MUSTANGBIO

KOL Call on MB-106 for the Treatment of Relapsed or Refractory B-Cell Non-Hodgkin Lymphoma

December 9, 2020

Forward Looking Safe Harbor Statement

This presentation may contain "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934, each as amended. These statements are often, but not always, made through the use of words or phrases such as "anticipates", expects", plans", believes", "intends", and similar words or phrases. Such statements involve risks and uncertainties that could cause Mustang Bio's actual results to differ materially from the anticipated results and expectations expressed in these forward-looking statements. These statements are only predictions based on current information and expectations and involve a number of risks and uncertainties. Actual events or results may differ materially from those projected in any such statements due to various factors, including the risks and uncertainties inherent in clinical trials, drug development, and commercialization. You are cautioned not to place undue reliance on these forward-looking statements, which speak only as of the date hereof. All forward-looking statements are qualified in their entirety by this cautionary statement and Mustang Bio undertakes no obligation to update these statements, except as required by law. The information contained herein is intended to be reviewed in its totality, and any stipulations, conditions or provisos that apply to a given piece of information in one part of this presentation should be read as applying mutatis mutandis to every other instance of such information appearing herein.

MUSTANGBIO

Key Opinion Leader Call on MB-106 for the Treatment of Relapsed or Refractory B-Cell Non-Hodgkin Lymphoma

Mazyar Shadman, MD MPH

Brian Till, MD

Fred Hutch and University of Washington

Financial Disclosure

Mazyar Shadman

- Consulting, Advisory Boards, steering committees or data safety monitoring committees:
  - Abbvie, Genentech, AstraZeneca, Sound Biologics, Pharmacyclics, Verastem, ADC Therapeutics, Beigene, Cellectar, Bristol Myers Squibb, Morphosys, TG Therapeutics, Innate Pharma, and Atara Biotherapeutics
- Research Funding:
  - Mustang Bio, Celgene, Bristol Myers Squibb, Pharmacyclics, Gilead, Genentech, Abbvie, TG Therapeutics, Beigene, AstraZeneca, Sunesis, Beigene

Brian Till

- Patent/royalties and research funding from Mustang Bio for the CD20 CAR

Outline

1. Unmet needs in the era of immunotherapy for B-NHLs
2. ASH data for MB-106
3. Discussion and the current treatment landscape

Unmet needs in the era of immunotherapy for B-NHLs

Unmet needs in the era of immunotherapy for B-NHLs (1/2)

Point of reference: currently approved and investigational therapies

CAR-T therapy (autologous)

- **Pros**
- Long-term remissions in 30-40% of DLBCL pts and high CR rate in MCL
- One-time treatment, no need for multiple visits, outcomes are known relatively early
- **Cons**
- Treatment failure in 60-70% of DLBCL pts and short follow-up for MCL and FL
- CD19 antigen loss in ~ one-third of relapses
- Need for hospitalization (Yescarta and Tecartus)
- Toxicity: Grade ≥ 3 CRS : ~15% and Grade ≥ 3 ICANS: 20-30% with Yescarta and Tecartus

Bispecific Abs

Pros

- Promising clinical efficacy and Favorable safety profile with lower rate of high-grade CRS or ICANS
- Potential for outpatient treatment

Cons

- Multiple visits and infusions/injections
- Long treatment period: months, years, indefinite?

Allo-CARs and CAR-NK

- Early data, logistics, cost
- Anti CD52 ab use in alloCARs (ALLO-501) ➔ risk of infection?

Vision: A CAR-T product given in the outpatient setting and has improved efficacy with minimal toxicity

FRED HUTCH

Unmet needs in the era of immunotherapy for B-NHLs (2/2)

Point of reference: currently approved therapies

- Chronic Lymphocytic Leukemia (CLL)
  - A unique disease among B-NHLs given the current therapeutic options and effective treatments
  - Treatments are effective and the focus is on:
    1. Time-limited therapy (venetoclax-based)
    2. Better safety profile (next generation BCRis)
    3. Improved efficacy in high-risk patients (10-20%)
  - **The bar is much higher for safety profile for any potential CAR-T product for CLL**
  - A CAR-T product with a great safety profile can potentially be used in the MRD positive setting in earlier lines of therapy

Safety profile could be differentiating factor in CLL for any CAR-T product given the competitive landscape

ASH presentation

Third Generation CD20 targeted CAR T-Cell therapy (MB-106) for Treatment of Patients with Relapsed/Refractory B-NHL

Mazyar Shadman, MD MPH [1,2], Cecilia Yeung, MD [1,2], Mary W Redman, PhD [1], Sang Yun Lee, Ph.D. [1], Dong Hoon Lee, B.S. [1], Ajeetha Ramachandran, PhD, [3] Susan Ra, BS [1], Edmond A Marzbani [2], MD, Solomon A. Graf [1,2], MD, Edus H. Warren, MD, PhD, [1,2] Ajay K. Gopal, MD [1,2], Aude G. Chapuis, MD [1,2], Merav Bar, MD [1,2], Damian J. Green, MD [1,2], Jordan Gauthier, MD, MSc [1,2], Ryan D. Cassaday, MD [1,2], Hans-Peter Kiem, MD, PhD [1,2], Cameron J. Turtle, MBBS, PhD [1,2], David G. Maloney, MD, PhD [1,2], Brian G. Till, MD [1,2]

1. Fred Hutchinson Cancer Research Center, Seattle WA
2. University of Washington, Seattle WA
3. Mustang Bio, Worcester, MA

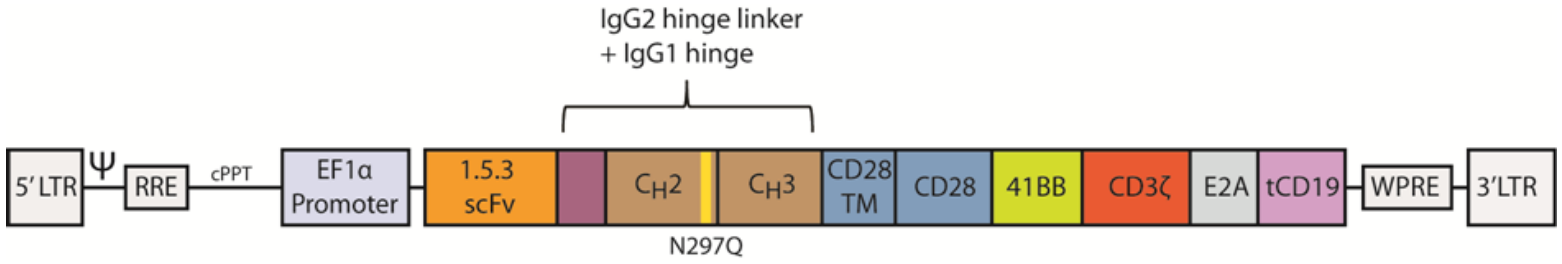
Abstract 1143
62nd ASH Annual Meeting

Background

- Chimeric antigen receptor (CAR) adoptive T cell therapy is effective for treatment of patients with relapsed/refractory B-NHL
- Only 30-40% of DLBCL patients have durable remissions with CD19 CARs and there is limited follow-up for MCL patients treated with CD19 CARs
- CD20 is a proven therapeutic target for B-NHL, supported by previously approved naked and radiolabeled anti-CD20 antibodies and promising efficacy from bispecific antibodies
- CD20-targeted CAR-T is another potential adoptive immunotherapy option that could be utilized in combination or in sequence with CD19 CAR-T
- We present interim results of our ongoing phase I/II clinical trial investigating safety and efficacy of a CD20 CAR-T for high-risk B-NHLs (NCT03277729)

