

Jefferies London Healthcare Conference

November 20, 2019

John McHutchison, AO, MD – CEO and President

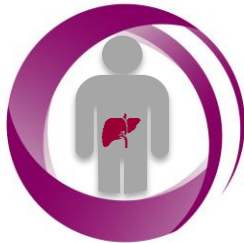
Cautionary Note Regarding Forward-Looking Statements

The information in this presentation contains forward-looking statements regarding future events, including statements about the clinical and therapeutic potential of Assembly Biosciences' core protein inhibitors and Microbiome program, including ABI-H0731, ABI-H2158, ABI-H3733 and ABI-M201, the initiation, timing, progress and results of nonclinical studies and clinical studies for our HBV-cure program and Microbiome program, our regulatory strategies for our core inhibitors, economic potential of our partnered programs and the strength of our capital position. Certain forward-looking statements may be identified by reference to a future period or periods or by use of forward-looking terminology such as "designed," "expected," "likely", "may," "potential," "projected," or "will." Such forward-looking statements, which are intended to be covered by the safe harbor provisions contained in Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended, are just predictions and are subject to risks and uncertainties that could cause the actual events or results to differ materially. These risks and uncertainties include, among others: Assembly Biosciences' expectations regarding sustained benefits and antiviral reductions of patients in its clinical trials; outcomes of clinical studies are uncertain; results observed in earlier preclinical and nonclinical studies and early clinical studies may not be predictive of future clinical studies results; the emergence of unforeseen safety issues; the scientific theory for our therapeutics is unproven and novel; the components, timing, patient enrollment and completion rates, cost and results of clinical trials and other development activities involving our product candidates; the duration and results of regulatory review of our product candidates by the FDA and foreign regulatory authorities; our estimates regarding our capital requirements, and our need for future capital; and the possible impairment of, or inability to obtain or protect, intellectual property rights and the costs of obtaining and protecting such rights. These and other potential risks and uncertainties that could cause actual results to differ from the results predicted are more fully detailed under the heading "Risk Factors" in our Quarterly Reports on Form 10-Q for the quarter ended September 30, 2019 filed with the Securities and Exchange Commission (the "SEC") and any additional reports filed with the SEC following the date of this presentation. It is not possible for Assembly Biosciences management to predict all risks nor can it assess the impact of all factors on our business or the extent to which any factor, or combination of factors, may cause actual results to differ materially from those contained in any forward-looking statements. In light of these risks, uncertainties and assumptions, the forward-looking events and circumstances discussed in this presentation may not occur and actual results could differ materially and adversely from those anticipated. This presentation also contains estimates and other statistical data made by independent parties and us relating to market potential. These estimates involve a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates. Any forward-looking statement speaks only as of the date on which it is made, and no obligation to update or revise any forward-looking statement is assumed, whether as a result of new information, future events or otherwise, except as required by law.

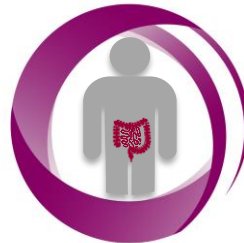


Assembly Biosciences Overview

HBV Cure



Microbiome



Unmet Patient
Need

No cure for almost all of the **quarter of a billion** patients with chronic HBV

The gut microbiome is **essential** to human health, yet there are **no approved** microbiome therapies



