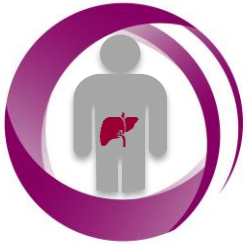
Corporate Overview

January 2020

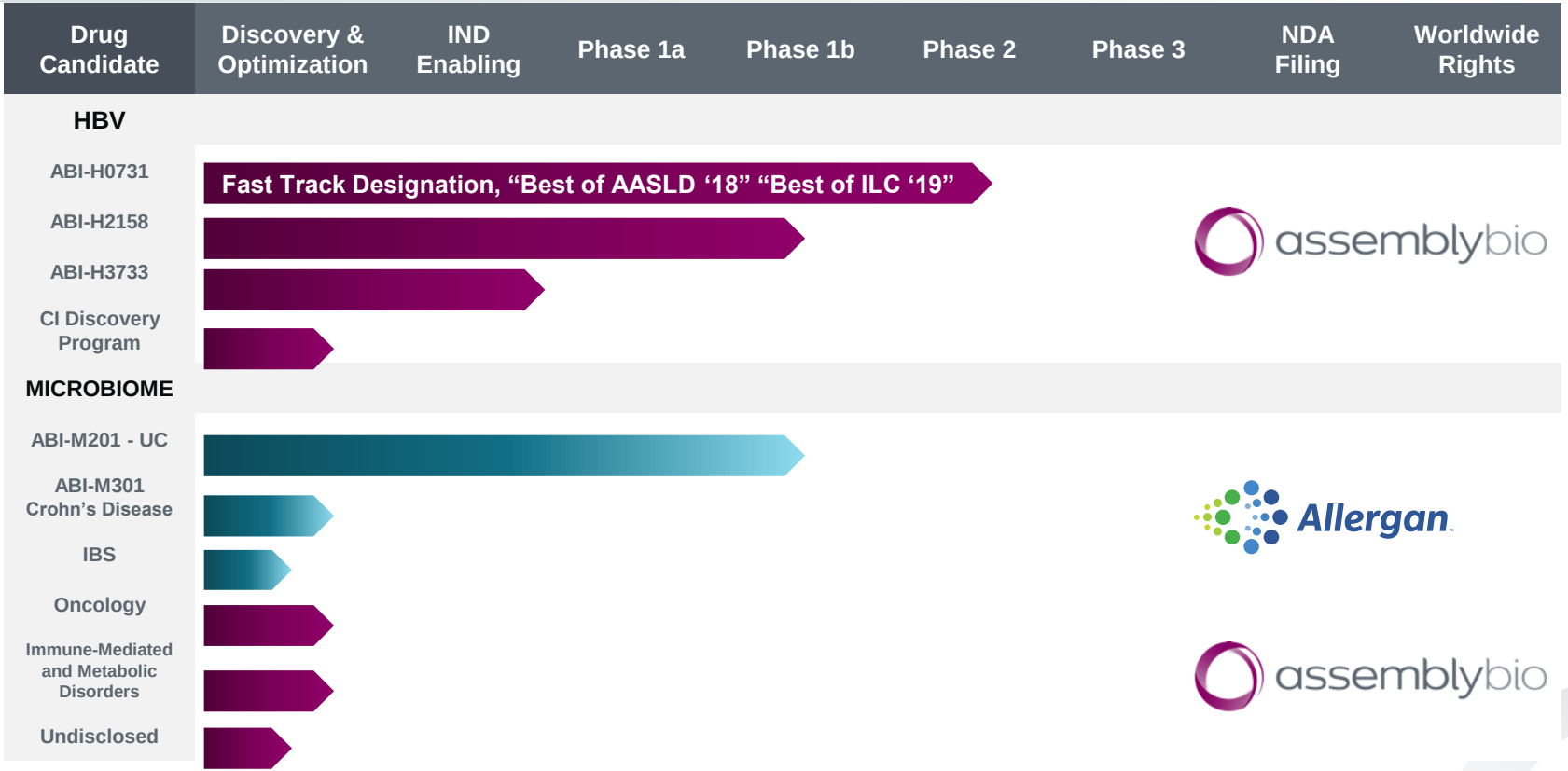
Cautionary Note Regarding Forward-Looking Statements

The information in this presentation contains estimates and 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 "anticipate," "believe," "designed," "expected," "initiate," "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: outcomes of clinical studies are uncertain; the results of earlier preclinical and nonclinical studies may not be predictive of future clinical studies results; 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; 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; 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 Report 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. 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. 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. 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

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
  - Withdrawal to 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

FDA Draft Guidance Provides Clear and Defined Potential Efficacy Endpoints For a Phase 3 Program

FDA Draft Guidance published in November 2018 suggests the following efficacy endpoints for evaluating new chronic Hepatitis B (CHB) therapy candidates in Phase 3 clinical trials:

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"[1]

https://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM624695.pdf *466-482*.

