Corporate Presentation

FEBRUARY 2021

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Assembly Biosciences: Leading Innovation in HBV Therapeutics

Major Global Health Need

- >270M people infected worldwide and ~1M deaths annually
- Significant need for finite and curative therapies

Broad R&D Pipeline

- Most advanced portfolio of core inhibitors (CI)
- Emerging research stage pipeline beyond core inhibitors

Industry-Leading HBV Expertise

- World-class team with expertise in hepatitis drug development

Resourced for Success

- $216.4 million in cash*
- Sufficient to fund operations into 2023

*As of 12/31/20

HBV is a Major Global Public Health Problem

Prevalence: **270M[1]**

Up to 1M people die each year from HBV-related causes

Treatments are life-long and reduce but do not eliminate the virus, resulting in very low cure rates

Opportunity to improve outcomes and increase number of patients diagnosed and treated, with development of finite and curative therapies

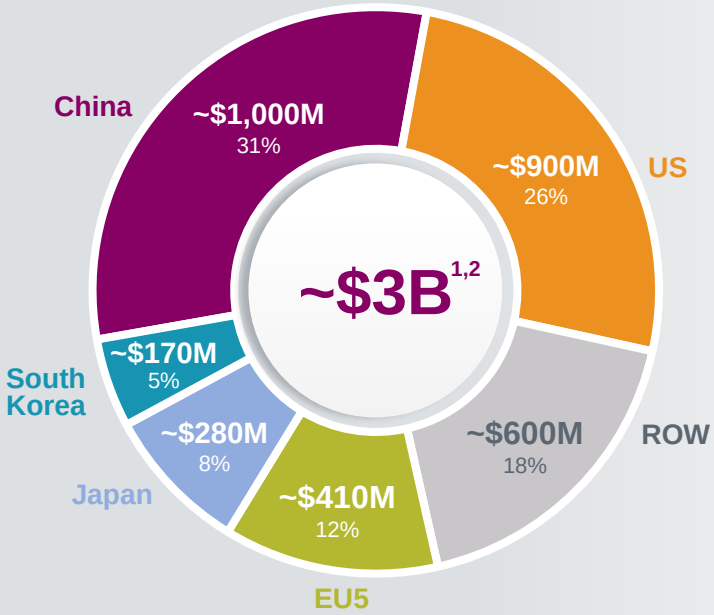
No new MOAs approved for HBV in >25 years

Source: [1]WHO (2016)

HBV is a Compelling Commercial Opportunity

$3B Global HBV Market, Historically

Global HBV Gross Sales by Key Country



- **Strong volume growth** has continued
  - ~35% increase in unit volumes from 2017 to 2019[1]
- **Concentrated commercial opportunity**
  - >80% of opportunity stems from 9 countries (China, US, and EU5, Japan and South Korea)
- **Significant market expansion potential**
  - With finite and curative therapies

[1]IQVIA Analytics Link 2017 [2]Viread LoE (Loss of exclusivity) was November 2017

Assembly's Vision and Path to Finite and Curative HBV Therapeutics

Singular Focus on Cure

- Finite and curative therapies represent the greatest unmet medical need for HBV patients

Leading Portfolio of Core Inhibitors

- Deep pipeline of potent CIs, including the most advanced and potential best-in-class compounds
- Focused development plans enable data-driven selection of optimal CI for combinations

Proof-of-Concept Combinations

- Initiated studies for triple combinations with RNAi and IFN
- Potential for additional combination studies or arms exploring CI + NrtI backbone with other mechanisms

Strong Research Engine Expanding Beyond CIs

- cccDNA disruptor research collaboration
- Discovery efforts on two novel undisclosed targets

Expertise, Focus, Resources and Collaborations to Succeed

Key Components to Drive Our HBV Strategy

1 More Potent Next Generation Core Inhibitors

2158 & 3733

- 2158 – Phase 2
- 3733 – Phase 1
- 4th core inhibitor candidate to be nominated in H1'21