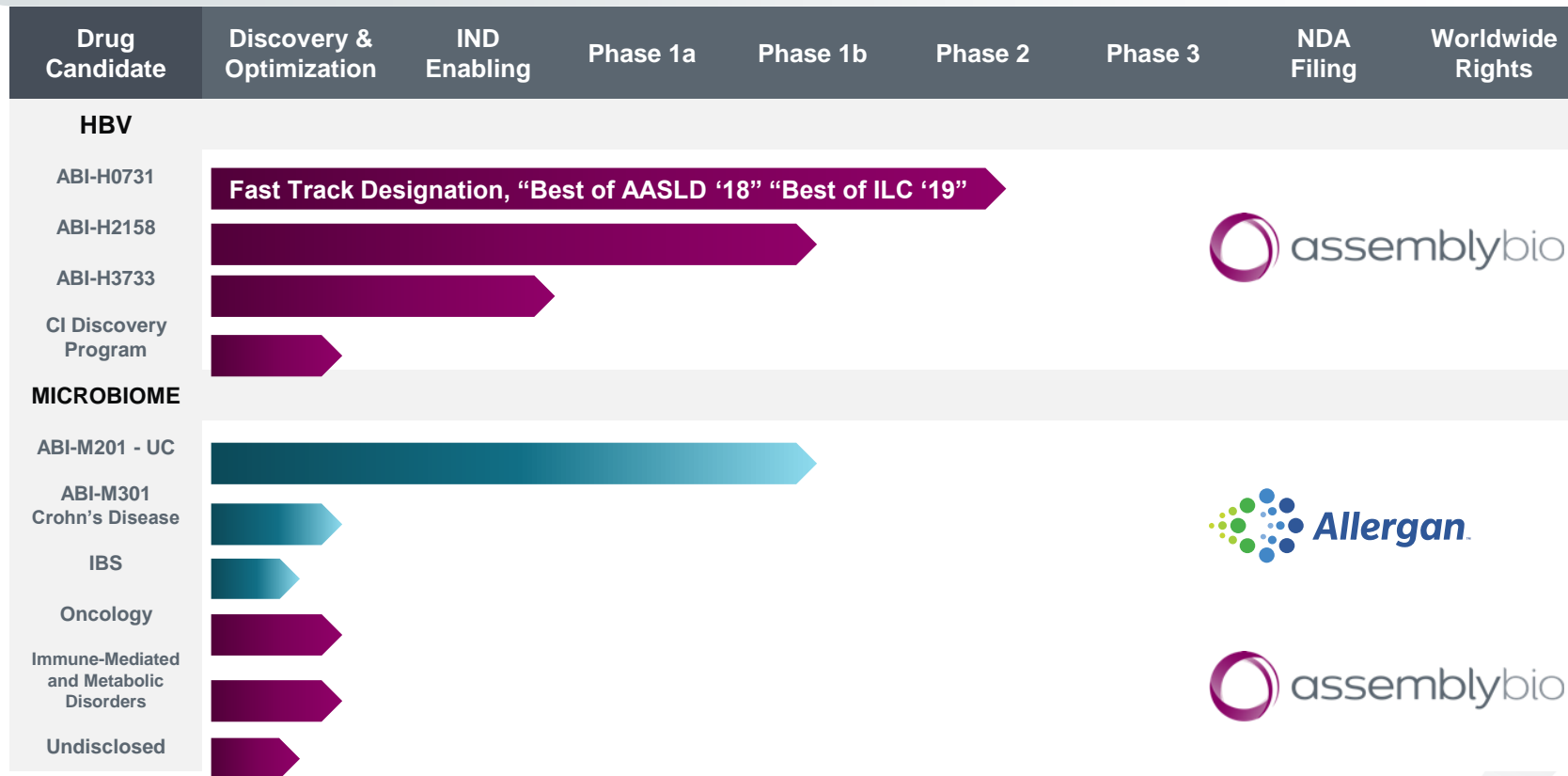
Innovation

First novel small molecule DAA candidate in development in recent years; Designed to **break the life cycle** of HBV

First live biotherapeutic candidate with rationally designed consortium of bacteria to be evaluated in patients with UC. Platform to address diseases beyond gastroenterology



Development Programs Focused on Large Patient Populations with High Unmet Need



Our Vision for Achieving HBV Curative Finite Regimens

HBV can and will be cured

Over time, cure rates will increase and Tx duration shorten

Core inhibitors will be central to curative strategies

Block multiple steps in the HBV life cycle

Cure rates will increase as the field advances

Tx will be **finite** but longer than HCV to start

Combination regimens will be required for cure

Multiple agents with complementary MOA's

Not all patient populations will respond equally

Different Tx regimens for different patient subgroups

Simple all oral regimen that is safe and well-tolerated

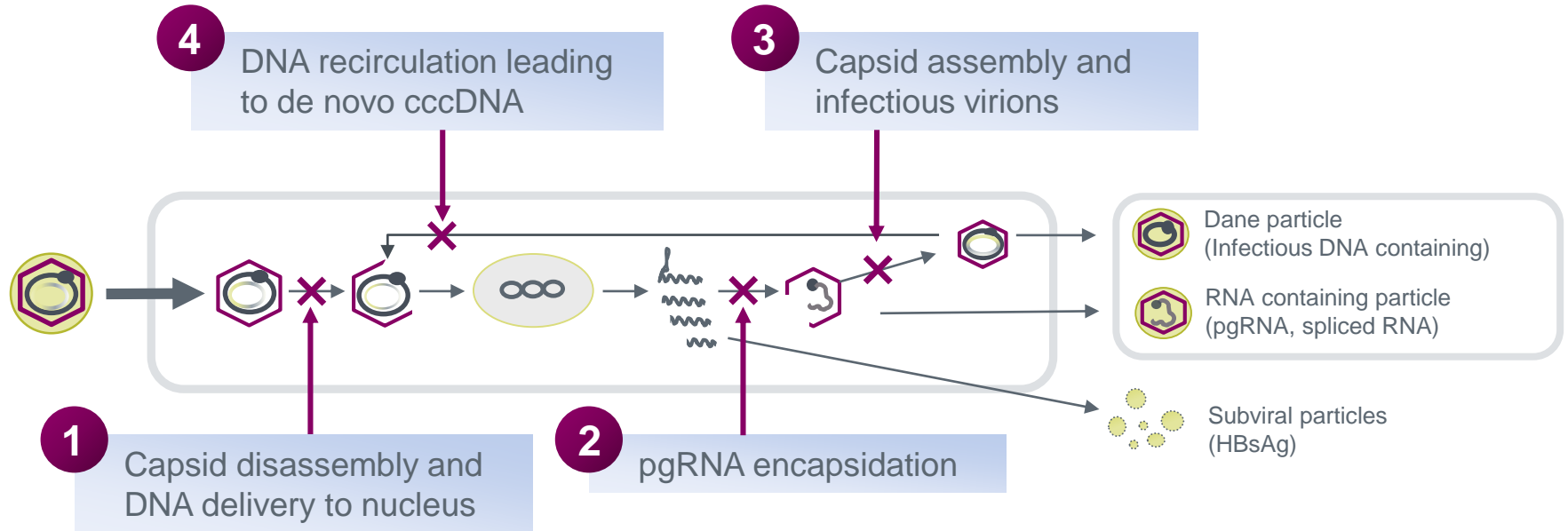
Ultimate winner for the 250M HBV infected patients globally



