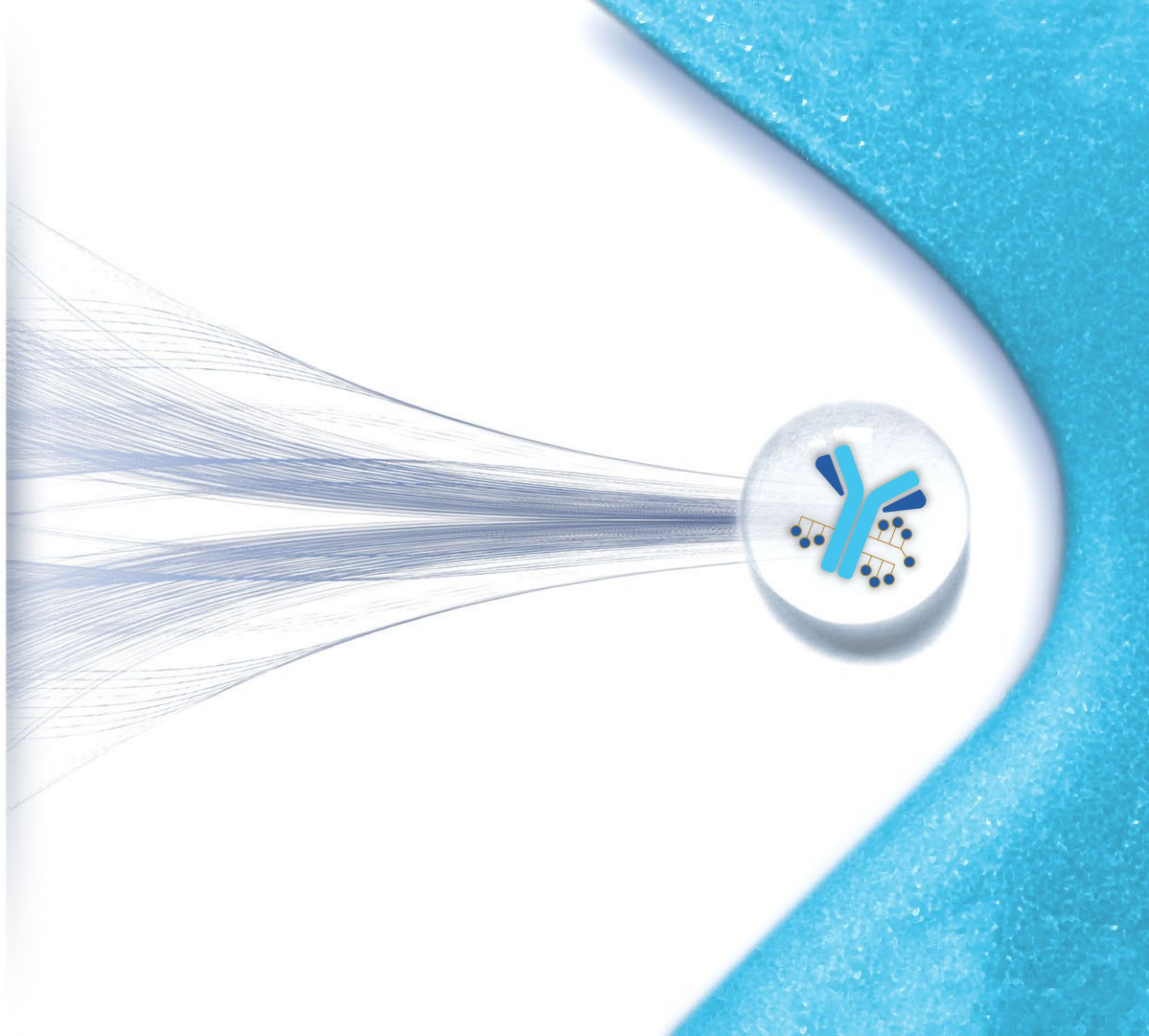
Mersana THERAPEUTICS

Accelerating ADC Innovation

…because patients are waiting

April 2021



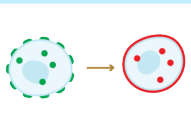
Legal Disclaimer

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 trials, the ability of the single-arm UPLIFT cohort to enable registration, expectations regarding future clinical trial results based on data achieved to date, and the sufficiency of the Company’s cash on hand.

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,” “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 preclinical testing or early clinical results may not be predictive of the results or success of ongoing or later preclinical or clinical trials, regulatory changes, particularly with respect to the change in the U.S. presidential administration, the FDA’s review of the protocol for our study of the single-arm UPLIFT cohort, 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 Annual Report on Form 10-K filed with the Securities and Exchange Commission (“SEC”) on February 26, 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, 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 Annual Report on Form 10-K and our other SEC filings are available by visiting EDGAR on the SEC website at http://www.sec.gov.

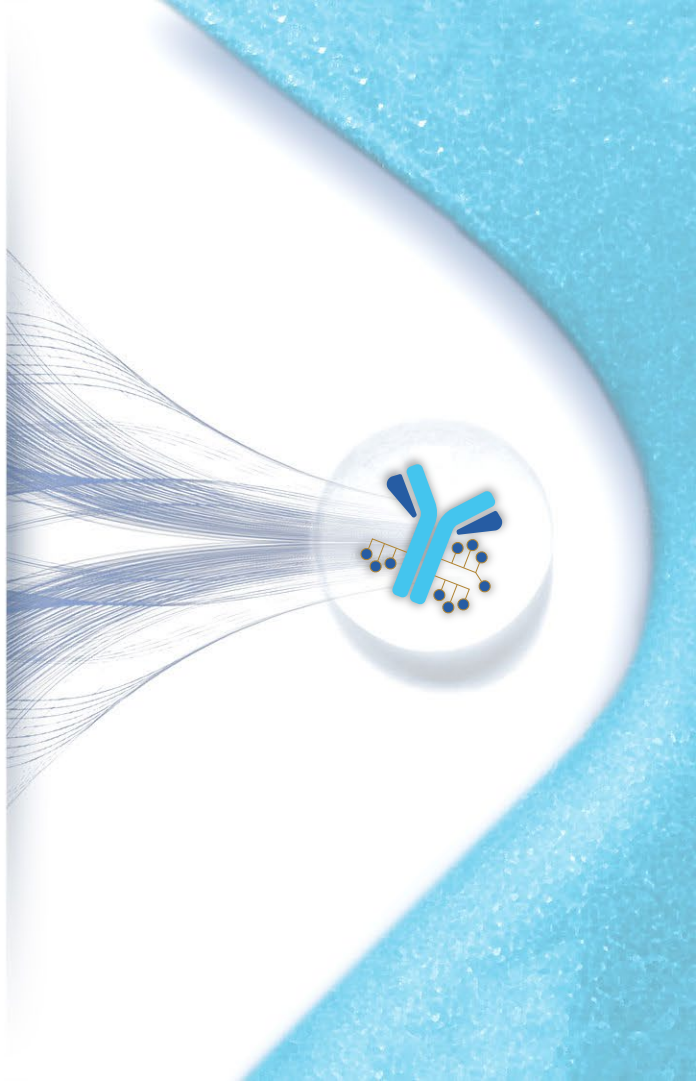
Mersana's Mission: Discover and Develop Life-Changing Antibody-Drug Conjugates for Patients Fighting Cancer