CD20 CAR (MB-106)

- MB-106 is a fully human third-generation CD20 targeted CAR with both 4-1BB and CD28 costimulatory domains
- Modified IgG1 spacer eliminates FcR binding
- Truncated CD19 transduction marker
- Lentiviral vector

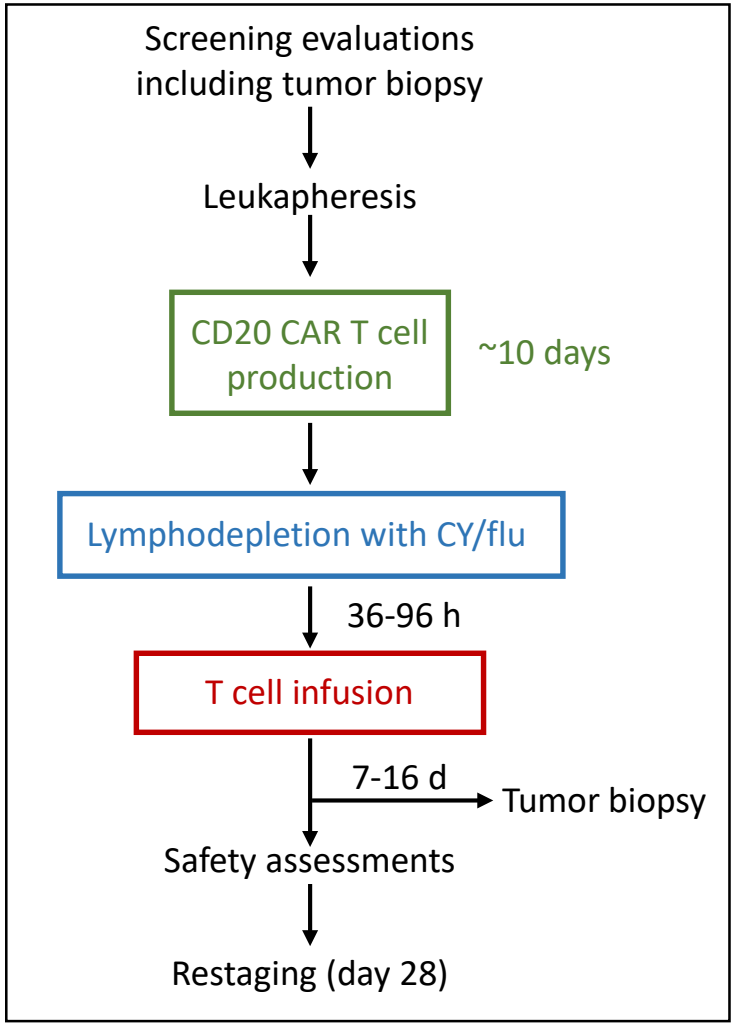


Dr. Brian Till's Lab – Fred Hutch

Abstract 1443 #ASH2020
@mshadman

Study Design

- Single institution phase I/II study
- Eligibility: $CD20^+$ B-NHLs
  - Large cell lymphoma after 2 lines of treatment
  - Follicular lymphoma and mantle cell lymphoma after at least 1 prior line of treatment
  - Other previously treated B-NHLs
  - Prior treatment with a CD19 CAR is allowed after recovery of normal B cells (≥ 20 B cells/µL)
- Lymphodepletion (LD):
  - Cyclophosphamide and Fludarabine (Cy-Flu)
- Dose levels (DL):
  - Dose level 0: 1×10^5 cells/kg
  - **Dose level 1: 3.3×10^5 cells/kg**
  - Dose level 2: 1×10^6 cells/kg
  - Dose level 3: 3.3×10^6 cells/kg
  - Dose level 4: 1×10^7 cells/kg



Abstract 1443 #ASH2020
@mshadman

Study Timeline

- "Original" cell manufacturing process (2017-2019):
  - Separate culturing of $CD4^+$ and $CD8^+$ cells
  - Variable lymphodepleting regimens (Cy alone or in combination with Flu) were used
  - 7 pts (3 FL, 3 MCL, 1 hairy cell variant) were treated with best response being stable disease (SD)
  - Due to challenges in meeting target cell doses, poor CAR-T expansion, and lack of clinical responses, enrollment was placed on hold and cell manufacturing process underwent a major revision
- "Modified" cell manufacturing process
  - Starting 2019 (enrollment is ongoing)
  - Manufacturing process was changed to combined culture of $CD4^+$ and $CD8^+$ cells
  - **As of 11/18/2020, 10 patients have undergone leukapheresis and 9 patients have reached the day 28 assessment for safety and efficacy**

- **For this presentation, we present the safety data from both the original and modified processes (n=16) and the efficacy data from the modified process (n=9)**

Results: Patient Characteristics

Patients treated with “modified process” and had day 28 evaluation (**N=9**)

Age, median (range)	**57 (43-67)**
Female sex, n(%)	**5 (55%)**
Follicular Lymphoma n(%)	**7 (78%)**
POD24	5/7 (71%)
History of transformation	3/7 (43%)
Prior lines of therapy median (range)	4 (2-7)
Prior Pi3K inhibitor	2/7 (28%)
Mantle Cell Lymphoma n(%)	**2 (22%)**
Prior lines of therapy median (range)	6 (5-7)
Prior ASCT	2/2 (100%)
Prior BTK inhibitor	2/2 (100%)
Pretreatment LDH (U/L) median (range)	**140 (103-216)**

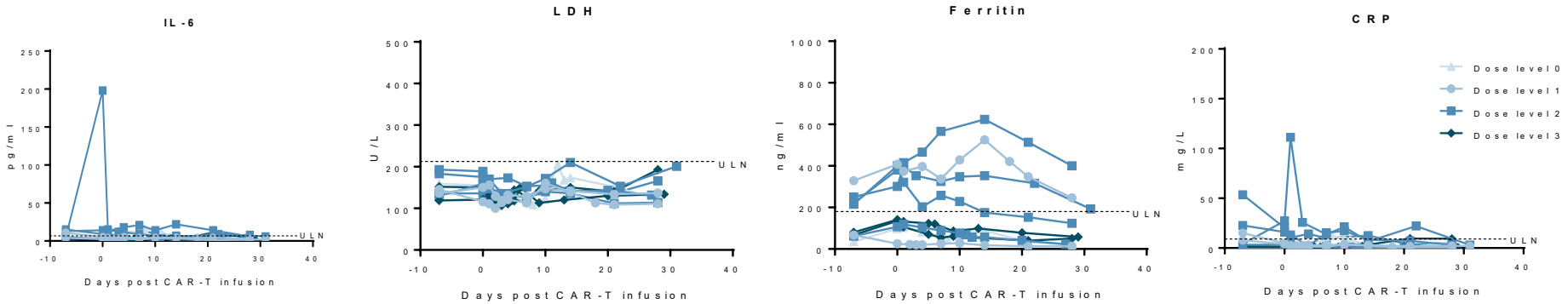
ASCT: Autologous stem cell transplant
BTK: Bruton tyrosine kinase
Pi3K: Phosphoinositide 3-kinases
POD24: Progression of disease within 24 months after last dose of first line chemotherapy for FL