2 Combination Studies

VBR+NrtI + 3rd MOA

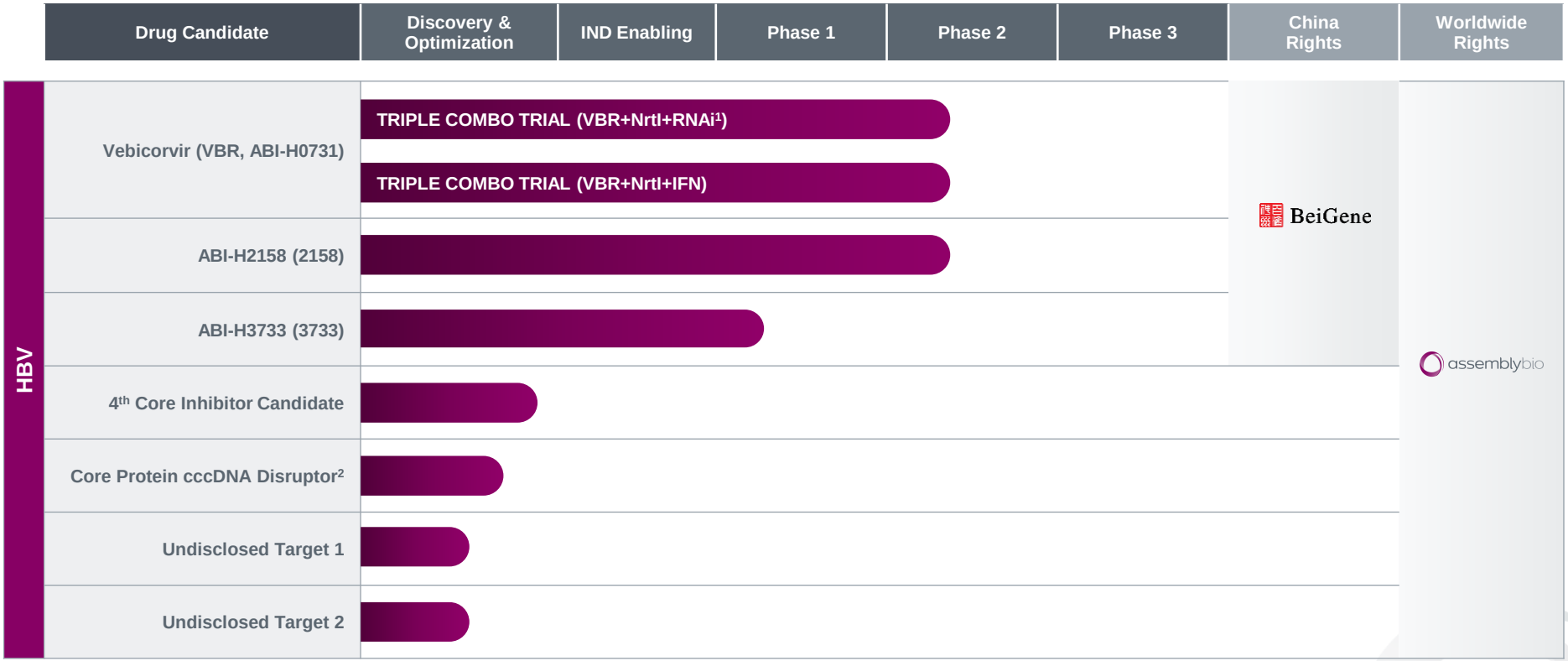
- VBR+NrtI + RNAi: Phase 2 initiated
- VBR+NrtI + IFN: Phase 2 initiated