Innovative Platforms	First-in-Class Product Candidates
 **DolaLock** Controlled Bystander Effect	**UpRi (XMT-1536)** NaPi2b Dolaflexin
 **Dolaflexin** Improved Therapeutic Index vs. Other Platforms	**XMT-1592** NaPi2b Dolasynthen
 **Dolasynthen** Homogenous and Customizable	**XMT-1660** B7-H4 Dolasynthen
 **Immunosynthen** Targeted Immune Stimulation	**XMT-2056** 1st Immunosynthen ADC

Poised for Significant Value Inflection Points and Continued Momentum in 2021

1	UpRi (XMT-1536) in Ovarian	Initiate UPLIFT Single-Arm Registration Strategy	Initiate Lifecycle Management Studies / Combinations
2	UpRi (XMT-1536) In NSCLC	Seek to Achieve Proof-of-Concept	Select Lead in NSCLC
3	XMT-1592	Complete Dose Escalation	
4	XMT-1660 (B7-H4)	IND-Enabling Studies	IND Submission Q1 2022
5	XMT-2056 (Immunosynthen)	IND-Enabling Studies	IND Submission Q1 2022

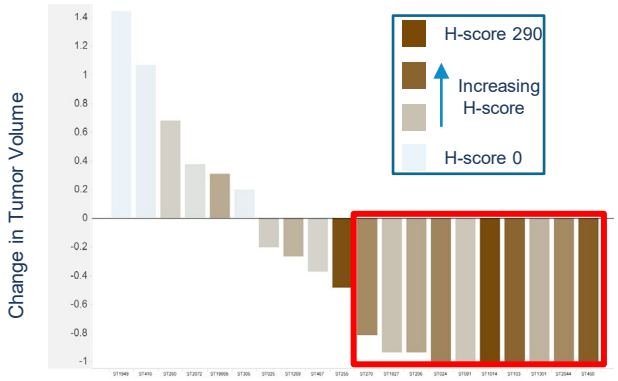
UpRi (XMT-1536): First-in-Class Dolaflexin ADC Targeting NaPi2b



Mersana is the Leader in Targeting NaPi2b, an Ideal and Validated ADC Target

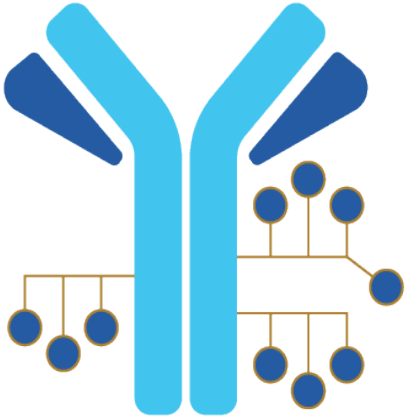
- NaPi2b is broadly expressed in ovarian cancer and NSCLC adenocarcinoma with limited expression in healthy tissues
  - No detectable expression in squamous NSCLC
- NaPi2b is a lineage marker (not an oncogene) that transports phosphate into the cell
  - The presence of EGFR and KRAS mutations in NSCLC adenocarcinoma correlates with more frequent expression of NaPi2b
- Initial clinical validation of target by Genentech using MMAE platform in era before introduction of bevacizumab and PARP
  - Genentech ADC not combinable with platinum due to overlapping severe neutropenia
- Proprietary biomarker assay can distinguish across low, medium, and high expression
  - Correlation between biomarker expression and tumor response in preclinical and clinical settings
  - Developing commercial diagnostic for use in registration enabling study

In Ovarian PDX Models, only tumors with an H-score above cutoff had a tumor response >50%



Mosher et al, AACR-NCI-EORTC International Conference, October 2017
Mitchell et al, AACR-NCI-EORTC International Conference, October 2019
D'Archangelo, et al. Abstract 194P ESMO 2014

XMT-1536 Has a New Name: UpRi



upifitamab rilsodotin

or UpRi, for short

Building a Potentially Foundational Medicine in Ovarian Cancer

UpRi Profile	**Clinically Meaningful Activity in Heavily-Pretreated Patients** **>30% ORR with CRs in Ovarian Cancer with Higher NaPi2b Expression**	**Consistent Tolerability Profile** **No Severe Neutropenia, Ocular Toxicity, or Peripheral Neuropathy**
UpRi Development Strategy	**UPLIFT Single-Arm Registration Strategy** **Potential for Differentiated Label and Evaluation of Both Biomarker-Selected and Overall Population**	**UPGRADE Umbrella Study** **Potential in Combos and Earlier Lines**

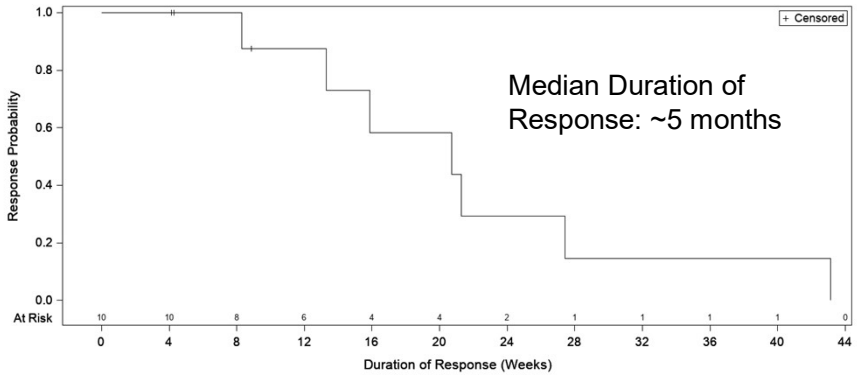
Data as of December 3, 2020. Complete data disclosure from January 5, 2021 available here: https://ir.mersana.com/events-and-presentations

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

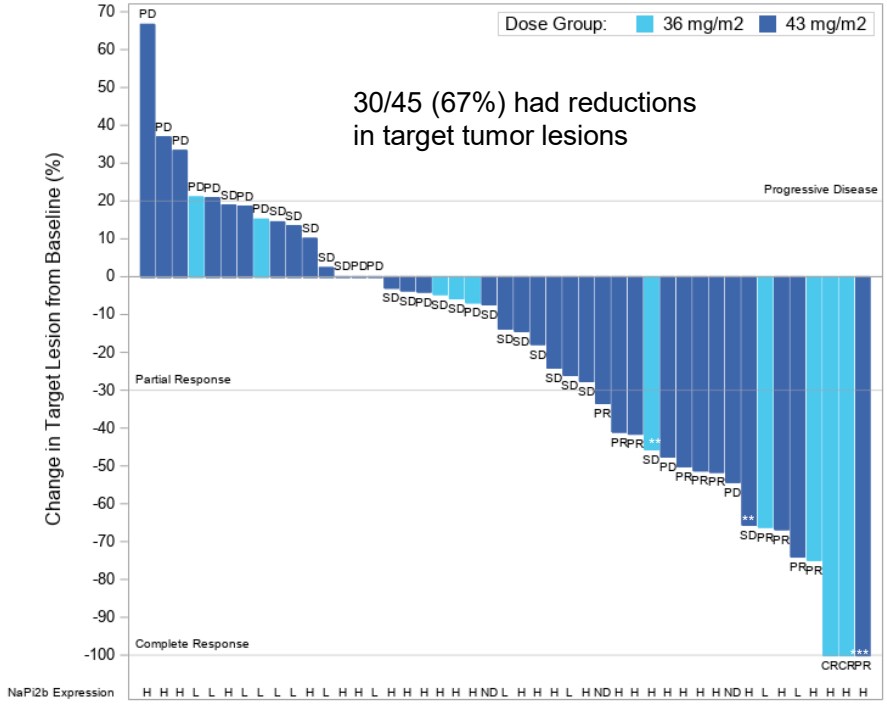
Best Response in Evaluable Patients with Ovarian Cancer (n = 47)