Assembly believes it has the most potent, most advanced, and broad series of core inhibitors at multiple stages of development



Core Inhibitors Prevent Multiple Steps of the HBV Lifecycle



Assembly's Planned Approach to Hepatitis B Clinical Development

First wave

1st generation CI Candidate

- Designed to achieve complete suppression of viral replication (HBV DNA and RNA)

Two potential paths to registration that are complementary:

- Chronic suppressive therapy
- Finite Duration
 - Consolidation period of Tx
 - Discontinue and observe for SVR

Second wave

Next generation CI Candidates

- More potent next generation CI candidates (2158 and 3733)
- Potential to accelerate the speed, efficiency and proportion of patients with complete suppression of viral replication

Potential for increased cure rates and/or shortened duration to cure

Third wave

Triple Drug CI Combinations

- Potential multi drug combinations with non-overlapping MOA's may drive response rates higher in a shorter duration of treatment

Focus on future POC studies to evaluate these approaches through carefully executed, scientific cross-company collaborations



Clear and Defined Regulatory Endpoints

FDA Draft Guidance suggests the following clear and defined regulatory endpoints for new therapies:

Chronic Suppressive Therapy (CST):

“Suppression of HBV DNA (defined as less than LLOQ, TND) on-treatment — similar to currently available chronic NrtI therapies”

Finite Cure as measured by absence of HBV DNA:

“Sustained suppression (more than 6 months) of HBV DNA (less than LLOQ, TND) off treatment after a finite duration of therapy”

OR

“Sustained suppression (more than 6 months) of HBV DNA (less than LLOQ, TND) off treatment with HBsAg loss (less than 0.05 international unit/milliliter (IU/mL)) with or without HBsAb seroconversion after a finite duration of therapy”

“At present, utility of reduction in HBsAg from baseline (without complete clearance) for assessing response to CHB therapies is unclear because of inconsistent correlations between qHBsAg and clinical response (Hu et al. 2018; Thompson et al. 2010; Chan et al. 2011).”



Program Objectives - Targeted Steps Toward Cure



AASLD 2018

Well-tolerated, PK supporting once daily dosing, and inhibits HBV DNA levels with monotherapy (Phase 1)



EASL 2019

Demonstrated elimination of residual viral replication not achievable on NrtI monotherapy (i.e DNA to “Target not Detected”) (Phase 2)



AASLD 2019

Demonstrated decrease in cccDNA population as reflected by significant reductions in pgRNA levels and other surrogate markers in absence of ALT flares (Phase 2)

GOAL (PHASE 2):

Demonstrate further decline of viral antigens during consolidation

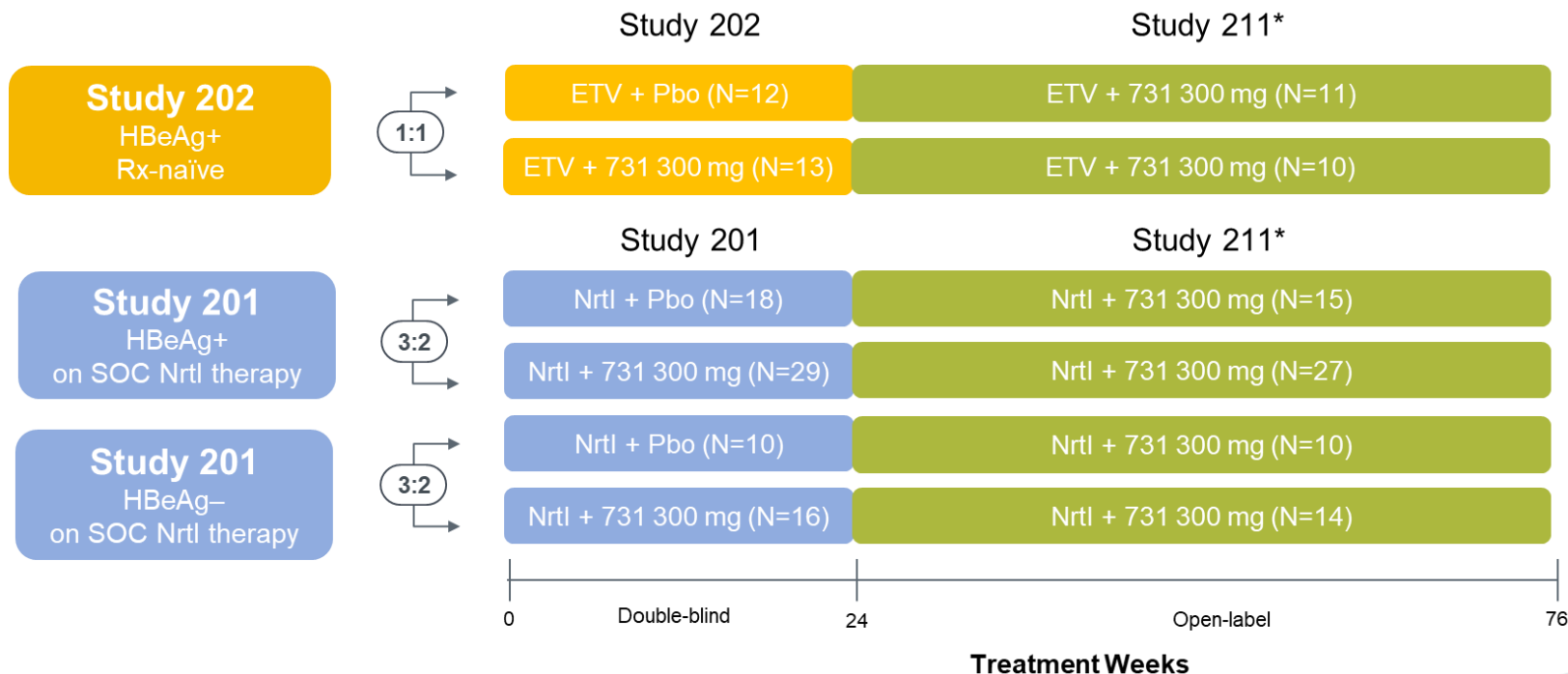
GOAL (PHASE 2):

