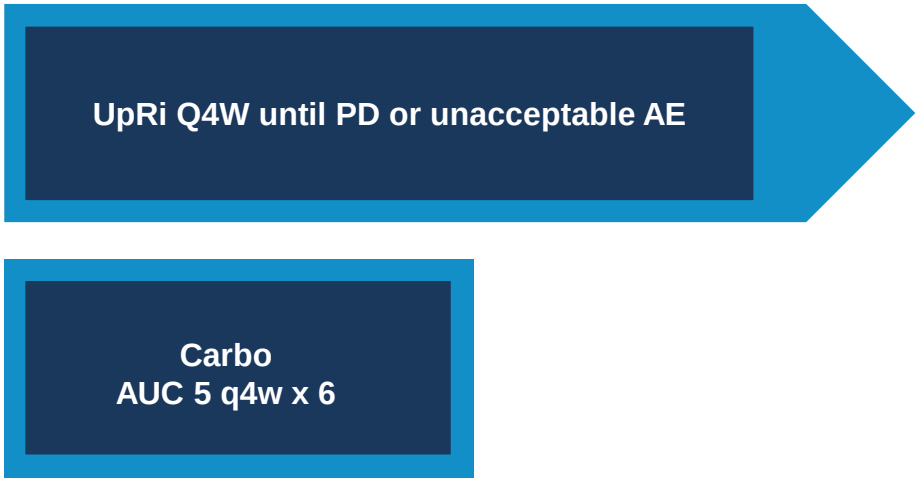
UP-NEXT Key Differentiators



- Platinum-Sensitive Population
  - Earlier in disease than UPLIFT population
  - Opportunity to be first ADC in earlier lines and platinum-sensitive disease
- UpRi Monotherapy
  - Randomized vs. placebo, higher probability of success
- Broader Population than Existing Maintenance Options
  - Enrolls patients who have achieved stable disease to platinum doublet in addition to patients who achieve partial or complete responses
  - Enrolls patients with prior bevacizumab, prior PARPi, both, or neither
- Registration Intent
  - Intended to support global launches
  - If positive, serves as confirmation of UPLIFT

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

Dose Escalation and Expansion



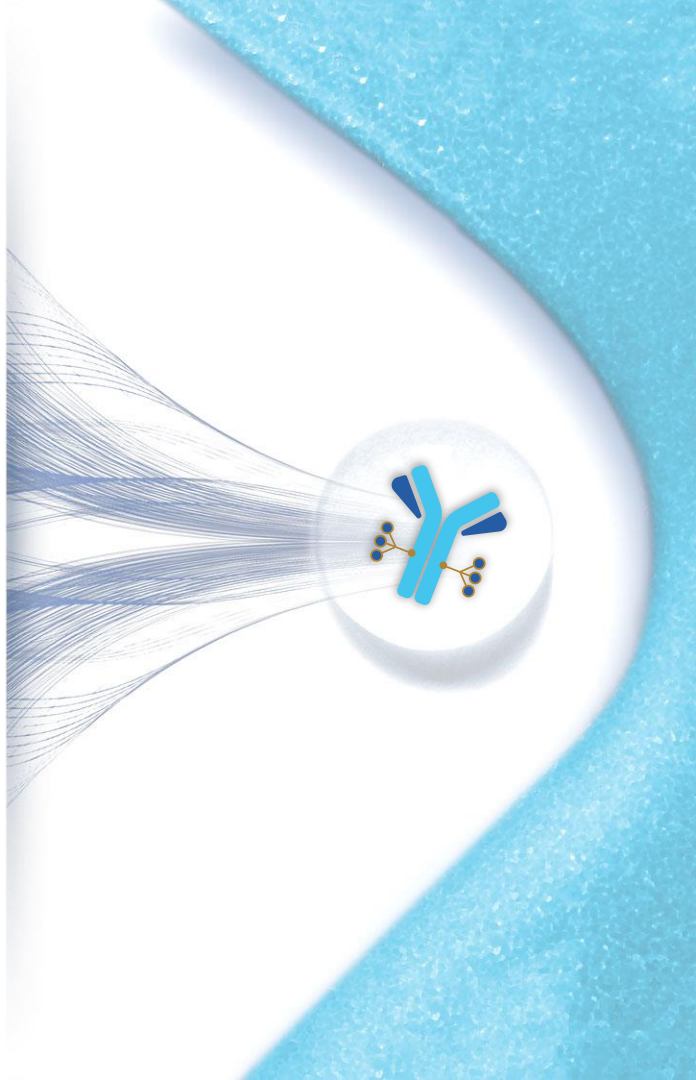
Key Enrollment Criteria:

- 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

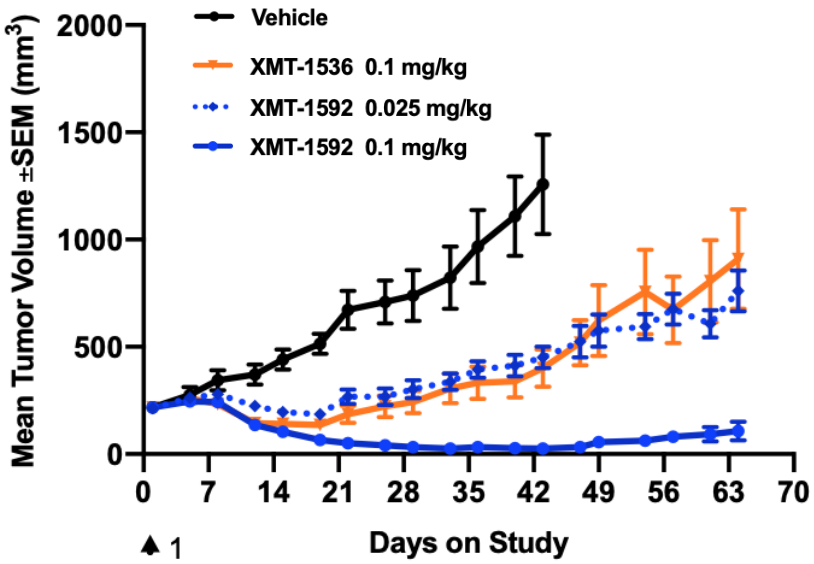
XMT-1592: Dolasynthen ADC Targeting NaPi2b



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

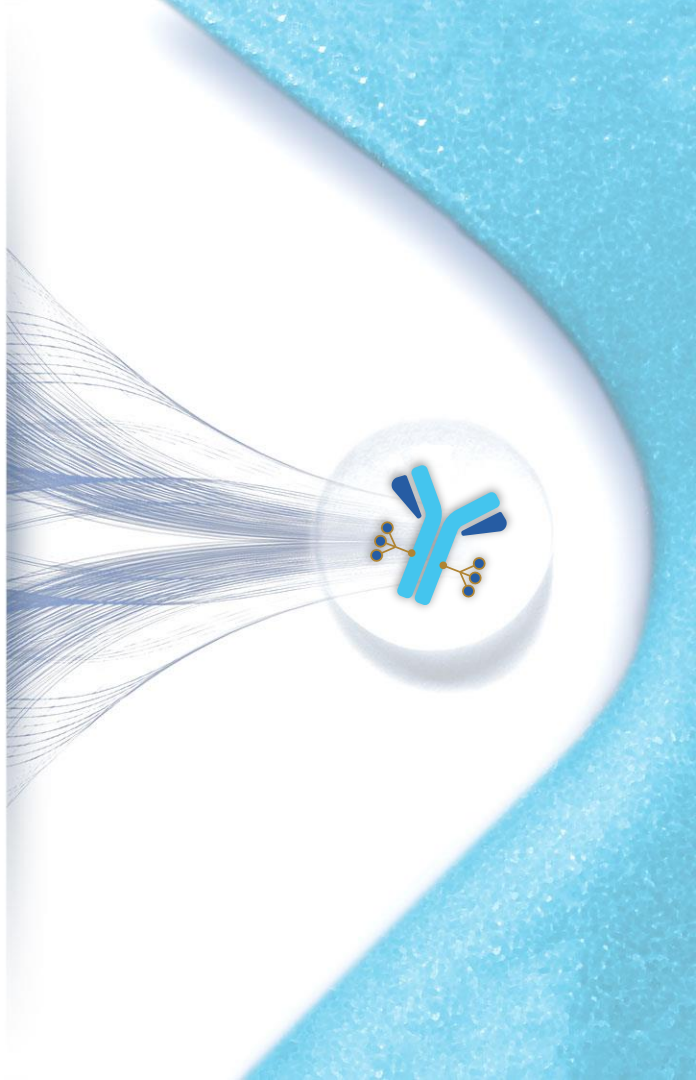
Molecular Attribute	XMT-1536	XMT-1592
Platform (scaffold)	Dolaflexin	Dolasynthen
Bioconjugation method	Stochastic	Site-Specific
DAR average	10-12	6
DAR distribution	Controlled Heterogeneity	Homogeneous