	All (n = 47)	Higher NaPi2b (n = 31)	Lower NaPi2b (n = 13)	NaPi2b Not Yet Determined (n = 3)
CR; n(%)	2 (4)	2 (6)	0	0
PR; n(%)	11 (23)	8 (26)	2 (15)	1 (33)
SD; n(%)	19 (40)	13 (42)	5 (38)	1 (33)
ORR; n (%)	**13 (28)**	**10 (32)**	**2 (15)**	**1 (33)**
DCR; n (%)	**32 (68)**	**23 (74)**	**7 (54)**	**2 (67)**

Durability of Response in Patients with Ovarian Cancer and Higher NaPi2b (n = 10)



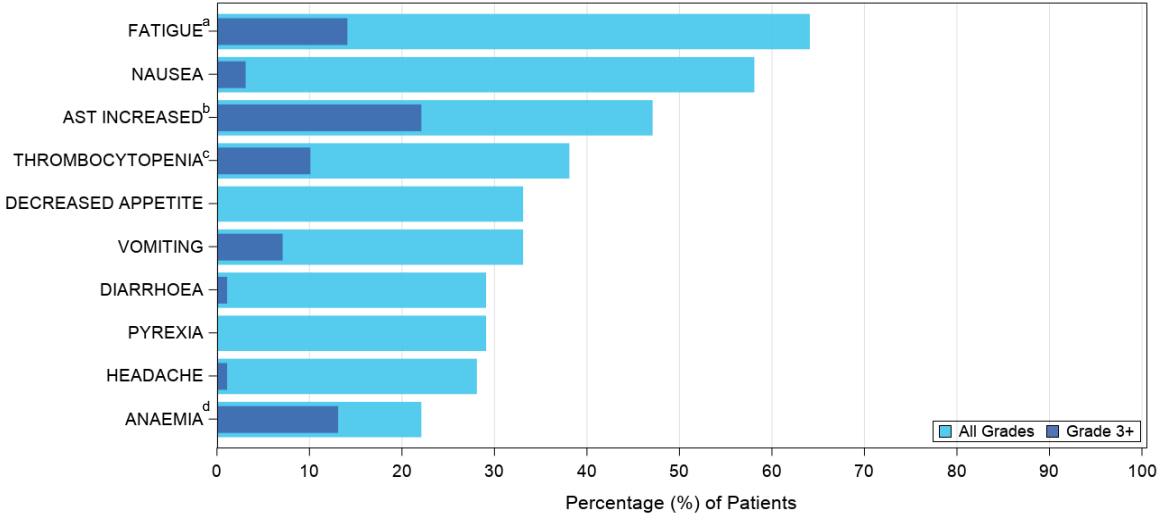
Maximum % Change from Baseline in Target Lesions in Patients with Ovarian Cancer (n = 45*)



Data as of December 3, 2020
* 2 patients not included in waterfall plot as tumor measurement data missing in the database as of data cut; both patients had BOR of PD due to new lesions
** Unconfirmed response, BOR per RECIST v1.1 is SD
*** CR of target lesions and non-CR/non-PD of non-target lesions, BOR per RECIST v1.1 is PR
H = Higher NaPi2b Expression; L = Lower NaPi2b Expression; ND = NaPi2b Expression not yet determined or tissue not available

Consistent Tolerability Profile Without Severe Neutropenia, Peripheral Neuropathy, or Ocular Toxicity

TRAEs Reported in ≥20% of Patients with Ovarian Cancer (N = 72)



SAEs	Patients, n (%) (N = 72)
Any SAEs*	28 (39%)
Treatment-Related SAEs	11 (15%)

Dose Modifications	Patients, n (%) (N = 72)
Any dose reduction, delay, or discontinuation due to TRAE	22 (31%)
Dose reductions due to TRAE	17 (24%)
Dose delays due to TRAE	8 (11%)
Discontinuations due to TRAE	5 (7%)

Data as of December 3, 2020
[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 and blood loss anaemia;
* Includes both related and unrelated SAEs as assessed by the Investigator
Abbreviations: SAEs = serious adverse events; TRAE = treatment related adverse event

Significant Unmet Medical Need in Platinum-Resistant Ovarian Cancer

Ovarian Cancer Expansion Cohort Studies an Even More Heavily Pre-Treated Population:
1-4+ Prior Lines, 67% prior Bev; 58% prior PARP

Study	Demographics	Control Arm	Control Arm Performance
Forward I ESMO 2019	1 – 3 Prior Median 2 Prior Prior PARPi: 10% Prior Bev: 47%	PLD, Topotecan, Weekly Paclitaxel	ORR 12%
Javelin 200 SGO 2019	1 – 3 Prior Median 2 Prior	PLD	ORR 4%
Corail ESMO 2018	1 – 3 Prior Median 2 Prior Prior PARPi: 5% Prior Bev: 46%	PLD or Topotecan	ORR 12%

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
Patients with Baseline Peripheral Neuropathy

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

Global:
US, Europe,
Australia, Canada

Dose:
43 mg/m^2 q4w

Amendment to
Current
Protocol

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)

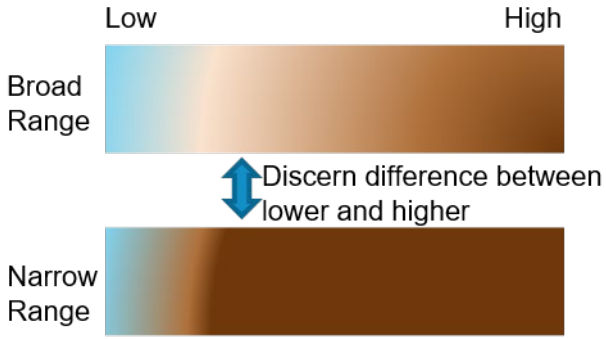
Other Secondary Endpoints:
- Duration of Response
- Safety

Prospectively-defined retrospective analysis seeks to validate NaPi2b biomarker cutoff with proposed commercial assay