3 Expanded Research Engine

Novel Targets

- Core Protein cccDNA Disruptor
- Multiple differentiated undisclosed targets

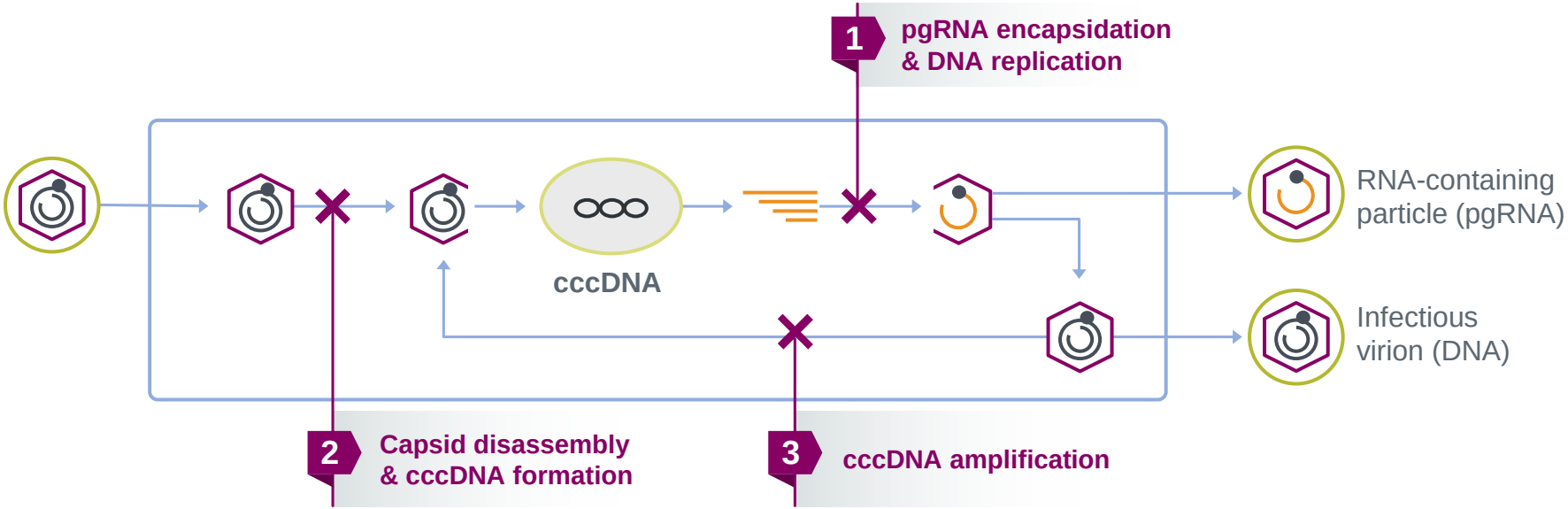
Broad HBV Clinical & Research Stage Portfolio



[1]RNAi Clinical Collaboration with Arbutus [2]Drug Discovery Collaboration with Door Pharma

Clinical Progress of Vebicorvir (VBR)

Core Inhibitor: Multiple Mechanisms of Action



- Core inhibitors target multiple steps of the HBV replication cycle to suppress HBV DNA, pgRNA, and cccDNA
- Combination of a core inhibitor and a NrtI will be the backbone for finite and curative regimens

cccDNA, covalently closed circular DNA; CHB, chronic hepatitis B; HBV, hepatitis B virus; NrtI, nucleos(t)ide analogue reverse transcriptase inhibitor; pgRNA, pregenomic RNA.