Results: Safety

Patients treated with “original: and “modified” processes and had day 28 evaluation (**N=16**)

AE of interest	Grade 1 n (%)	Grade 2 n (%)	Grade 3 n (%)	Grade 4 n (%)	Grade 5 n (%)	All grades n (%)
Cytokine Release Syndrome[1]	1 (6%)	-	1† (6%)	-	-	2 (12%)
ICANS [2]	-	-	-	-	-	-
Tumor Lysis Syndrome	-	-	-	-	-	-
Infections	-	-	2 (12%)	-	-	2 (12%)
Neutropenia	-	1 (6%)	3 (18%)	9 (56%)		13 (81%)

† unexplained elevated alkaline phosphatase in the setting of fever



1- Lee et al, Blood, 2014 ; 2- Lee, et al, BBMT, 2019

Abstract 1443 #ASH2020
@mshadman

Results: Efficacy

Patients treated with "modified process" and had day 28 evaluation (**N=9**)

Histology	**Response by Lugano PET criteria** †	**All dose levels**	Dose level 0 (n=1)	Dose level 1 (n=2)	Dose level 2 (n=4)	Dose level 3 (n=2)
			1 x 10^5 cells/kg	3.3 x 10^5 cells/kg	1 x 10^6 cells/kg	3.3 x 10^6 cells/kg
FL (n=7)						
	ORR, n(%)	**6/7 (85%)**	1/1	1/2	2/2	2/2
	CR, n(%)	**4/7 (57%)**	-	1/2	1/2	2/2
	PR,n (%)	**2/7 (28%)**	1/1	-	1/2	-
	SD,n (%)	**-**	-	-	-	--
	PD,n (%)	**1/7 (14%)**	-	1/2	-	-
MCL (n=2)						
	ORR, n(%)	**2/2 (100%)**	-	-	2/2	-
	CR,n(%)		-	-	-	-
	PR,n (%)	**2/2 (100%)**	-	-	2/2	-
	SD,n (%)		-	-	-	-
	PD,n (%)		-	-	-	-
All patients (n=9)						
	ORR, n(%)	**8/9 (89%)**	1/1 (100%)	1/2 (50%)	4/4 (100%)	2/2 (100%)
	CR, n(%)	**4/9 (44%)**		1/2 (50%)	1/4 (25%)	2/2 (100%)

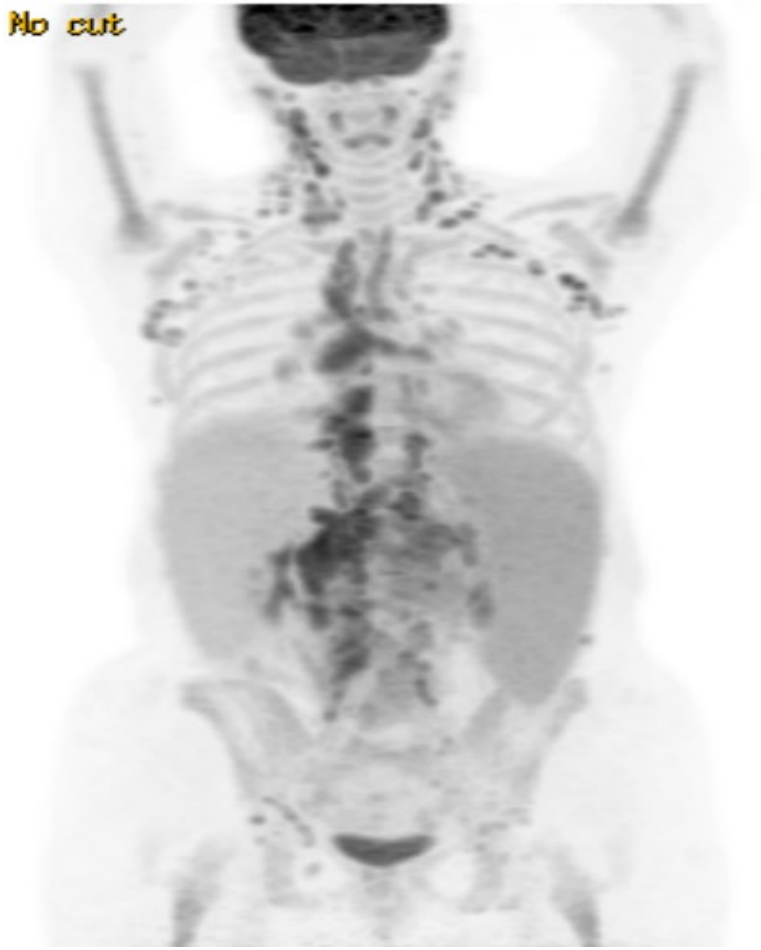
†Cheson, et al. J Clin Oncol, 2014

Abstract 1443 #ASH2020
@mshadman

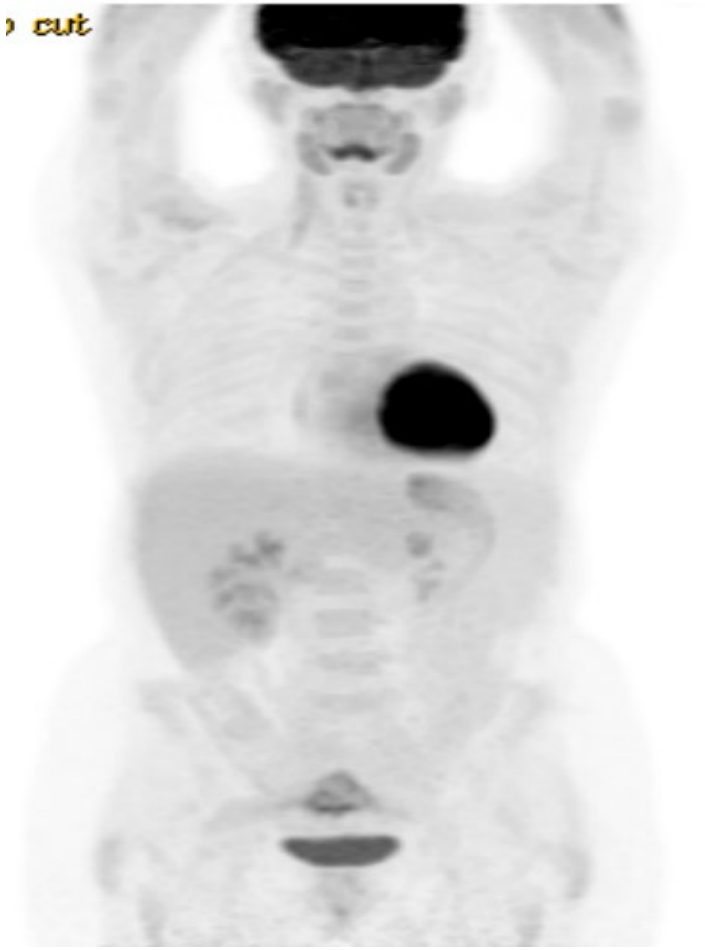
FL Patient with Partial Response

Dose level 2 (1 x 10^6 cells/kg)