4X Greater Activity in Preclinical Lung PDX

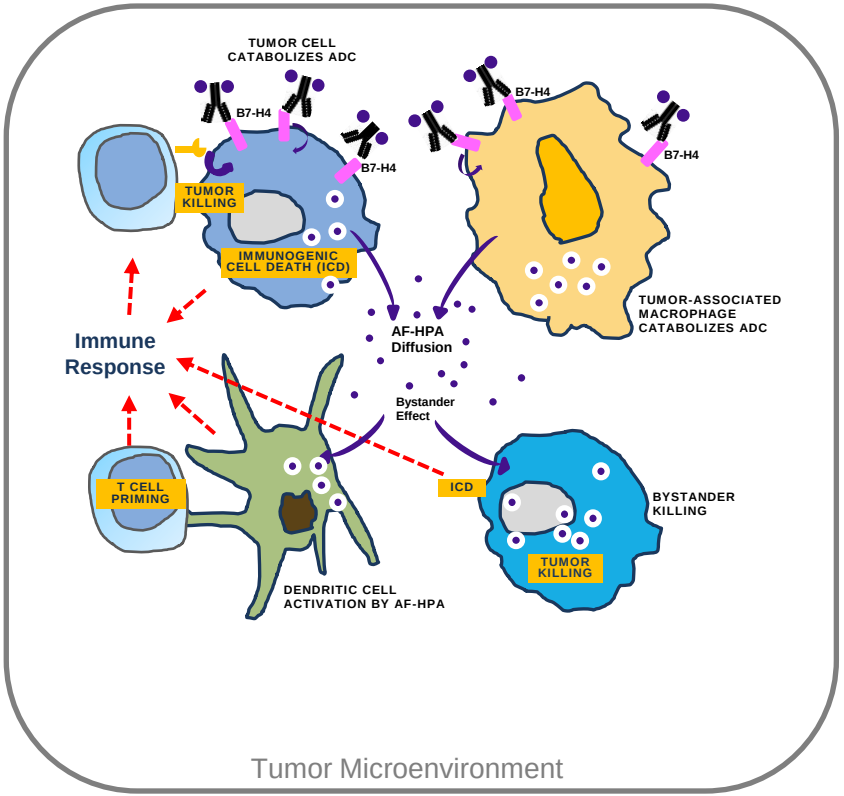


At least comparable tolerability at equal payload doses in NHP studies

XMT-1660: First-in-Class B7-H4 ADC



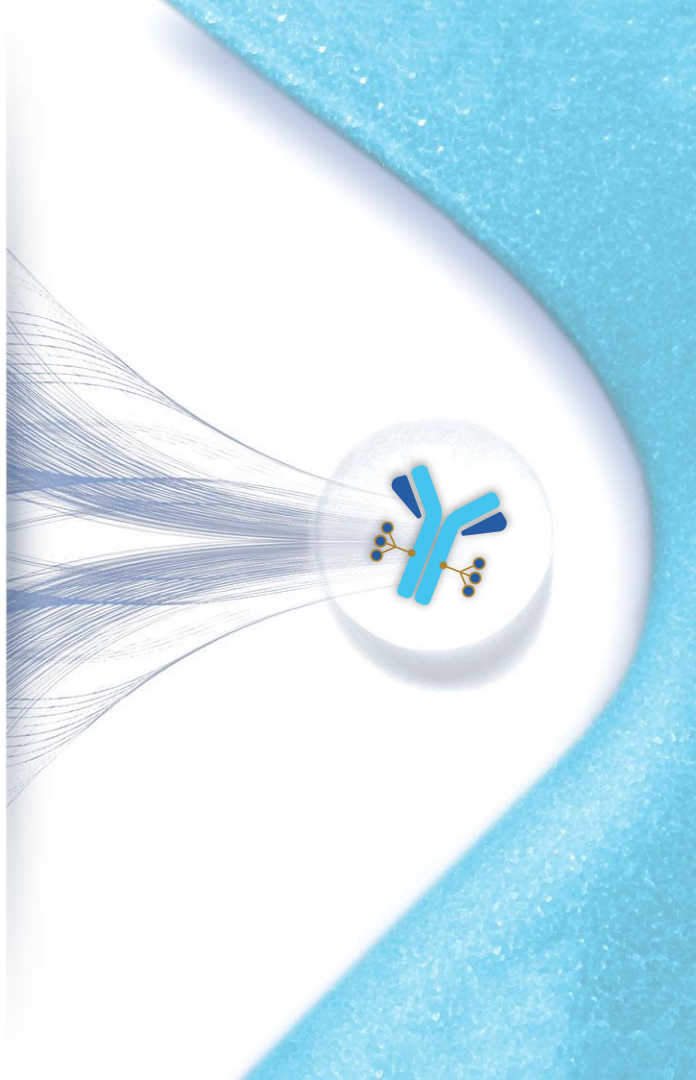
B7-H4 Expression Well-Suited for a DolaLock ADC