The Optimal Diagnostic Assay is Robust, Predictive and Reproducible

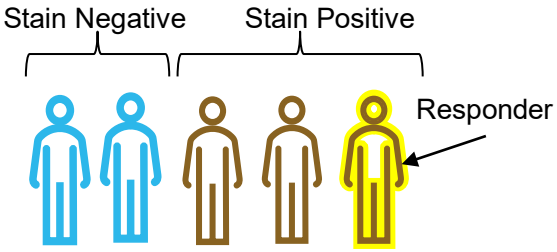
Robust

- Dynamic range allows for distinctions to be made between lower and higher expressors



Predictive

- Biomarker positive patients enriched for response



33% Respond with Biomarker
20% Respond without Biomarker

Reproducible

- Clear guidelines on how to read assay
- Can be performed outside of a central lab
- Reads the same regardless of lab

Reads the Same in

Athens, Greece

Athens, NY

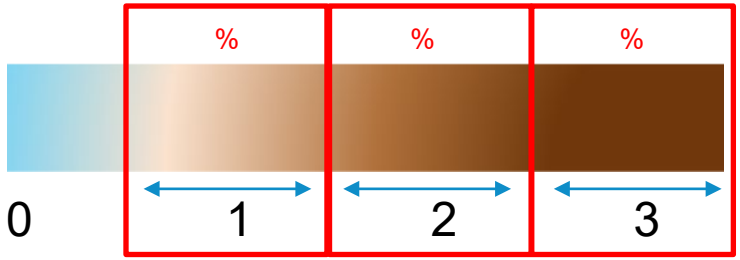
Athens, GA

Scoring Method Affects Reproducibility Across Readers and Labs

Numerical values are assigned according to brown intensity, but the reader is required to cut the data along a continuum

H-Score

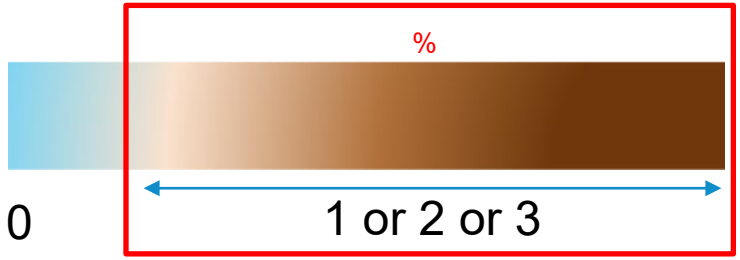
H =
(1 x percent “1+”) +
(2 x percent “2+”) +
(3 x percent “3+”)



Reader Must Distinguish Blue from Beige from Tan from Brown

Tumor Proportion Score

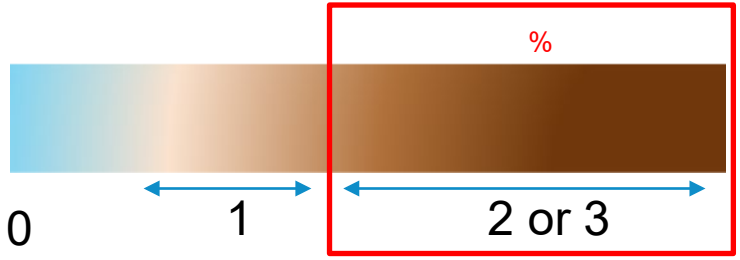
TPS =
Percent “1+” +
Percent “2+” +
Percent “3+”



Reader Must Distinguish Blue from any Brown

Tumor Proportion Score 2+ (PS2+)

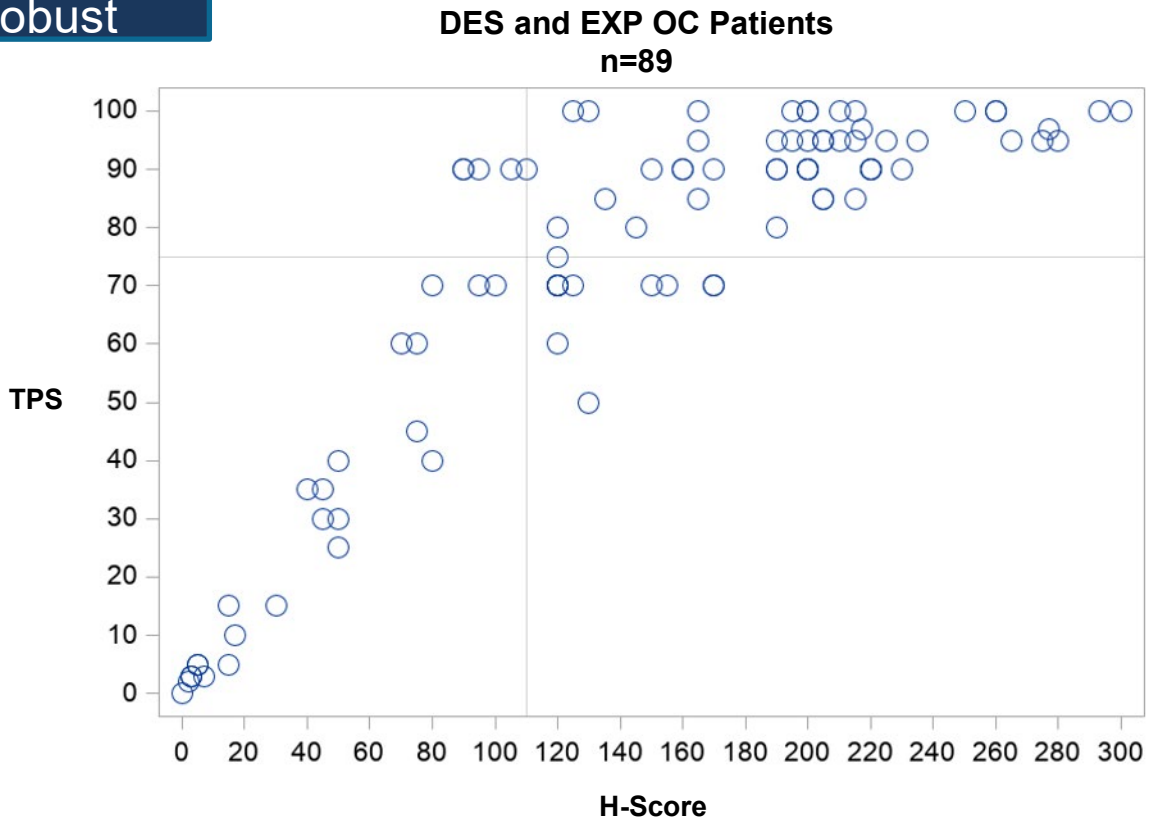
PS2+ =
Percent “2+” +
Percent “3+”



Reader Must Distinguish Tan from Beige

TPS is a Component of H-Score, is Correlated with H-Score and Offers Similar Prevalence