Baseline



Day 28 post CAR-T infusion

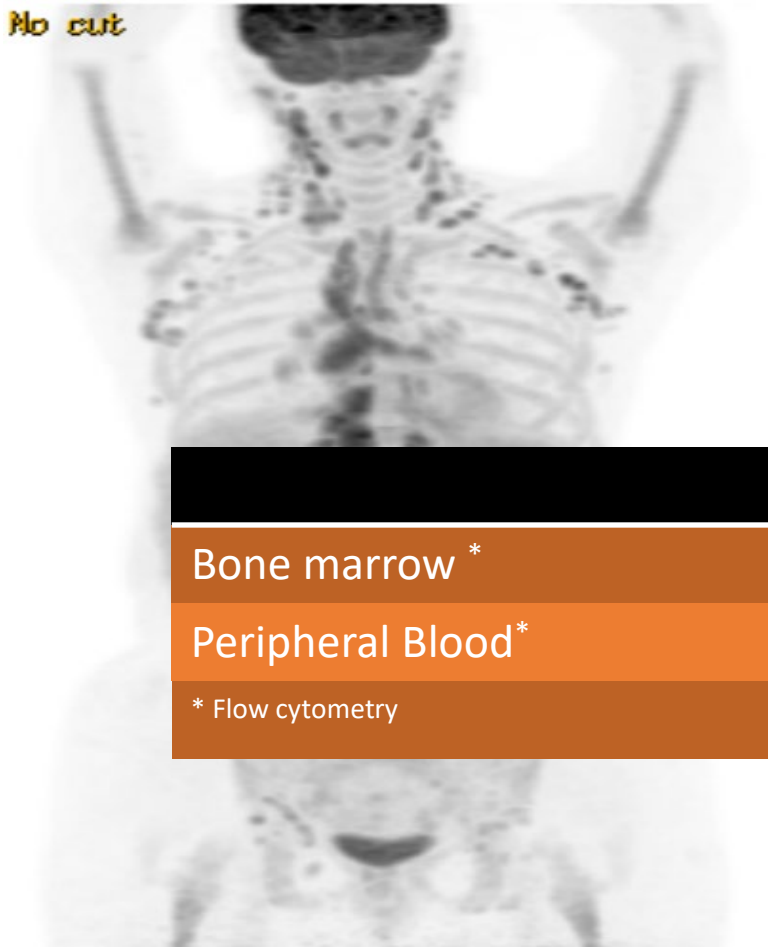


FRED HUTCH

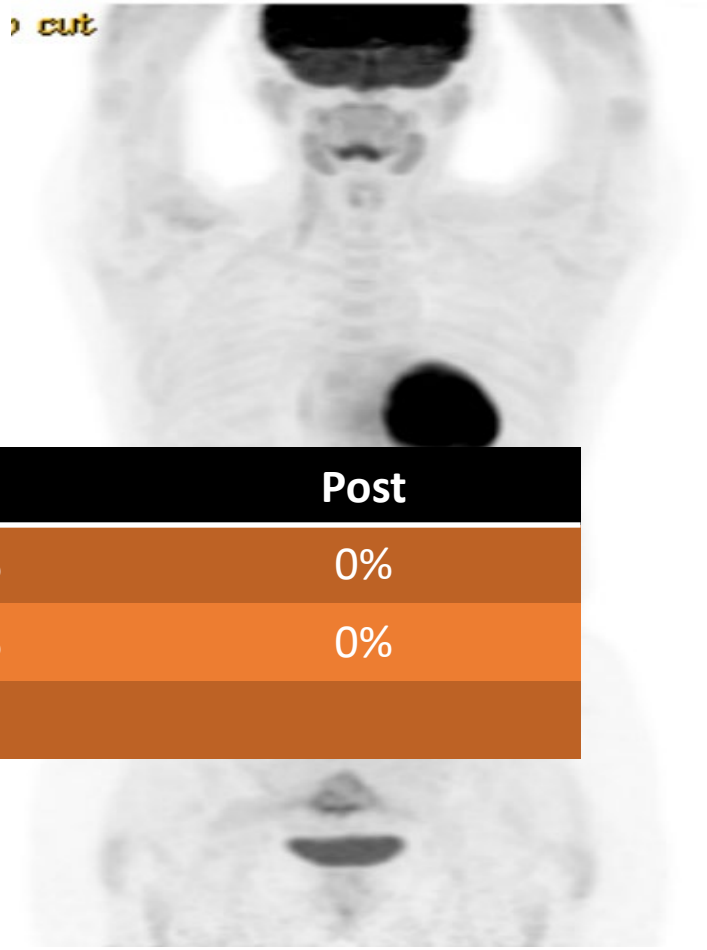
FL Patient with Partial Response

Dose level 2 (1 x 10^6 cells/kg)

Baseline



Day 28 post CAR-T infusion

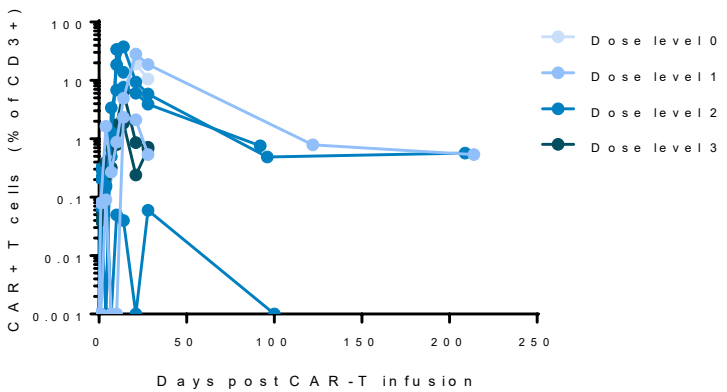


	Pre	Post
Bone marrow *	61%	0%
Peripheral Blood*	59%	0%

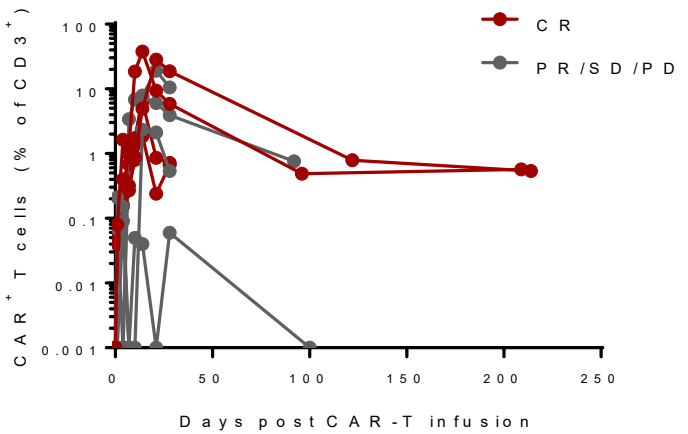
* Flow cytometry

Results: CAR-T persistence

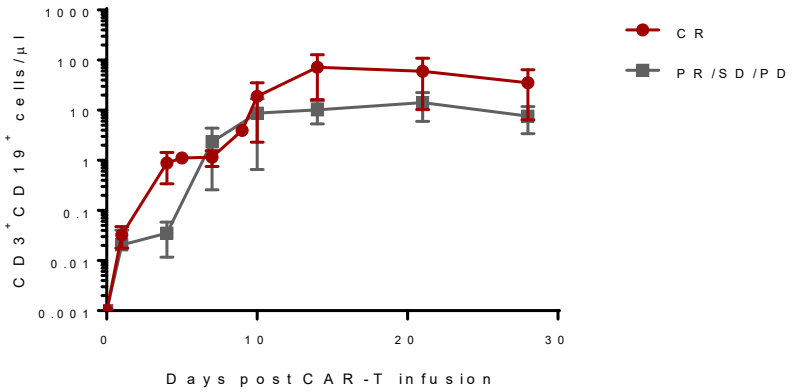
Expansion in individual patients by dose level