Core Inhibitors: Clinical Progress and Path to Cure

Development of more sensitive HBV nucleic acid assays

Greater suppression of HBV DNA and pgRNA

Greater normalization of ALT

No treatment-emergent resistance

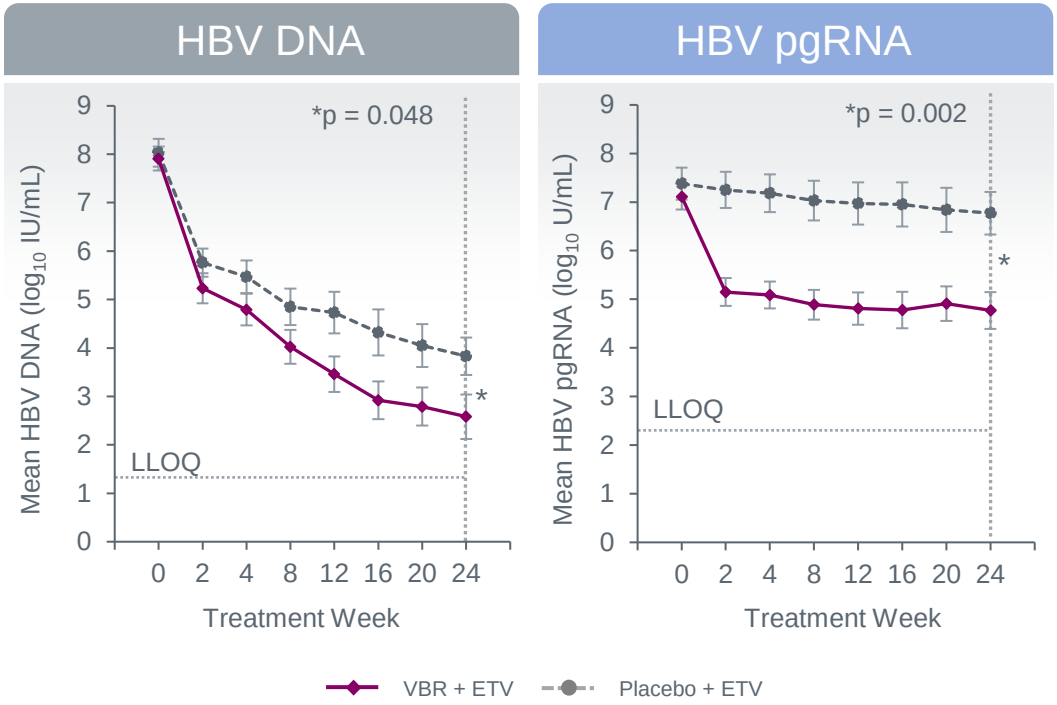
Long term safety

Multi-Drug Combinations

- VBR+NrtI + RNAi
- VBR+NrtI + IFN
- Potential for additional combinations of core inhibitor+NrtI backbone with other MOAs

GOAL: HBV Cure
with our best core inhibitor in the best combination regimen

Vebicorvir + NrtI Results in Greater Viral Suppression



In the Phase 2 program, including Studies 201, 202 and 211, VBR + NrtI led to greater viral suppression than NrtI alone across patient populations including:

- Treatment-naïve HBeAg positive patients (shown at left)
- Virologically-suppressed HBeAg negative patients as assessed by Assembly Bio's more sensitive HBV nucleic acid assays

HBV DNA LLOQ=20 IU/mL. HBV pgRNA LLOQ=135 U/mL Standard error shown in the plot.
731, ABI-H0731; ETV, entecavir; PBO, placebo.

VBR + NrtI Has a Favorable Safety Profile

The Phase 2 program, including Studies 201, 202 and 211, included 95 patients treated with VBR+NrtI for up to 1.5 years

AEs and laboratory abnormalities were mostly Grade 1 or 2, did not increase with time and were similar between placebo+NrtI and VBR+NrtI

Rash reported with VBR was predominantly Grade 1, not associated with systemic involvement and resolved without dosing interruption

No increased ALT and/or AST indicative of hepatotoxicity

Jacobson, et al. AASLD 2020, Poster 820. AE: Adverse Event

Next Generation Core Inhibitors

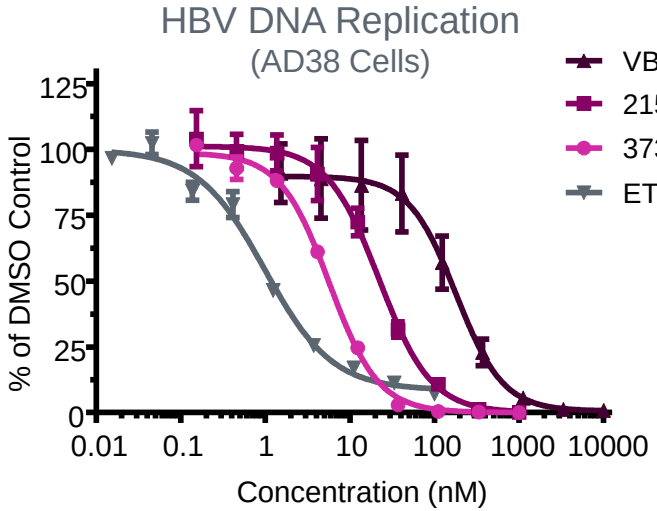
Developing Next Generation CIs and Optimizing Profile