Robust



TPS ≥ 75% is 62% of samples tested

H-score ≥ 110 is 68% of samples tested

In the Clinic, TPS>=75 Selects for Enhanced Response

Predictive

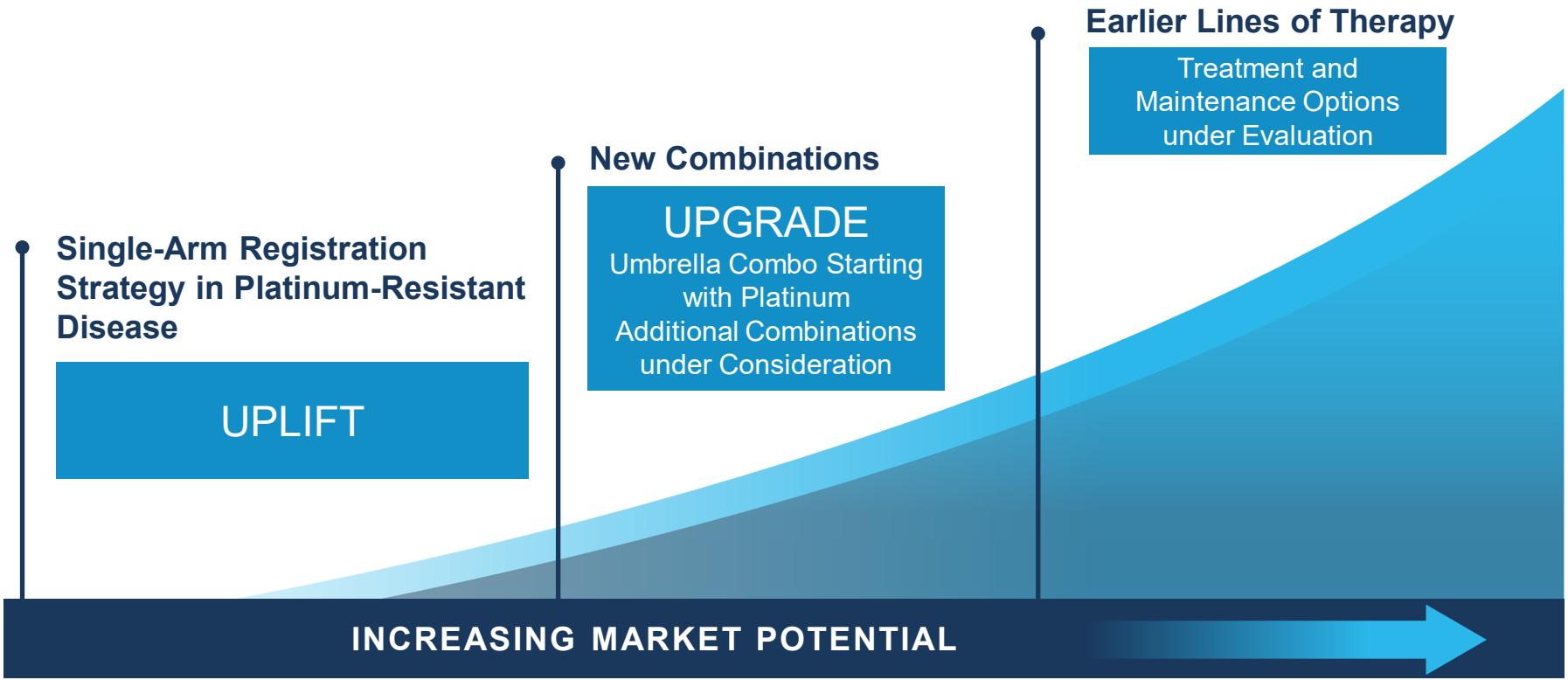
Best Response in Evaluable Patients with Ovarian Cancer by H-Score (n = 47)				
	All (n = 47)	Higher NaPi2b (n = 31)	Lower NaPi2b (n = 13)	NaPi2b Not Yet Determined (n = 3)
CR; n(%)	2 (4)	2 (6)	0	0
PR; n(%)	11 (23)	8 (26)	2 (15)	1 (33)
SD; n(%)	19 (40)	13 (42)	5 (38)	1 (33)
ORR; n (%)	**13 (28)**	**10 (32)**	**2 (15)**	**1 (33)**
DCR; n (%)	**32 (68)**	**23 (74)**	**7 (54)**	**2 (67)**

Higher NaPi2b Expression defined as at or above the lowest H-score at which response was observed in dose escalation (H-110)

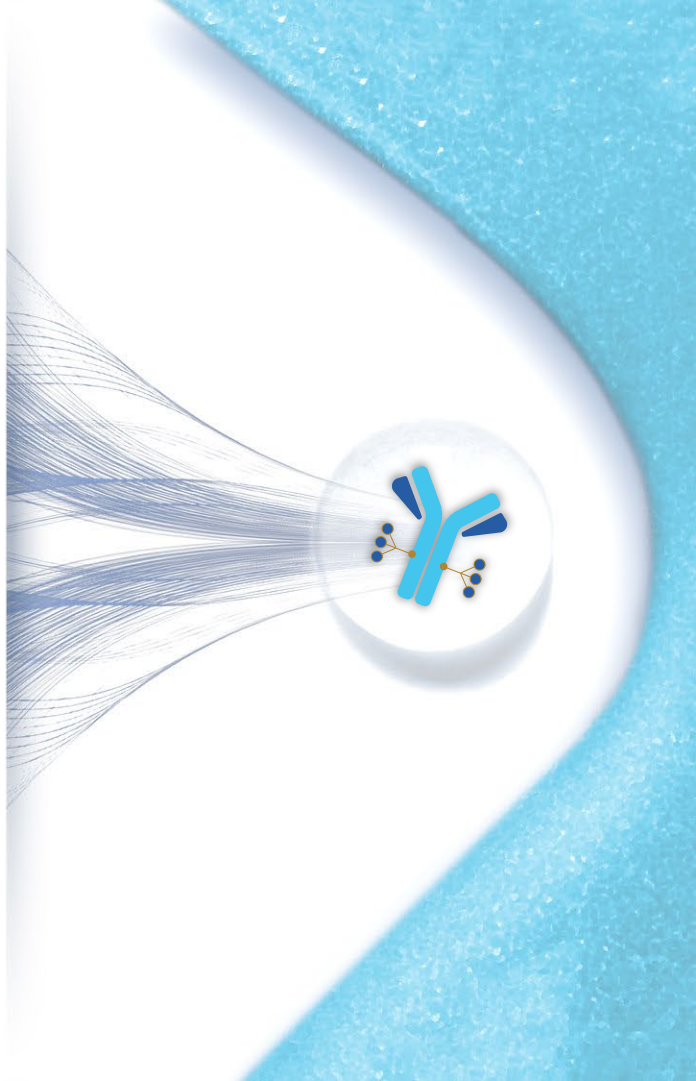
Best Response in Evaluable Patients with Ovarian Cancer by TPS (n = 47)				
	All (n = 47)	High NaPi2b (n = 26) TPS>=75	Low NaPi2b (n = 18) TPS<75	NaPi2b Not Yet Determined (n = 3)
CR; n(%)	2 (4)	2 (8)	0	0
PR; n(%)	11 (23)	8 (31)	2 (11)	1 (33)
SD; n(%)	19 (40)	11 (42)	7 (39)	1 (33)
ORR; n (%)	**13 (28)**	**10 (39)**	**2 (11)**	**1 (33)**
DCR; n (%)	**32 (68)**	**21 (81)**	**9 (50)**	**2 (67)**