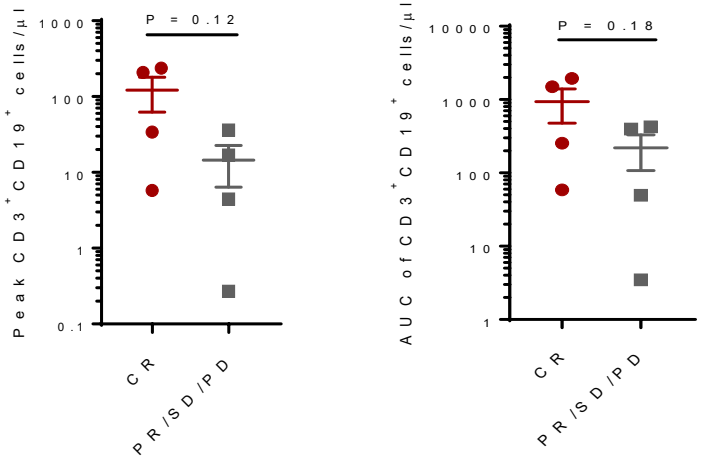
Expansion in individual patients by response



Expansion in all patients by response



Expansion in CR patients vs. others



FRED HUTCH

Summary

- MB-106 is a third generation fully human CD20 targeted CAR-T cell therapy for treatment of B-NHLs.
- Safety: Extremely favorable safety profile has been observed:
  - CRS in 2 of 16 patients (all grades)
  - no ICANS
- Efficacy: High overall and complete responses with “modified process”:
  - FL patients : ORR 85% ; CR 57%
  - All patients: ORR 89% ; CR 44%
  - Robust CAR-T expansion and persistence
- Enrollment continues for the current study. All CD20+ NHL are eligible. CLL pts are also eligible with the new amendment (NCT03277729)
- A multicenter phase 2 study is planned

Discussion and the current treatment landscape

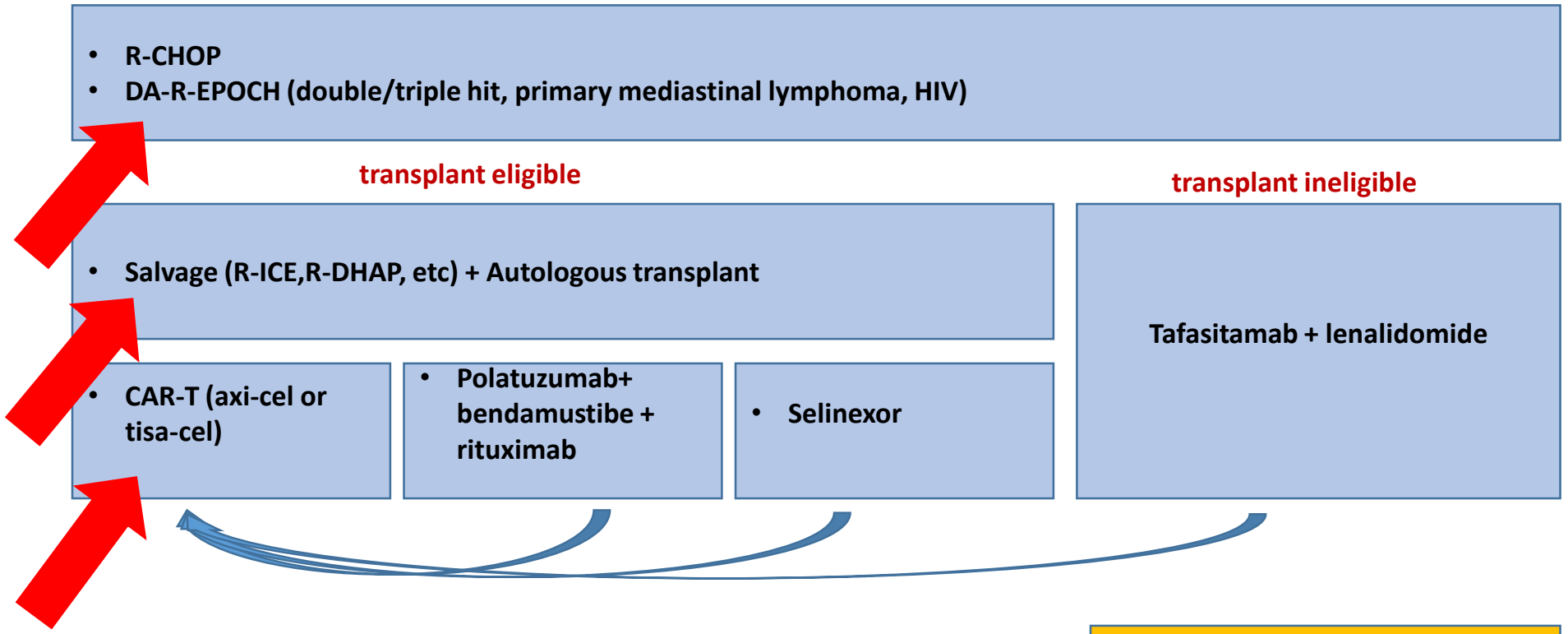
Potential role of MB-106 in current landscape

- Early signal of very favorable safety profile compared with CD19 CARs
- High response rates in FL suggest potent activity
- Good CAR-T persistence, all CR patients remain in remission
- Data on MCL limited, and no data on DLBCL yet
- Compared with bispecific:
  - Single infusion
  - Favorable safety (28% CRS with mosunetuzumab)
  - Favorable efficacy in indolent NHL (mosun 64% ORR, 42% CR)

Safety of MB-106 compared with other CAR-T for NHL

	Axi-cel	Brexu-cel	Tisa-cel	Liso-cel	CD19/20 CAR (MCW)	CD19/20 CAR (China)	Mosunu-tuzumab	MB-106 (all)	MB-106 (modified process)
CRS (any)	91-93%	91%	45-57%	42-74%	64%	50%	28%	12.5%	11%
CRS (Gr ≥3)	7-13%	15%	4.5-17%	2-5%	5%	14%	1.4%	6%* *Elev Alk phos	0%
ICANS (any)	64-69%	63%	18-20%	30-32%	32%	21%	1.4%	0%	0%
ICANS (Gr ≥3)	19-31%	31%	7.5-11%	9-16%	14%	0%	0%	0%	0%
Tociliz-umab	43-62%	59%	19-25%	18%	32%	17%		6%	0%
ICU	7-17%		42%	3%	5%			0%	0%
Cortico-steroids	27-55%	38%	11%	10%	32%			0%	0%

Large Cell Lymphomas



Coming:
- CD19 CAR-T (liso-cel)
- CAR-Ts in second line

Follicular Lymphoma (FL)

- Chemo+anti CD20 ab

- anti CD20 maintenance (not an universal approach)
- radioimmunotherapy (antiCD20)

Late release (more than 24 months)