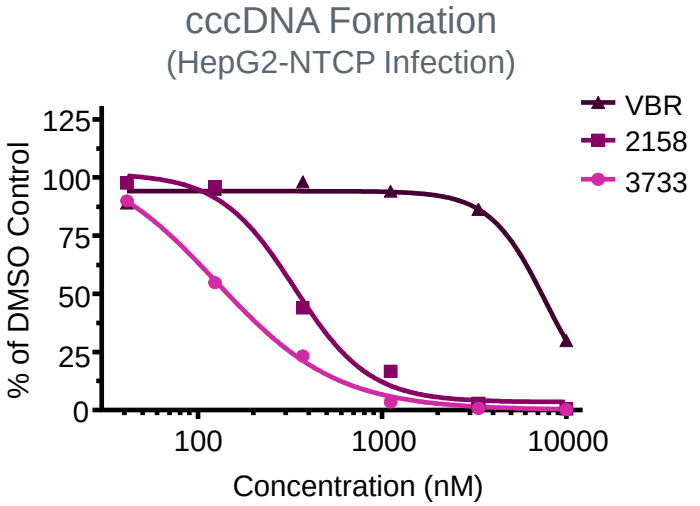
Best core inhibitor = Achieves most complete viral suppression with optimized profile

- 2158 - Phase 2 development
- 3733 - Phase 1 development
- 4th CI to be nominated in H1 2021 targeting best-in-class profile:
  - <10 nM potency against ***both*** cccDNA formation and production of new virions
  - Pan-genotypic
  - Once-a-day dosing
  - Low dose, suitable for co-formulation
  - Complementary with other MOAs
  - Safe and low potential for DDIs

Assembly Bio to make data-driven decisions to choose the CI with the best profile to become the antiviral backbone (+NrtI) of finite and curative regimens

Potency of VBR, 2158, 3733, and ETV
in vitro





	VBR	2158	3733	ETV
HepAD38 DNA replication, EC_{50} (nM)	173±40	22±2	5.7±0.2	0.98±0.06
HepG2-NTCP infection cccDNA formation, EC_{50} (nM)	5447	334	125	>>1000

cccDNA, covalently closed circular DNA; DMSO, dimethyl sulfoxide; EC_{50}, concentration of a drug that gives half-maximal response; ETV, entecavir; Gen, generation; VBR, vebicorvir.
Huang Q, et al. EASL 2019.

Relative Potency of Assembly Core Inhibitors

Human Plasma				
	HBV DNA EC_{50} (nM)	**C_{min} Total/ Protein adjusted HBV DNA EC_{50}**	**cccDNA EC_{50} (nM)**	**C_{min} Total/ Protein adjusted cccDNA EC_{50}**
Vebicorvir 300 mg	154	3	2210	0.2
2158 300 mg	41	19	204	4
3733 300 mg	12	28[1]	62	6[1]
4th core inhibitor target	**<5**	**>50**	**<10**	**>25**

Data do not take into account liver enrichment of compounds. Liver concentrations of VBR, 2158, and 3733 are predicted to be enhanced 18-fold, 5-fold, and 6-fold, respectively, compared to plasma based on preclinical PK studies

- Vebicorvir achieves potency and plasma exposure to drive potent antiviral activity; goal is to increase exposure & potency to drive greater inhibition of cccDNA formation