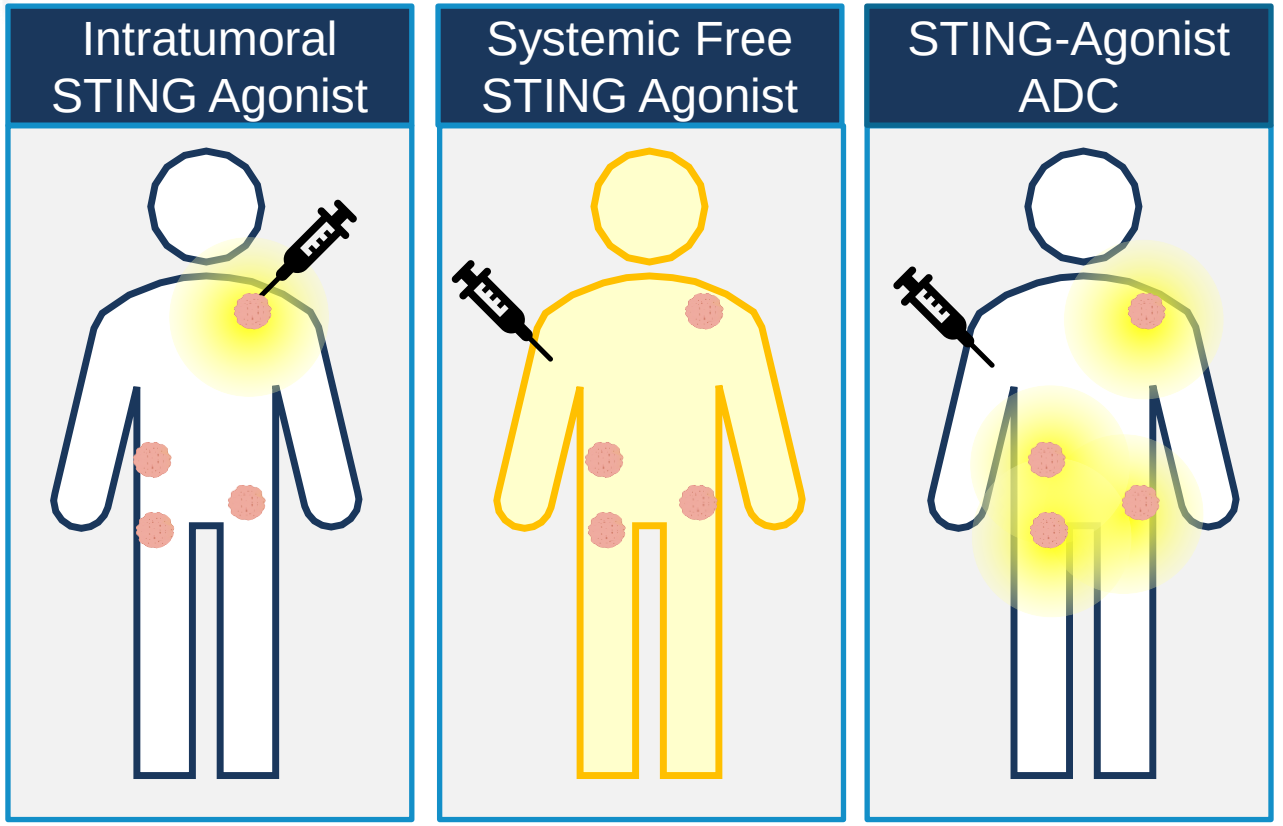
"The Perfect Storm"

- 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-2056: First Immunosynthen STING-Agonist ADC Development Candidate



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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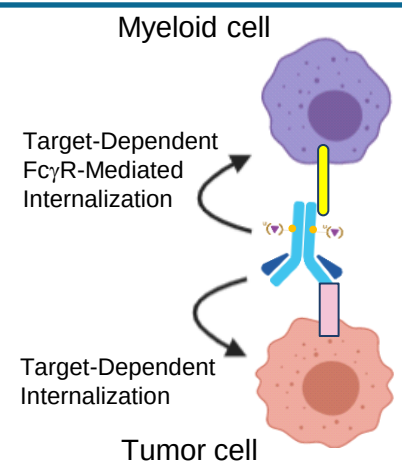
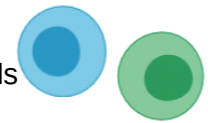
Tumor