- Lenalidomide + rituximab
- Chemo+anti CD20 ab

Early relapse (within 24 months -POD)

- Achieve a remission (trial)
- autologous vs. allogeneic transplant

idelalisib

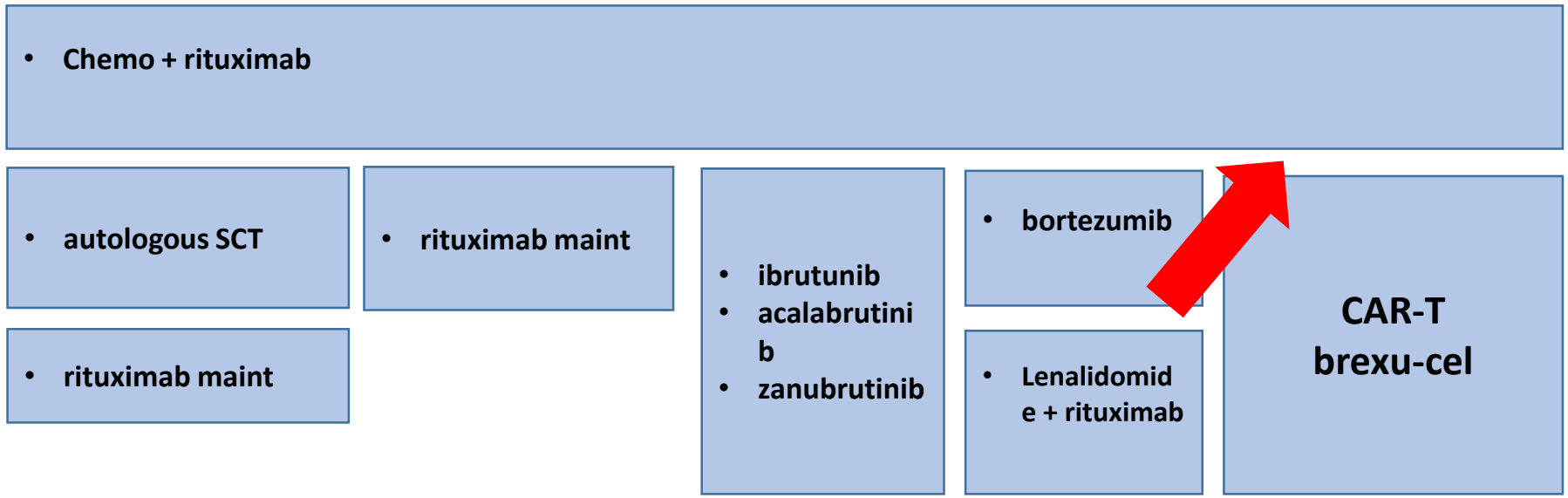
duvelisib

copanlisib

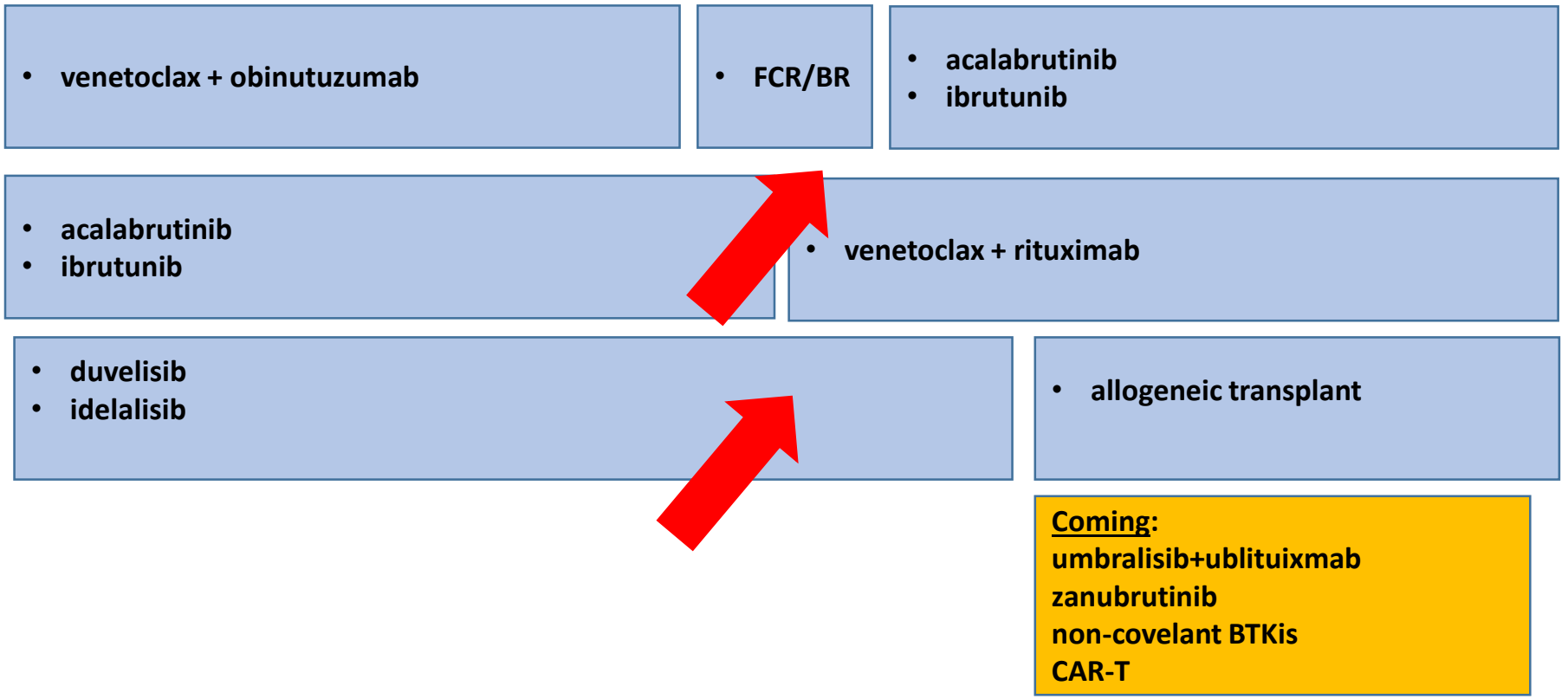
tazematostat (EZH2 mutation or no options)

Coming:
- CD19 CART (axi-cel)
- bispecific abs (CD3/CD20) mosunutuzumab

Mantle Cell Lymphoma (MCL)