Data Cutoff: December 3, 2020

UpRi (XMT-1536): An Opportunity to Deliver a Potentially Foundational Therapy for Ovarian Cancer



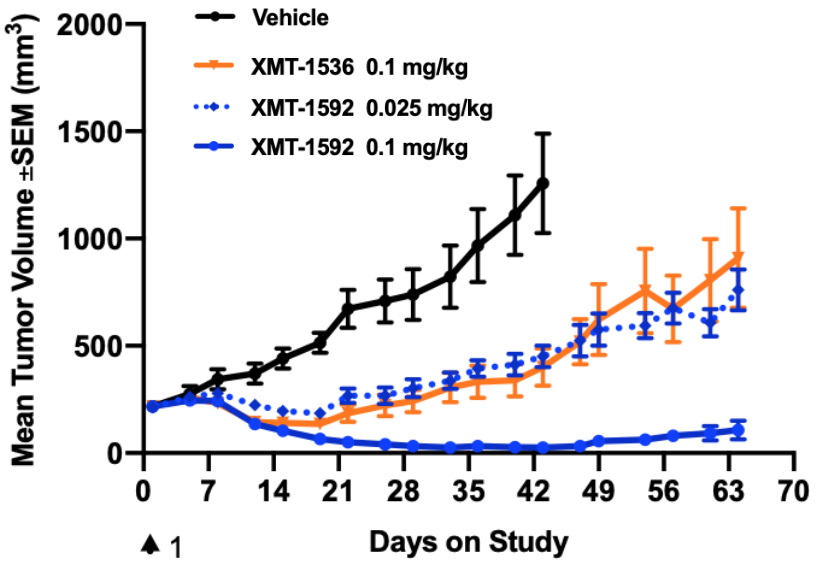
XMT-1592: Dolasynthen ADC Targeting NaPi2b



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

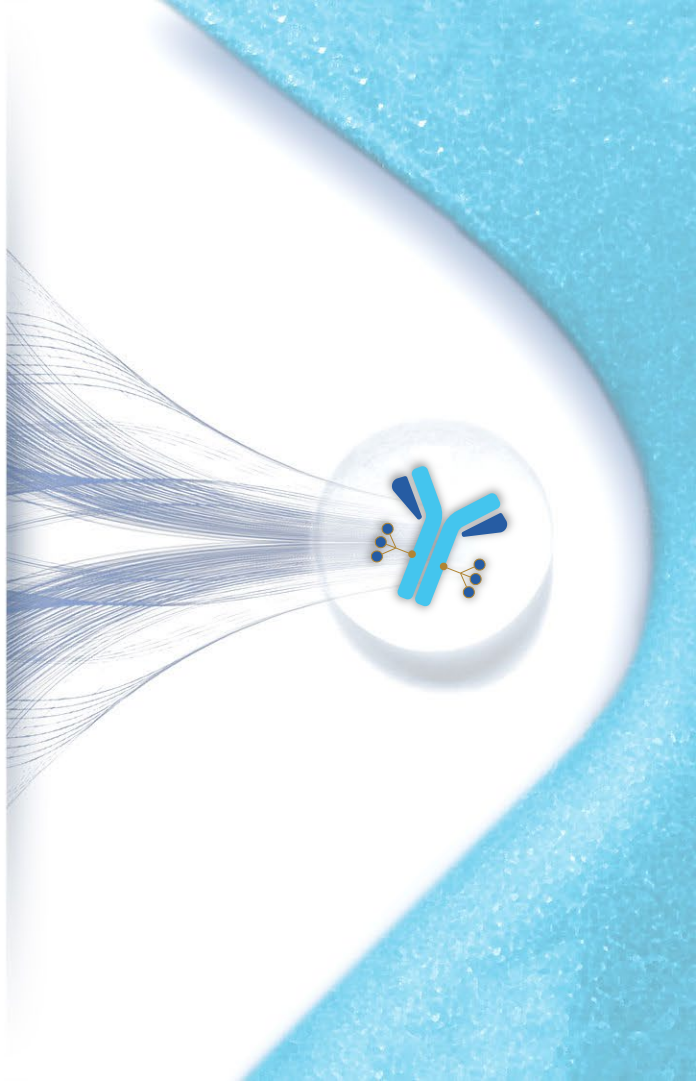
Molecular Attribute	XMT-1536	XMT-1592
Platform (scaffold)	Dolaflexin	Dolasynthen
Bioconjugation method	Stochastic	Site-Specific
DAR average	10-12	6
DAR distribution	Controlled Heterogeneity	Homogeneous