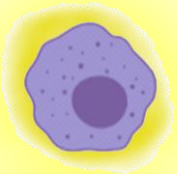


No internalization into undesired immune cells (T, B)

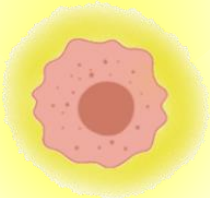


Hit the tumor-resident immune cells

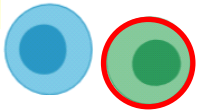
Hit the tumor cells



STING Activated in Myeloid Cell



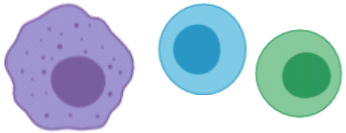
STING Activated in Tumor Cell



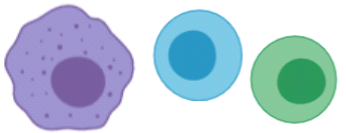
Stimulated T Cells

Periphery

No internalization into immune cells



No stimulation of immune cells

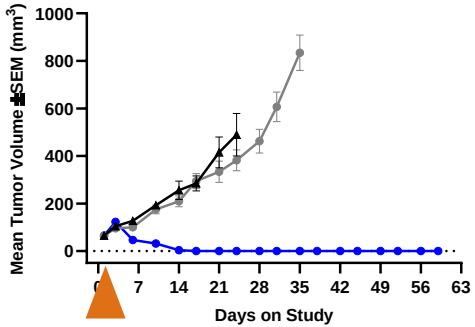


Immunosynthen ADCs Active Against Diverse Tumor Antigens and Tumor-Associated Antigens in Multiple Models After Single, Low IV Dose