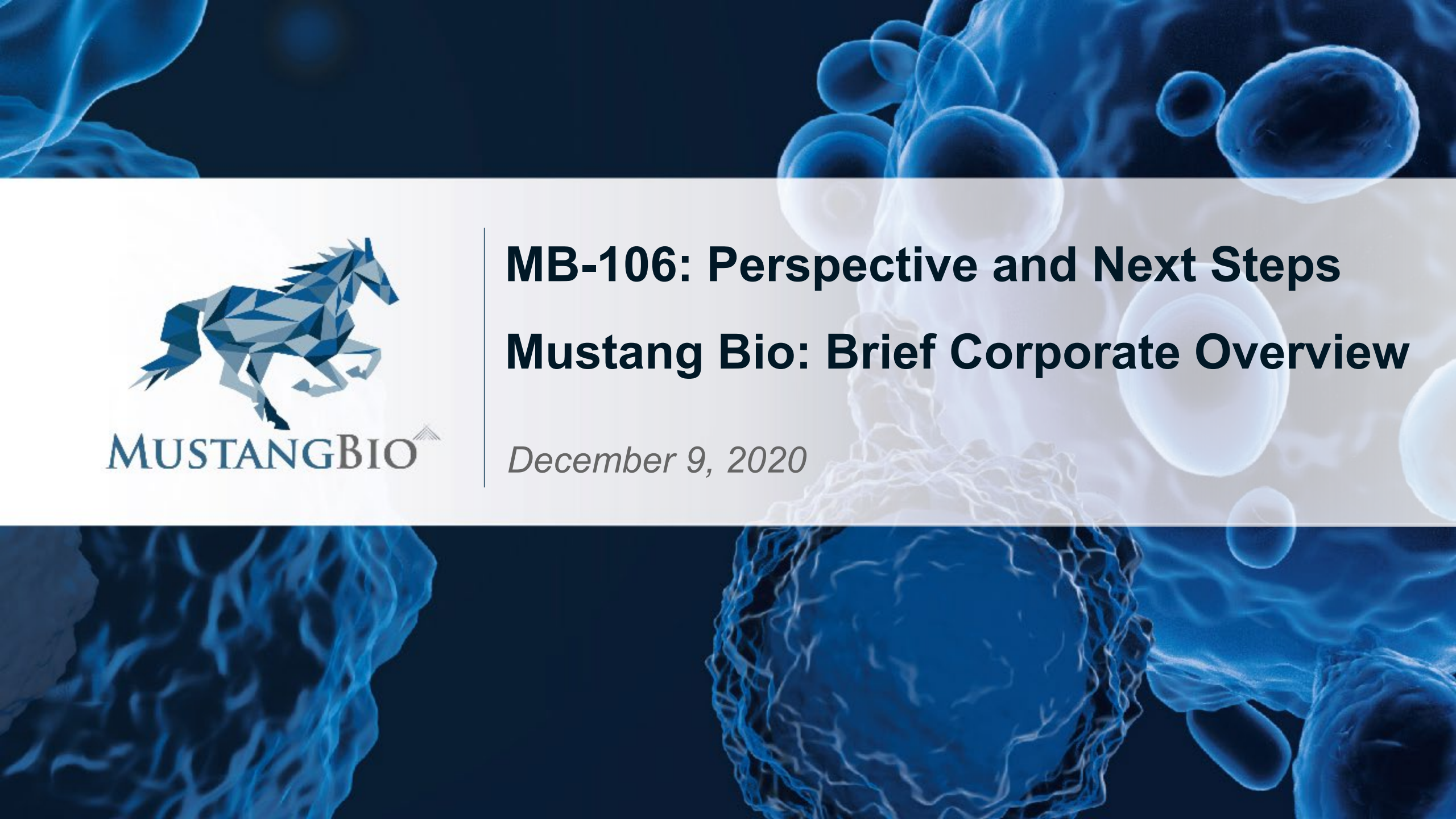
Chronic Lymphocytic Leukemia (CLL)



Liso-cel in CLL

	Liso-cel monotherapy [1]	Liso-cel with ibrutinib [2]
N	23	19
All CRS	74%	74%
Grade ≥ 3 CRS	9%	5%
All NE	39%	32%
Grade ≥ 3 NE	22%	16%
ORR	82%	95%
CR	46%	63%
uMRD4 PB	75%	89%
uMRD4 BM	65%	79%

Wierda,ASH,2020 ; Siddiqi,ASH,2020



MB-106: Perspective and Next Steps

Mustang Bio: Brief Corporate Overview

December 9, 2020

MB-106: Competitive Considerations

- Emerging from ASH 2020, we see exciting momentum for MB-106 – including visibility into multicenter trial
  - MB-106 is potentially a highly active CAR-T even at low doses
    - ORR & CR so far are in the range of other cell therapies & bispecifics – allowing for small patient numbers
    - Considering dose level 3, potential exists for a dose-response relationship
  - MB-106 has shown a safety profile that is emerging as potentially superior to bispecifics & all other cell therapies
  - As an autologous CAR-T, the manufacturing & regulatory risks of MB-106 are potentially lower – and, in some cases, potentially far lower – than the risks associated with allogeneic CAR-Ts & other cell therapies
  - The cost of goods is highly competitive vis-à-vis bispecifics & all other cell therapies
  - As a result of its superior safety profile
    - We believe MB-106 will be able to be administered in an outpatient setting at a far wider range of medical centers than the currently approved CAR-Ts, as well as allogeneic CAR-Ts & other cell therapies
    - We believe the total burden to the health care system will be substantially lower than for bispecifics & all other cell therapies
- With continued dose escalation in 2021, we hope to build an even more competitive profile for MB-106
  - Sustain compelling activity at the current 3.3 x 10^6 cells/kg dose level (now 2/2 CRs) and beyond
  - Demonstrate best-in-class duration of response
  - Maintain superior safety
  - Replicate results as we expand into CLL & NHL relapsed from CD19 CAR-T

MUSTANGBIO

Autologous CAR-T Carries Lower CMC Risk vs. Other Cell Therapies

Issues well understood by FDA & industry – minimizes chance of CMC hold, CRL

- **Allogenic CAR-Ts**
  - Graft-vs-host disease – though apparently not an issue in recent trials – remains a risk for large-scale development
  - Host-vs-graft response leads to depletion of CAR-Ts in patient
    - Re-dosing required, but this strategy may be ineffective due to potential for patients to develop immunity against CAR-T cells
    - Strategies to prevent this response (e.g., Allogene's CD52 antibody) may lead to delayed T-cell recovery & increased infection risk
  - Promise of superior cost of goods (COGs) has not yet been realized, though off-the-shelf products do appear to offer faster time to treatment
    - Insufficient gene editing requires sorting step to minimize non-edited cells in product ⇒ significant cost
    - Additional QC assay for release of product required, e.g., HLA presence ⇒ significant cost
    - Batch sizes likely limited by exhaustion of T-cells during *ex vivo* expansion – which would result in diminished product efficacy
- **NK cells – heterogeneous group of products, including NK cells (FATE, Gamida) & CAR-NK cells (FATE, MDACC)**
  - Manufacturing is very different, in particular for products generated *ex vivo* from iPSCs (FATE) or cord blood (MDACC)
    - May involve expensive cultures, especially at large scale needed for allogeneic batches
    - Need to prove that final product is not contaminated by other cells from starting material
      - Expensive assays to establish and run
  - NK cells are fragile & do not freeze well
    - Limited experience with frozen cells in clinic to-date
    - Long term storage could pose a challenge
  - Due to short life span for some products, re-dosing may be required
  - Unlike T-cells, NK cells may not proliferate well *in vivo* – might lead to larges dose requirements, high COGs