Following consolidation, demonstrate sustained viral DNA/RNA suppression off therapy (SVR)



ABI-H0731: Interim Data from Ongoing Phase 2 Extension Study

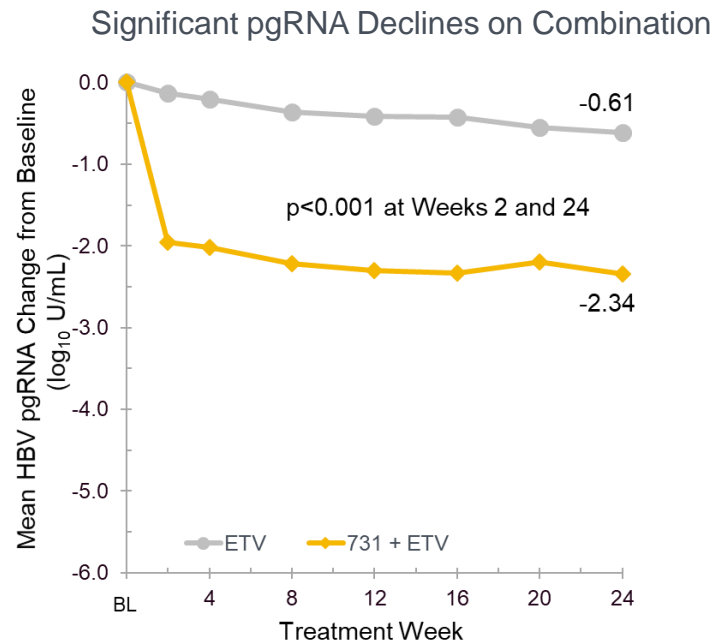
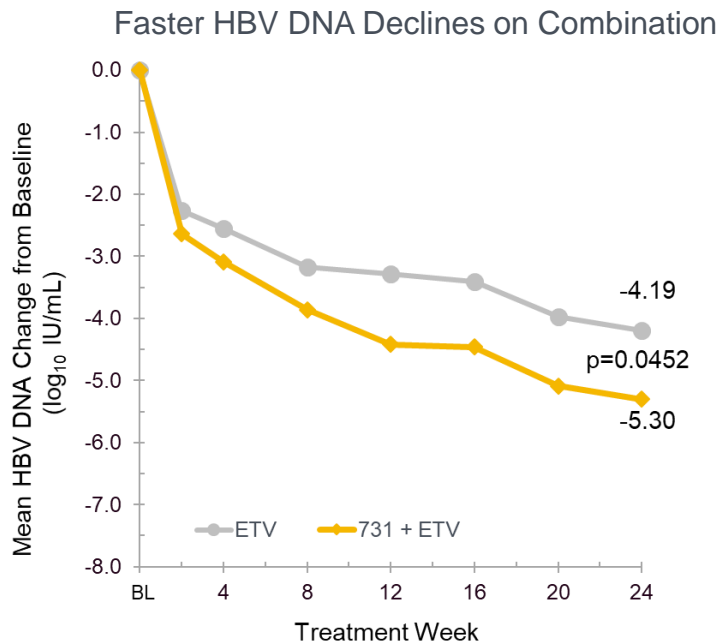
Overview of ABI-H0731 Phase 2a Clinical Studies



*n values represent the 87 patients who transitioned to 211 and remain on treatment and included in this analysis
 ETV, entecavir, Pbo, placebo, SOC, standard of care