[1] Based on preliminary PK in healthy volunteers

ABI-H2158: Data from Phase 1b Dose-Ranging Study

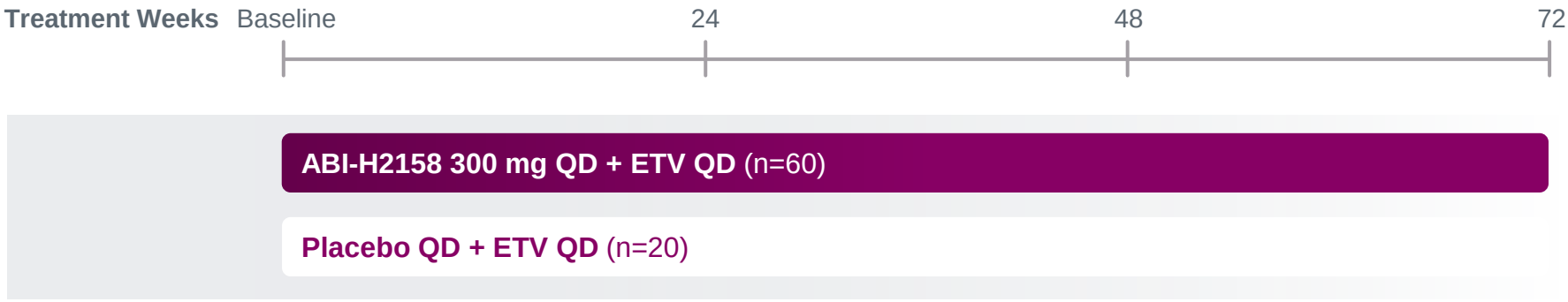
Safety: Favorable safety profile when administered orally once daily for 14 days

Efficacy: Potent antiviral activity

	ABI-H2158 (PO QD x 14 days)			Placebo (n=6)
	2158 100 mg (n=7)	2158 300 mg (n=7)	2158 500 mg (n=7)	
HBV DNA Mean Change from Baseline to Day 15 (log_{10} IU/mL), (Range)	-2.3 (-1.7 to -3.0)	-2.5 (-0.8 to -3.3)	-2.7 (-1.7 to -3.2)	-0.08 (-0.3 to 0.1)
pgRNA Mean Change from Baseline to Day 15 (log_{10} U/mL), (Range)	-2.1 (-1.5 to -2.7)	-2.3 (-1.4 to -3.2)	-2.1 (-1.3 to -3.5)	-0.08 (-0.2 to -0.1)
C_{max}, µg/mL	3.39	8.80	10.42	-
AUC_{0-24}, h•µg/mL	46.12	112.70	120.70	-

Agarwal et al. EASL 2020

ABI-H2158: Ongoing Phase 2 Clinical Trial



Evaluate changes in DNA, pgRNA and viral antigens and compare to VBR

Interim data expected in H2 2021

Potential to incorporate modified stopping criteria and evaluate off-treatment response

ETV, entecavir

Combination Studies

Core Inhibitor + NrtI as Backbone

+ Additional MOA

Combination Approaches to Achieve Finite and Curative Regimens

PHASE 2 STUDIES WITH 2 POTENT ANTIVIRALS
Optimized CI and NrtI as backbone

EXPLORATORY PROOF-OF-CONCEPT STUDIES
Multi-Mechanism Combinations in Different Populations