MUSTANGBIO

MB-106: Next Steps

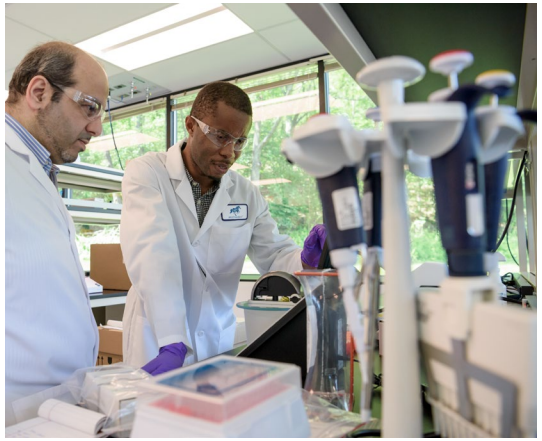
- FHCRC
  - Continue dose escalation
    - Complete dose level 3: 3.3 x 10^6 CAR-T cells/kg
    - Escalate to dose level 4: 1x10^7 CAR T cells/kg)
  - Start enrolling CLL patients

- Mustang
  - Tech transfer underway from FHCRC to Mustang facility in Worcester, MA
  - Anticipate written response in January 2021 to pre-IND meeting request
  - IND filing 1Q2021

MUSTANGBIO

Mustang Bio:

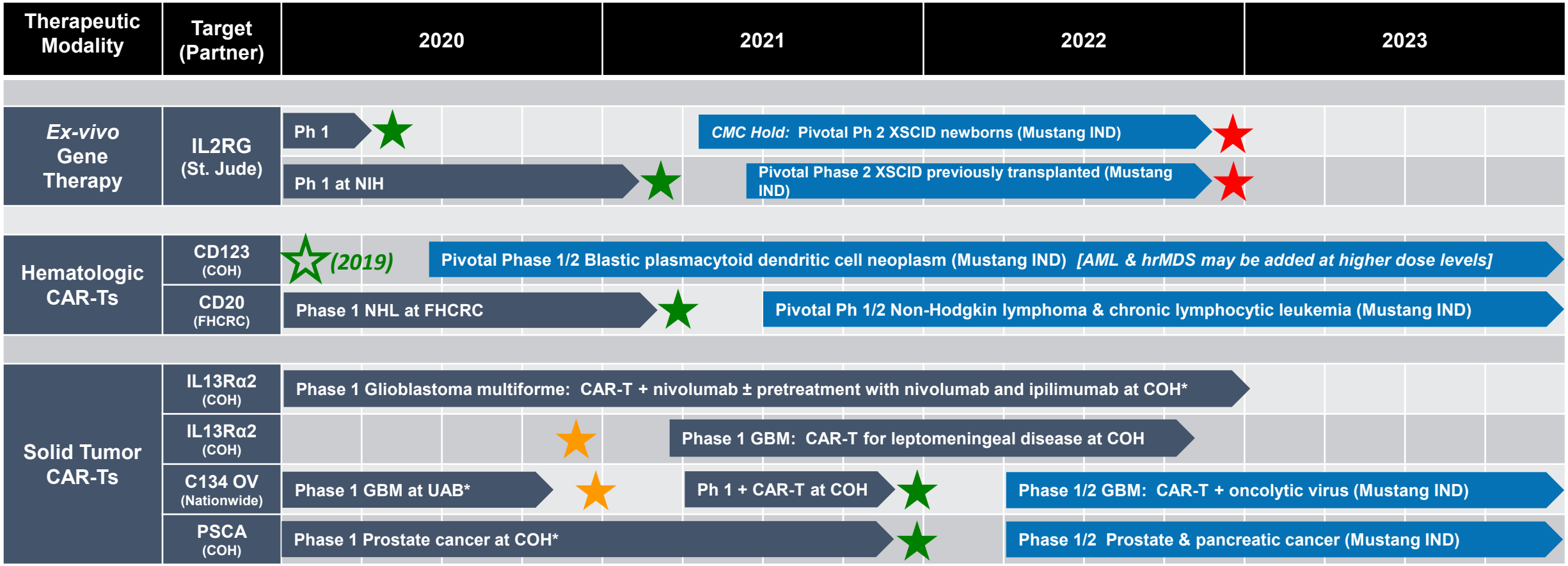
Building a *Fully Integrated* Gene & Cell Therapy Company



- **Mustang (NASDAQ:MBIO) is focused on developing next-generation therapies for patients with cancer and rare genetic diseases**
- Transformational *ex vivo* lentiviral gene therapy for XSCID licensed from St. Jude
  - Highly compelling results in 2 ongoing clinical trials led by St. Jude & NIH
  - Targeting approval of Mustang INDs for both programs 1Q2021
- In addition to MB-106, 5 CAR-Ts licensed from City of Hope also in phase 1 trials
  - MB-102: Targets CD123 for acute myelogenous leukemia (AML) & related diseases
    - Encouraging phase 1 results in AML & blastic plasmacytoid dendritic cell neoplasm (BPDCN)
    - First Mustang IND trial now enrolling & processing cells in our facility for BPDCN
  - MB-101: Targets IL13Rα2 for glioblastoma multiforme (GBM)
    - Encouraging phase 1 results in GBM
    - 3 trials now ongoing or planned at COH to build on these results, including innovative combination with oncolytic virus
- 27,000 square foot cell processing & translational research facility on UMass Medical School campus with capacity to launch at commercial scale
- ~65 Associates with extensive gene & cell therapy industry experience

MUSTANGBIO

Robust Pipeline of Therapies Addressing Highly Challenging Diseases



St. Jude = St. Jude Children's Research Hospital
NIH = National Institutes of Health
COH = City of Hope National Medical Center
FHCRC = Fred Hutchinson Cancer Research Center
Nationwide = Nationwide Children's Hospital
UAB = University of Alabama at Birmingham

XSCID = X-linked severe combined immunodeficiency
AML = Acute myelogenous leukemia
hrMDS = High-risk myelodysplastic syndrome
NHL = Non-Hodgkin lymphoma
GBM = Glioblastoma multiforme
OV = Oncolytic virus

Mustang files new IND
COH files new IND
Topline data available

** Partially or totally supported by grants*

MUSTANGBIO

Financial Summary

- As of September 30, 2020, cash, cash equivalents and restricted cash of $76.3 million (net loss of $13.0M for 3 months ending 9/30)
- No debt
- $37.0M gross proceeds in June 2020 from underwritten public offering, including exercise of the over-allotment option
- 2019 financing
  - $31.6M gross proceeds in May 2019 from underwritten public offering, including full exercise of the over-allotment option

MUSTANGBIO

Mustang Target Goals Through 4Q2021: At Least 4 Open Mustang INDs

Anticipate initiating pivotal XSCID trials & building on early indications of CAR-T activity

- ***Newly diagnosed* XSCID (MB-107):** Anticipate resolution of CMC hold 1Q2021
- ***Previously transplanted* XSCID (MB-207):** File Mustang IND for pivotal multicenter trial 1Q2021
- **CD20 CAR-T (MB-106):** Tech transfer & prepare for 1Q2021 Mustang IND filing for NHL & CLL
- **IL13Rα2 CAR-T (MB-101):** COH to file INDs for leptomeningeal GBM & for innovative combination trial in GBM (CAR-T + oncolytic virus) 4Q2020
- **Other possible data disclosures from collaboration partners' trials in 2021**
  - Follow-up data from FHCRC MB-106 trial
  - Follow-up data from COH CD123 (MB-102) & PSCA (MB-105) CAR-T trials
- **Continue BD&L activities**
  - In-licensing opportunities to expand our *ex vivo* gene therapy franchise for rare diseases
  - Partnering opportunities to access non-dilutive capital

MUSTANGBIO

Questions?

December 9, 2020