Study 202: Superior DNA/pgRNA Declines Observed with 731+ETV Combination



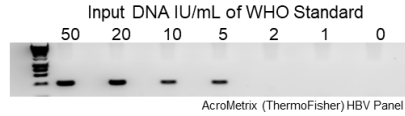
- Faster HBV DNA declines were observed with 731+ETV than with ETV alone, with statistically significant declines in HBV DNA observed in the combo arm at Week 24 ($p=0.0452$)
- Rapid 2-log reductions in HBV pgRNA levels by Week 2 were observed only in patients receiving combo ($p<0.001$)
- The initial rapid phase decline of pgRNA is thought to be mechanism-based inhibition (i.e., pgRNA not packaged and secreted into plasma), while the second slower phase decline is believed to reflect reduction in cccDNA pools



Study 201: DNA/pgRNA Declines Observed in Nrtl-Suppressed, HBeAg+ Patients

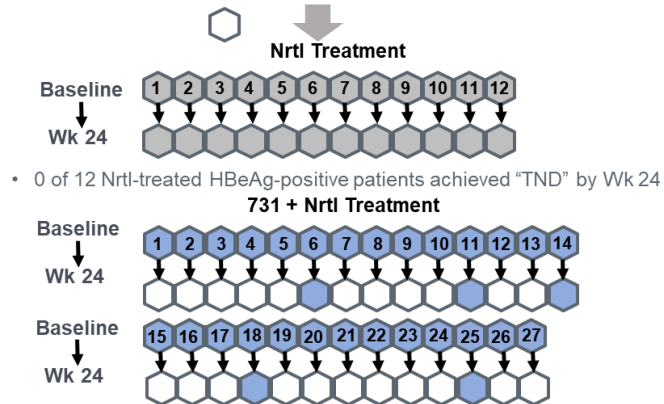
Deeper HBV DNA Declines on Combination

Highly sensitive semi-quantitative PCR assay developed to detect viral DNA levels as low as 5 IU/mL to monitor loss of residual virus



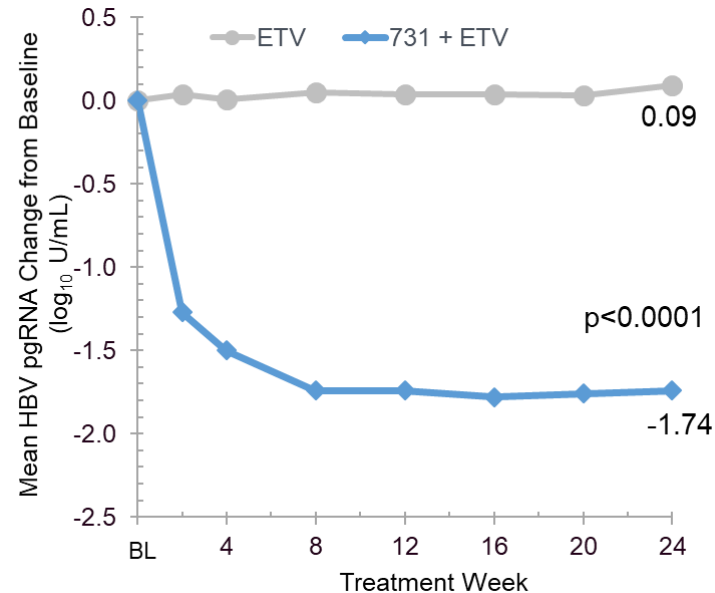
Gel Assay Standardization and Validation

Individual patient gel results; "Target Detected" (blue hexagon) or "Target Not Detected" (white hexagon)