4X Greater Activity in Lung PDX

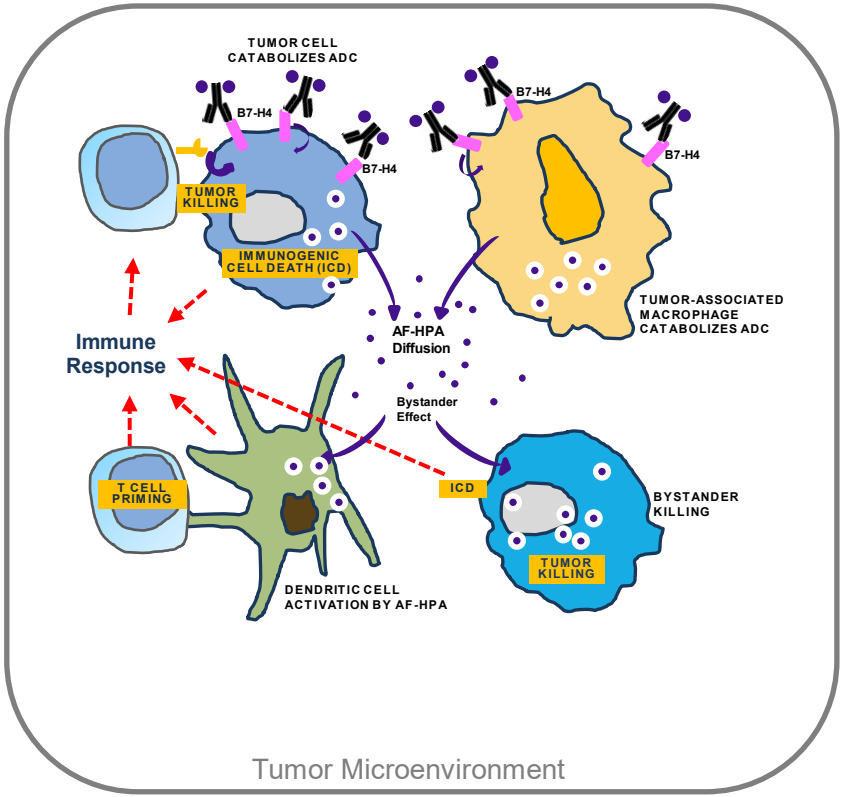


At least comparable tolerability at equal payload doses in NHP studies

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



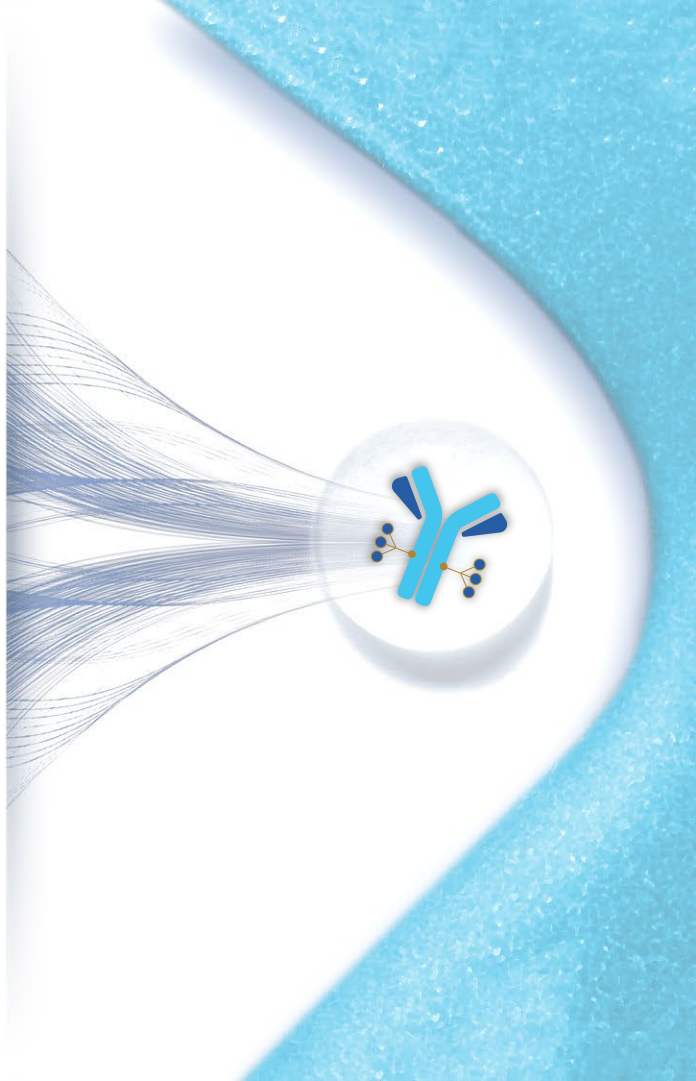
B7-H4 Expression Well-Suited for a DolaLock ADC



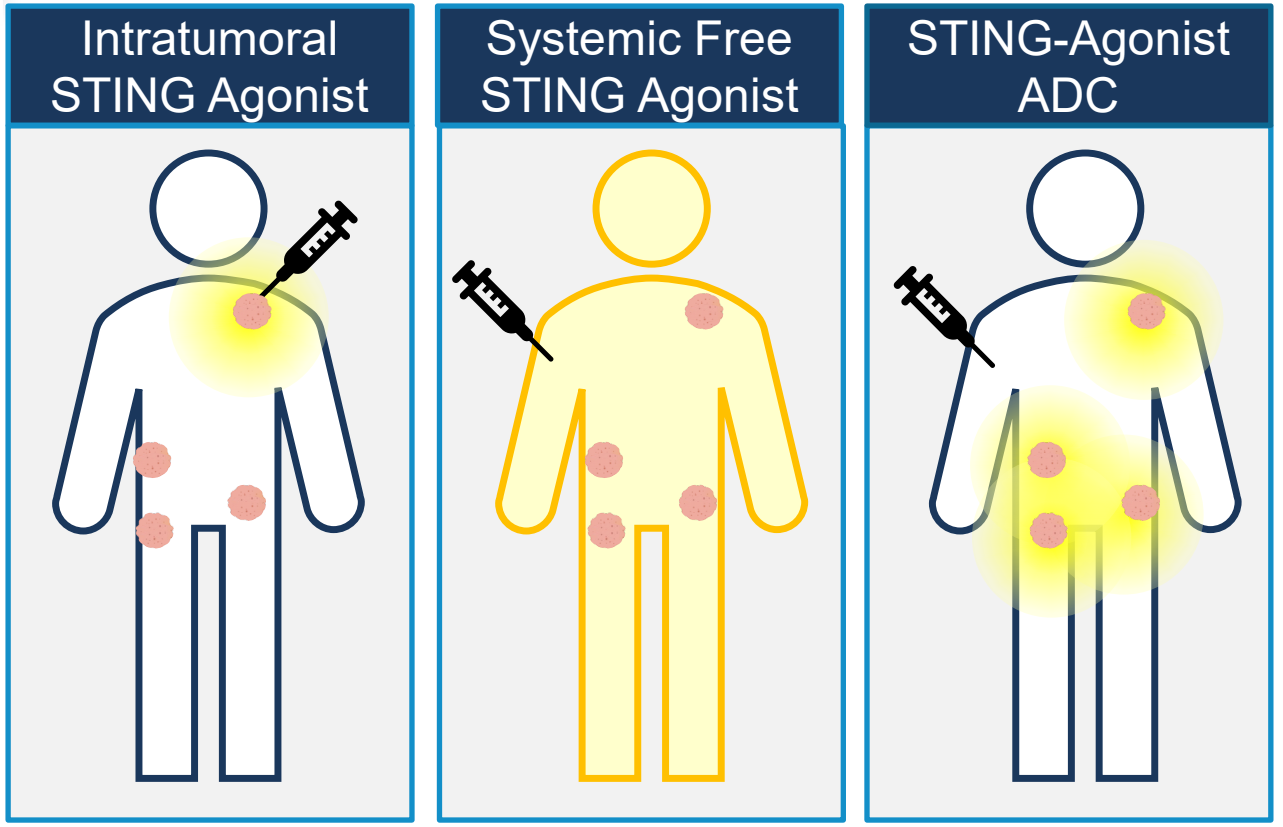
"The Perfect Storm"

- 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

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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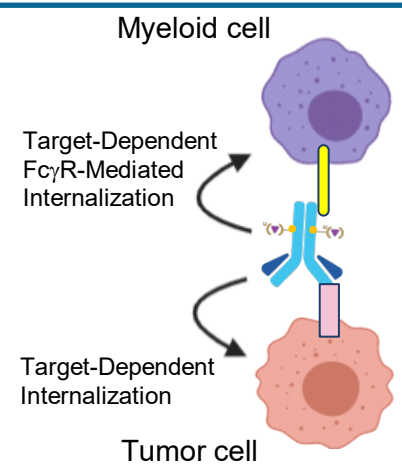
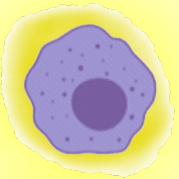
Tumor



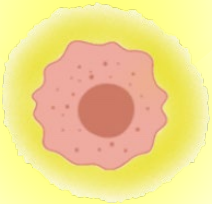
No internalization into undesired immune cells (T, B)