FURTHER DEVELOPMENT
Phase 3 Registrational Program

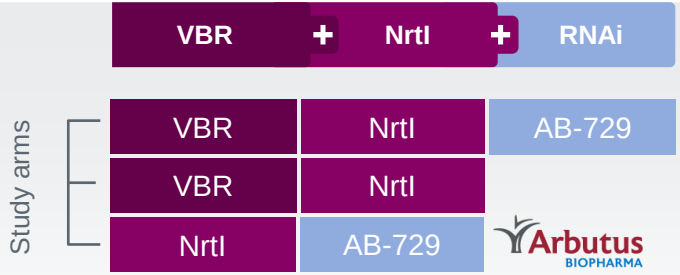
\+ **RNAi** — PHASE 2

\+ **IFN** — PHASE 2

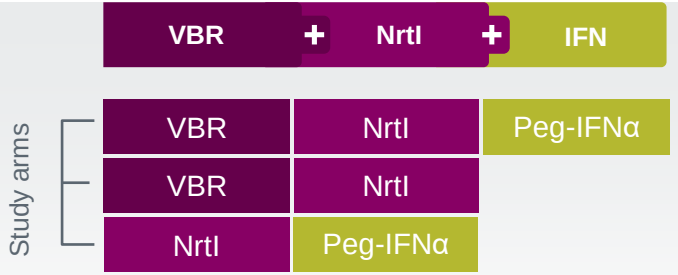
\+ **Other mechanisms** (e.g., Core Protein cccDNA Disruptor) — R&D PLANNED PROGRAMS

Initiated Two Phase 2 Triple Combination Clinical Studies

VBR+NrtI+3rd Mechanism of Action



RNAi-induced HBsAg reduction in combination with antivirals has potential to restore host immune response to HBV



IFN may increase HBV-specific immunity in addition to antiviral effects

In previous HBV studies, IFN has demonstrated greater HBsAg loss in combination with NrtI

- Evaluating safety and on-treatment response of the 3-drug vs 2-drug combinations
- Opportunity to incorporate modified stopping criteria to assess off-treatment response

Potential for Additional Multi-Drug Combinations

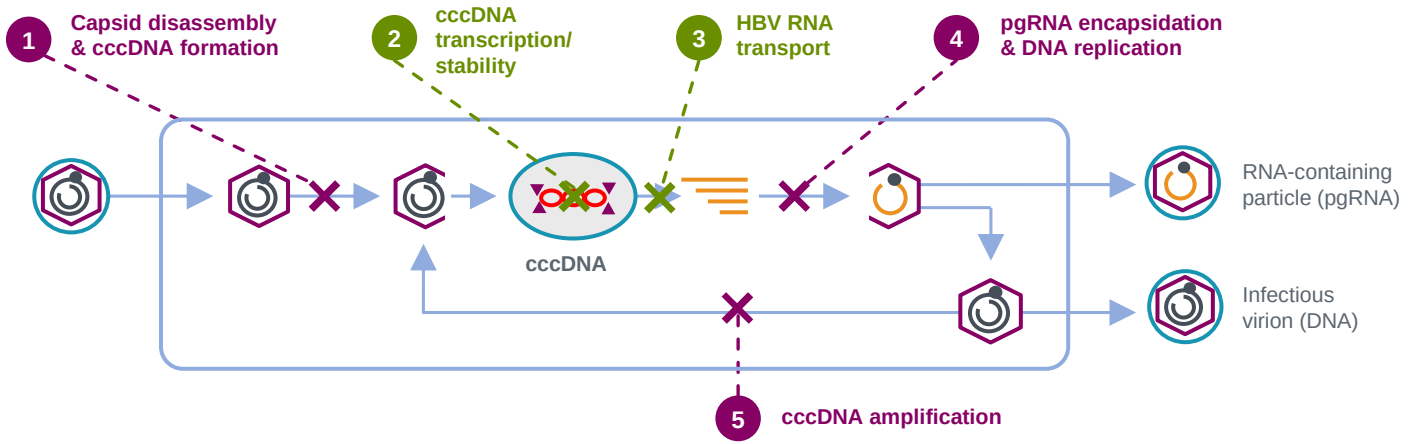
Expanded Research Engine

Beyond Core Inhibitors

Novel Target: HBV Core Protein cccDNA Disruptor

Goal: Target intra-nuclear HBV core protein – cccDNA interaction (not affected by current core inhibitors)

Effect: Disrupt HBV transcription (reduce antigen, enhance immunity) and potentially stability of cccDNA