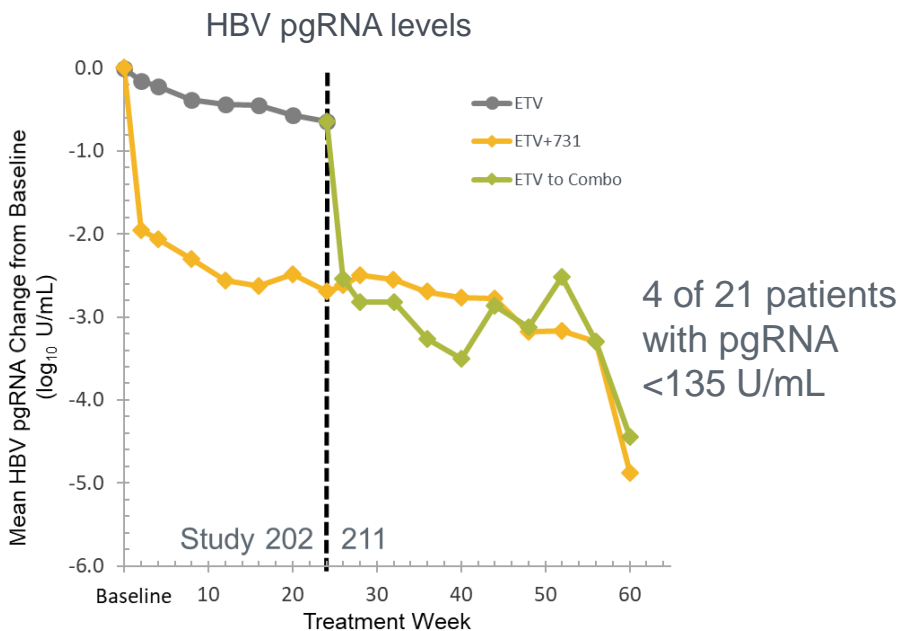
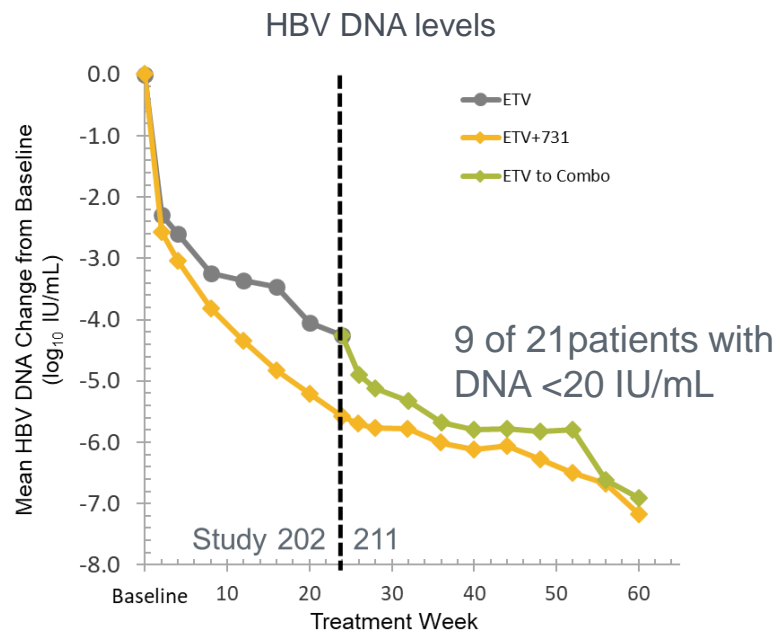
- 22 of 27 (81%) 731+Nrtl treated patients achieved TND by Week 24 (81% vs 0%, $p<0.001$)

Significant pgRNA Declines on Combination



- Among HBeAg-positive patients, rapid reductions in HBV pgRNA levels by Week 8 were observed only in patients treated with 731+ETV

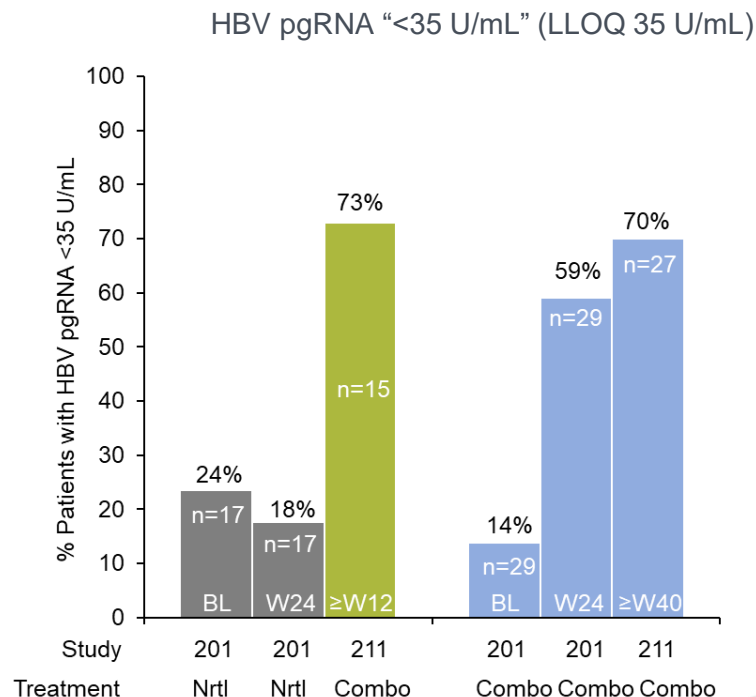
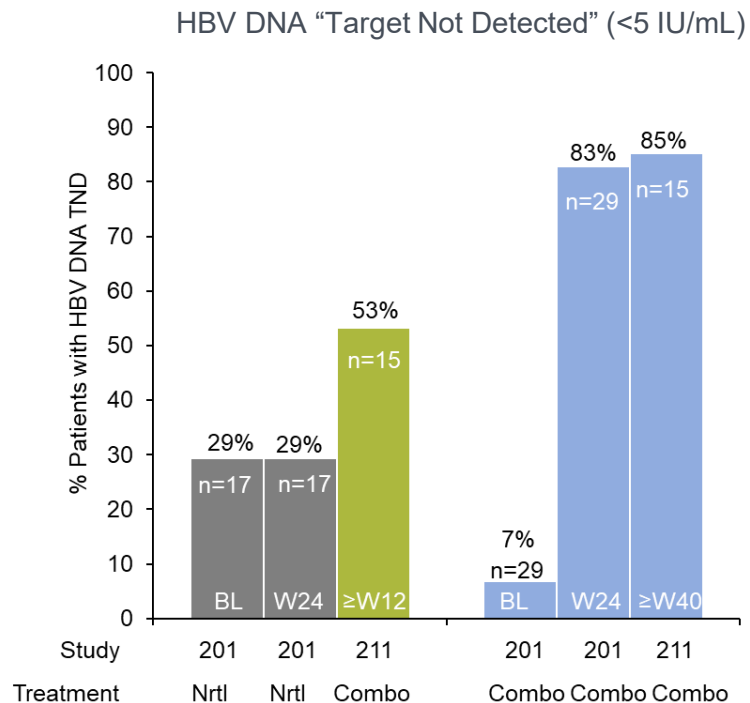
Study 202/211: Further DNA/pgRNA Declines Observed over Time