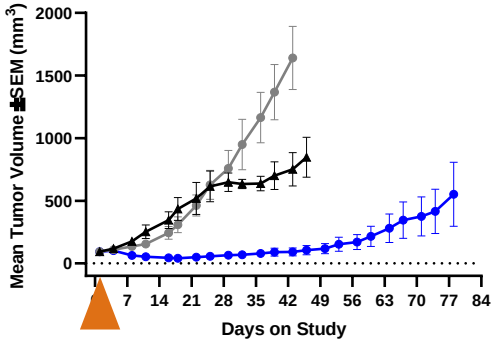
Legend

Vehicle
Control ADC
Targeted ADC

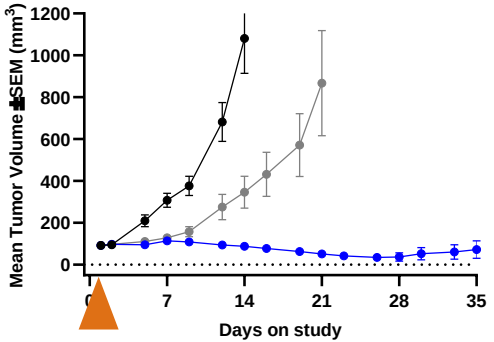
Tumor Antigen A
3.0 mg/kg



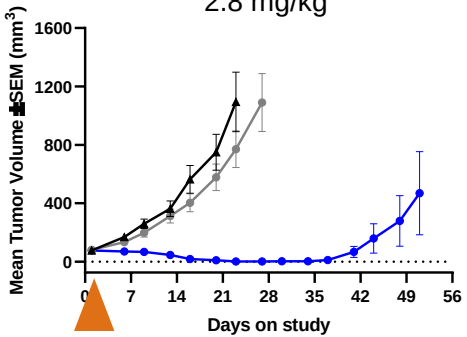
Tumor Antigen B
3.0 mg/kg



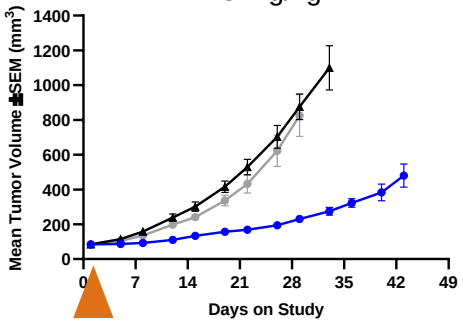
Tumor-Associated Antigen A
2.2 mg/kg



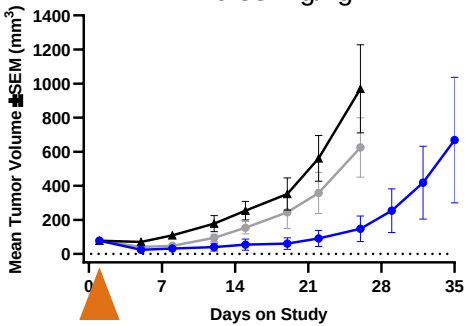
Tumor Antigen C
2.8 mg/kg



Tumor Antigen D
2.5 mg/kg



Tumor-Associated Antigen B
0.88 mg/kg



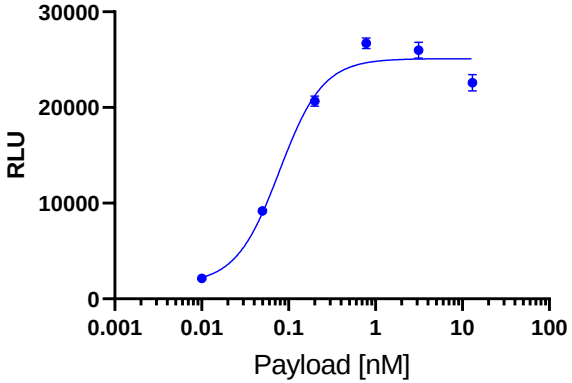
XMT-2056: First Immunosynthen Development Candidate

Summary of Data

Fc-mediated uptake and THP1 cell activation

IRF3 Reporter (THP1)

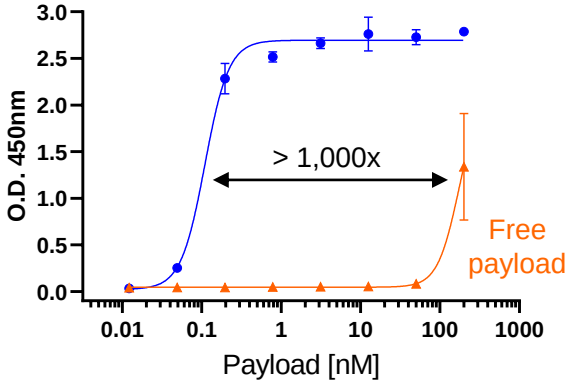
EC_{50} = 0.08 nM



Tumor cells with PBMCs

CXCL10 ELISA

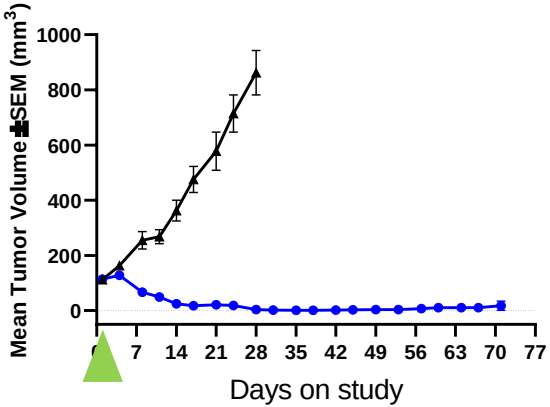
EC_{50} = 0.11 nM



***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

Goals and Anticipated Milestones

Upifitamab Rilsodotin UpRi (XMT-1536)	✓ Q1 2021: Initiate UPLIFT single-arm registration strategy as amendment ✓ Q3 2021: Initiate UPGRADE combination dose escalation umbrella study ✓ 2H 2021: Report data from ovarian expansion cohort • Q4 2021: Report top-line data from NSCLC expansion cohort
XMT-1592	• Around YE 2021: Report top-line dose escalation data and outline further development path
XMT-1660	• Early 2022: Initiate Phase I dose escalation
XMT-2056	• Q4 2021: Disclose target • Early 2022: Initiate Phase I dose escalation
Corporate	• Continue to leverage proprietary platforms to expand pipeline • Proactively evaluate potential for collaborations that maximize value

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 Strategy					
		Platinum-Sensitive Ovarian Cancer	Dolaflexin	UPGRADE Combo Study					
		NSCLC Adenocarcinoma	Dolaflexin						
XMT-1592*	NaPi2b	Ovarian Cancer NSCLC Adenocarcinoma	Dolasynthen						
XMT-1660	B7-H4	Multiple Solid Tumors	Dolasynthen						
XMT-2056	Undisclosed	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