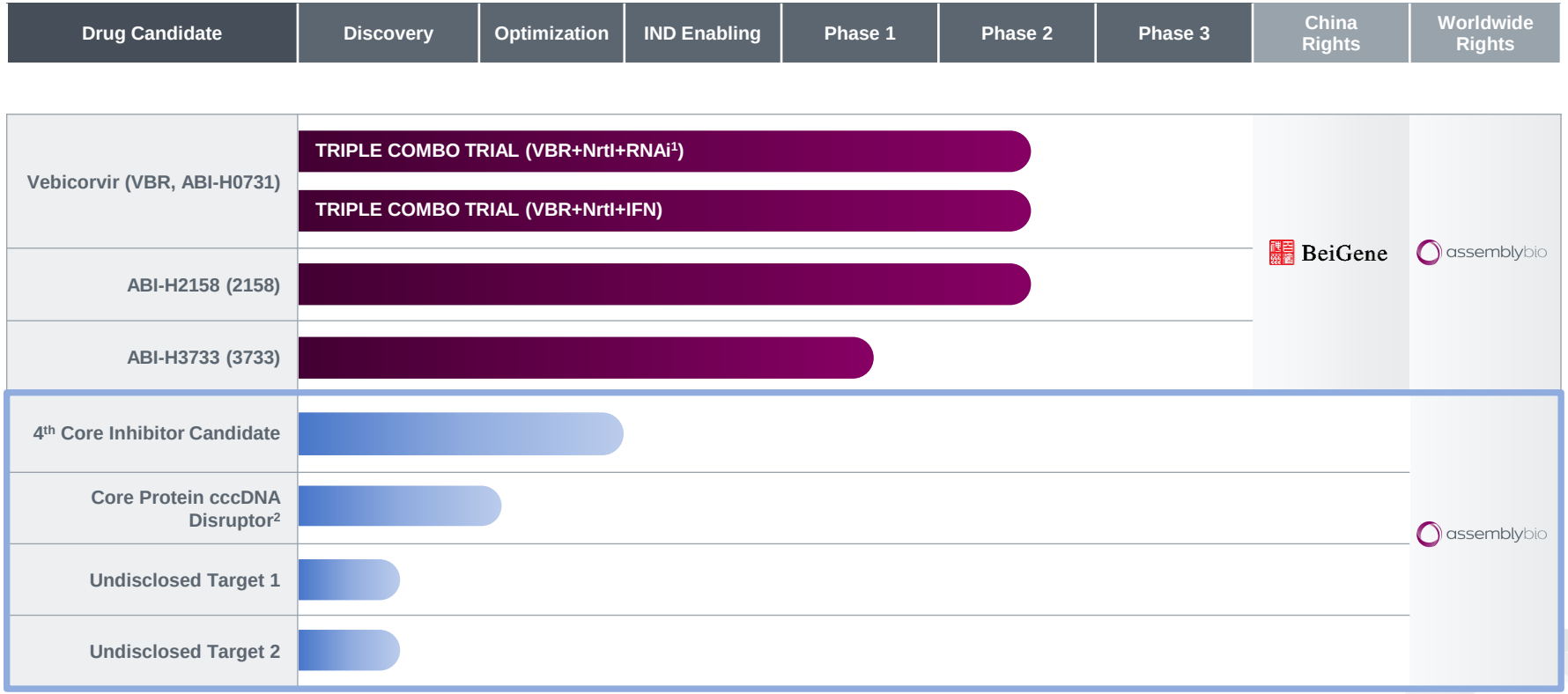


1 4 5 Target for current core inhibitors

2 3 Opportunity for novel inhibitors

Door Pharma

Expanding Research Stage Portfolio



[1]RNAi Clinical Collaboration with Arbutus [2]Drug Discovery Collaboration with Door Pharma

Key Objectives and Anticipated Progress through 2022

2021

- ✓ Initiate Triple Combo Study – RNAi
- ✓ Initiate Triple Combo Study - IFN
- ❑ Nominate 4th core inhibitor
- ❑ Interim Phase 2 data for 2158

2022

- Interim Phase 2 data – VBR+NrtI + IFN
- Interim Phase 2 data – VBR+NrtI + RNAi
- IND for 4th core inhibitor
- Additional Phase 2 data for 2158

Strong Balance Sheet

$216M in cash (as of 12/31/20) extending runway into 2023

Nasdaq: ASMB