- The mean HBV DNA and pgRNA declines from baseline at Week 48 were 6.3 logs and 3.0 logs, respectively, for patients treated with 731+ETV
- The observed acceleration in second phase decline of HBV pgRNA levels likely reflects reductions of cccDNA pools



Study 201/211: DNA/pgRNA Declines to Highly Suppressed Levels Observed in Nrtl-Suppressed Patients



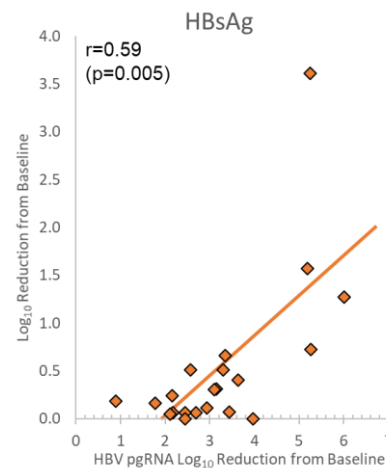
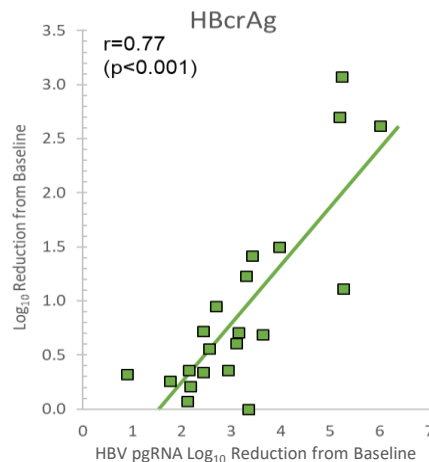
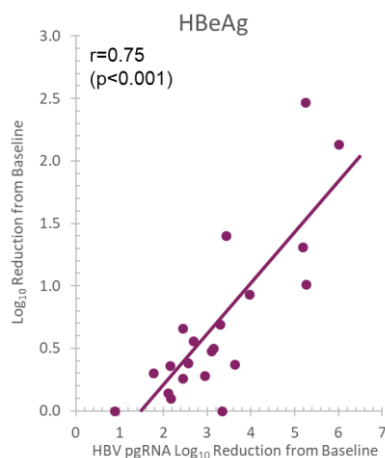
- Only patients receiving 731+ETV had reduced HBV DNA levels to TND and pgRNA levels to <35 U/mL



Study 202/211: Correlation Between HBV pgRNA Reductions and Viral Antigen Declines in the Absence of ALT Elevations

Patients Treated 16–60 Weeks with 731+ETV

Number	<40 U/L	Log ₁₀ Decrease	Mean Log Reductions at Last Timepoint (range)			Mean Max Log Reductions (range)			Patients Exhibiting ≥0.5 Log Decline (%)		
Patients	ALT	pgRNA	HBeAg	HBcrAg	HBsAg	HBeAg	HBcrAg	HBsAg	HBeAg	HBcrAg	HBsAg
11	10	>3.0	1.03 (0.0–2.5)	1.42 (0.0–3.1)	0.86 (0.0–3.6)	1.09 (0.4–2.3)	1.46 (0.6–3.1)	0.87 (0.0–3.6)	9 (82)	10 (91)	6 (55)
8	8	2.0–3.0	0.34 (0.1–0.7)	0.45 (0.1–1.0)	0.14 (0.0–0.5)	0.36 (0.1–0.8)	0.59 (0.0–1.0)	0.17 (0.0–0.7)	2 (25)	6 (75)	1 (13)
2	2	<2.0	0.15 (0.9–1.8)	0.29 (0.3–0.3)	0.17 (0.0–0.3)	0.15 (0.0–0.4)	0.40 (0.2–0.5)	0.21 (0.2–0.3)	0 (0)	0 (0)	0 (0)



- Addition of 731 resulted in multi-log reductions in pgRNA; NrtI therapy failed to significantly reduce pgRNA
- **>3 log reductions of pgRNA were associated with greatest level of declines in HBeAg and HBcrAg, surrogate markers of cccDNA**

r is Spearman's correlation between reduction in pgRNA and HBV antigen. The straight-line fit is calculated by choosing the line that minimizes the least square sum of the vertical distance d , of all the selected markers pictured by using the following equation: $y = a + bx$, where " a " is the intercept and " b " is the slope.