Hit the tumor-resident immune cells

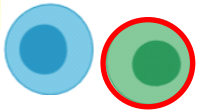
Hit the tumor cells



STING Activated in Myeloid Cell



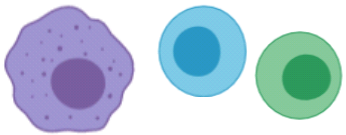
STING Activated in Tumor Cell



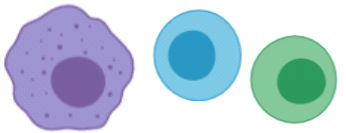
Stimulated T Cells

Periphery

No internalization into immune cells



No stimulation of immune cells

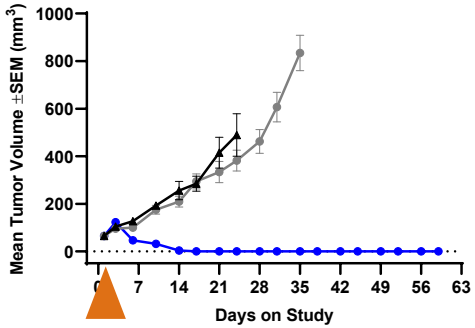


Immunosynthen ADCs Active Against Diverse Tumor Antigens and Tumor-Associated Antigens in Multiple Models After Single, Low IV Dose

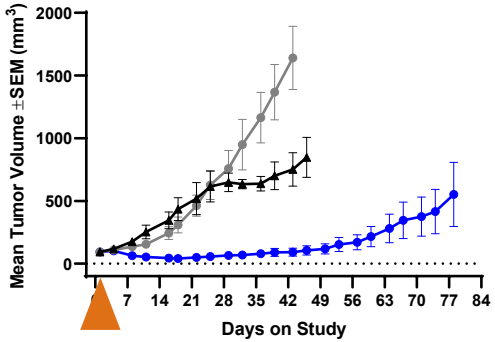
Legend

Vehicle
Control ADC
Targeted ADC

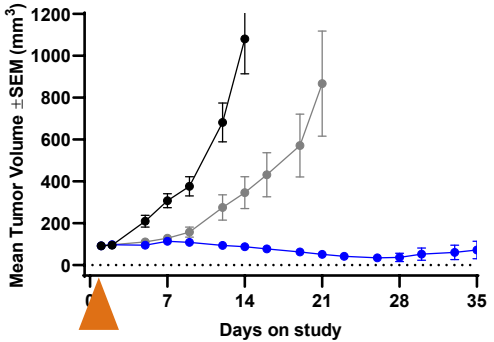
Tumor Antigen A
3.0 mg/kg



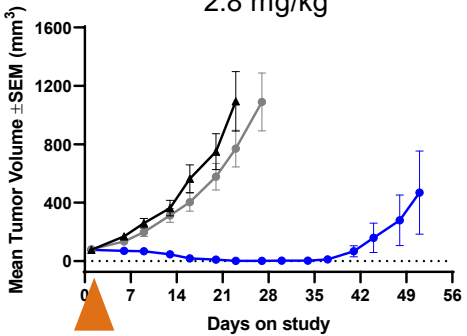
Tumor Antigen B
3.0 mg/kg



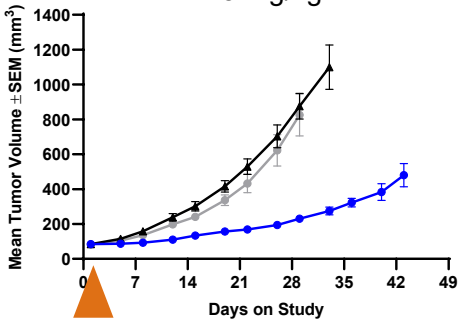
Tumor-Associated Antigen A
2.2 mg/kg



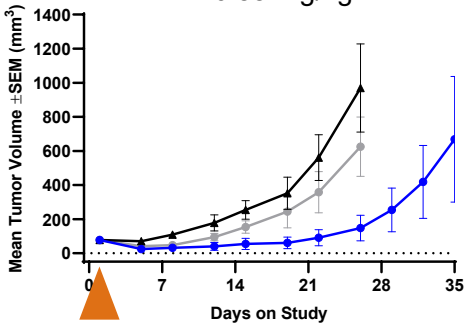
Tumor Antigen C
2.8 mg/kg



Tumor Antigen D
2.5 mg/kg



Tumor-Associated Antigen B
0.88 mg/kg



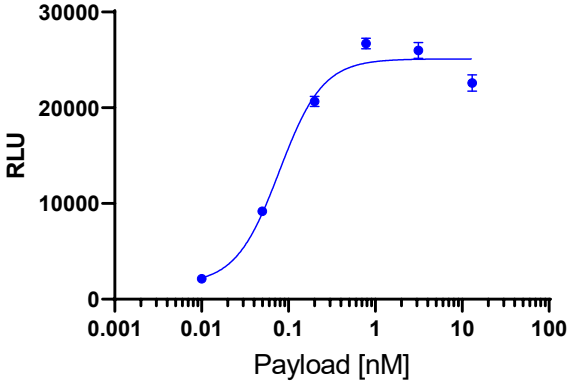
XMT-2056: First Immunosynthen Development Candidate

Summary of Data

Fc-mediated uptake and THP1 cell activation

IRF3 Reporter (THP1)

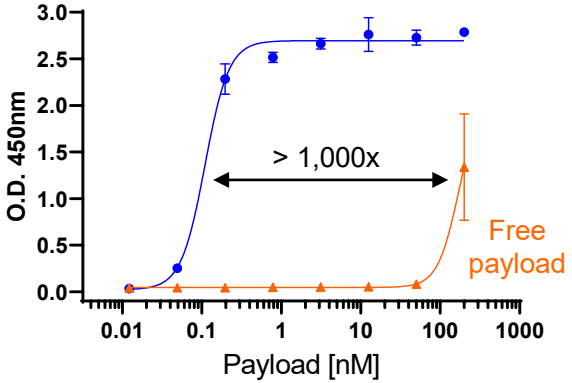
EC_{50} = 0.08 nM



Tumor cells with PBMCs

CXCL10 ELISA

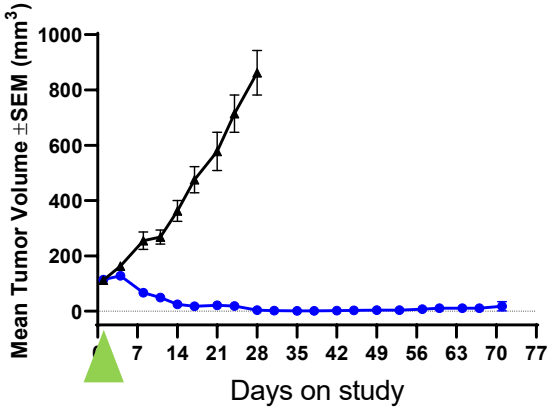
EC_{50} = 0.11 nM



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 for 2021

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 updated interim data from NSCLC expansion cohort
XMT-1592	• 2H 2021: Report dose escalation data • Q4 2021: Outline further development path
XMT-1660	• Q4 2021: Complete IND-enabling studies to initiate Phase I dose escalation in 2022
XMT-2056	• Q4 2021: Complete IND-enabling studies to initiate Phase I dose escalation in 2022 • Q4 2021: Disclose target
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	Ovarian Cancer	Dolaflexin						
		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