Study 201/211: Progression of Viral Markers in HBV Nrtl-Suppressed Patients

Parameter	Patients, n (%)
Combo Treatment ≥40 weeks	27 (100)
ALT ≤40 U/L	25 (93)
DNA TND (<5 IU/mL)	23 (85)
pgRNA <35 U/mL	19 (70)
DNA TND + pgRNA <35 U/mL	18 (67)
HBeAg <1 IU/mL and/or experienced a >0.5 log decline	14 (52)
HBcrAg <100 kU/mL and/or experienced a >0.5 log drop	9 (33)
HBsAg experienced a >0.5 log drop	1 (4)
DNA TND + pgRNA <35 U/mL + HBeAg <1 IU/mL or ≥0.5 log decline	10 (37)

- Viral markers in these patients receiving long-term Nrtl treatment were significantly lower than in Rx-naïve patients, with several approaching the LLOQ
- Results are supportive of mixed source (cccDNA and integrants) HBsAg in long-term HBeAg-negative and Nrtl-suppressed patients that appears different than other viral antigens, similar to prior reports^{1,2}

¹Wooddell, C.I. et al. Sci Transl Med 2017 Sep 27;9(409). pii: eaan0241. doi: 10.1126/scitranslmed.aan0241.

²Podlaha, O. et al. The International Liver Congress. Vienna, Austria, April 10–14, 2019.



ABI-H0731 Core Inhibitor Program Summary

- **Summary of Interim Data for Phase 2a Studies with ABI-H0731**

- Well tolerated
- Combination of 731+Nrtl demonstrated superior antiviral activity vs. Nrtl monotherapy
 - Faster and deeper declines in HBV DNA observed
 - HBV DNA TND and pgRNA <35 U/mL thresholds only achieved in patients receiving the combination
 - Significant HBV pgRNA (surrogate marker of cccDNA) declines in both studies
 - Second phase declines in pgRNA >3 logs, which is a primary surrogate marker of cccDNA, were strongly associated with reductions in viral antigens, suggesting declining cccDNA pools



Program Objectives - Targeted Steps Toward Cure



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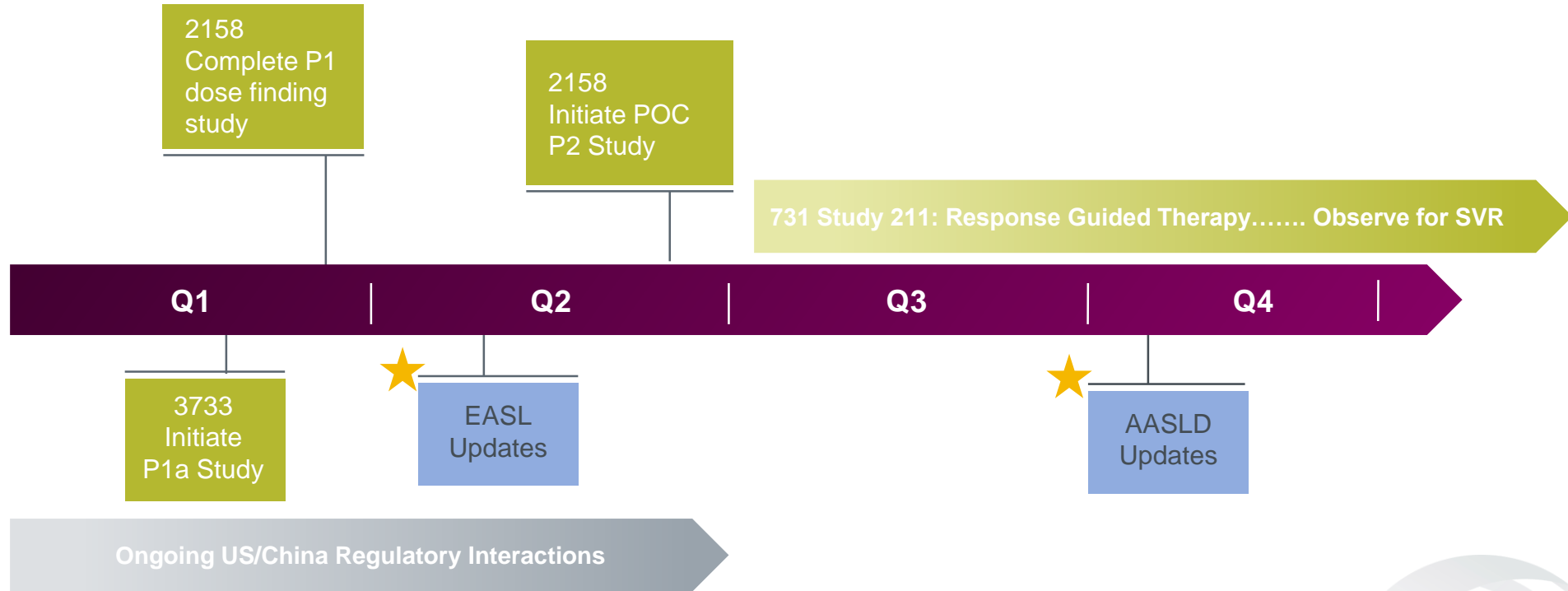
Demonstrate further decline of viral antigens during consolidation

GOAL (PHASE 2):

Following consolidation, demonstrate sustained viral DNA/RNA suppression off therapy (SVR)



2020: Anticipated HBV Milestones



STRONG BALANCE SHEET: ~\$157 M in cash (as of 9/30/2019)



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Thank you