[1]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):

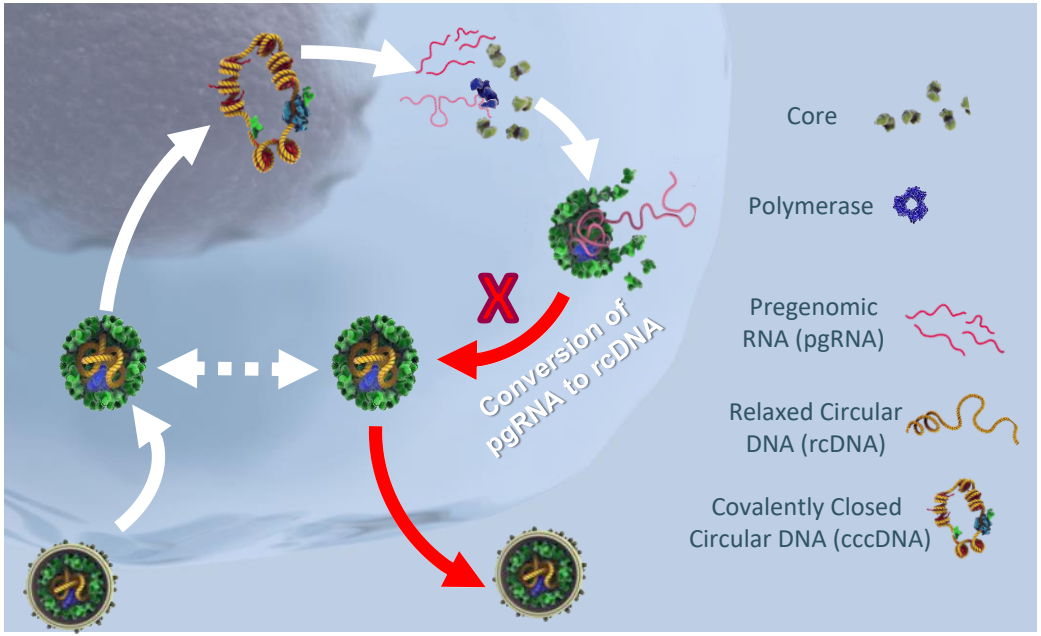
Demonstrate further decline of viral antigens during consolidation

GOAL (PHASE 2):

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

HBV Life Cycle Slides

New Therapies are Needed to Increase Cure Rates in CHB



Nucleos(t)ide Pol Inhibitors (NrtI)

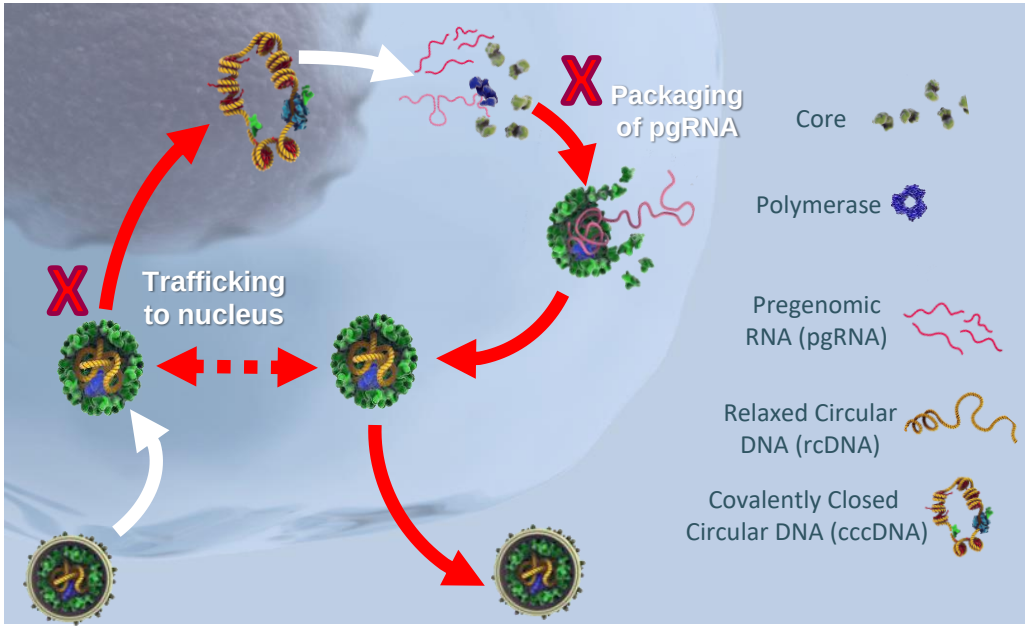
- Current “Standard of Care” for HBV
- Safe, well tolerated, with minimal resistance
- Reduce HBV DNA

But Fail to ……

- Eliminate virus
- Prevent new cccDNA formation
- Indefinite treatment

Cure is not possible without elimination of residual virus

CIs Block Viral Replication and cccDNA Establishment



Core Protein Inhibitors (CIs)

- Inhibit multiple steps in viral replication cycle
- Achieve deeper levels of viral inhibition than Nrtl's alone

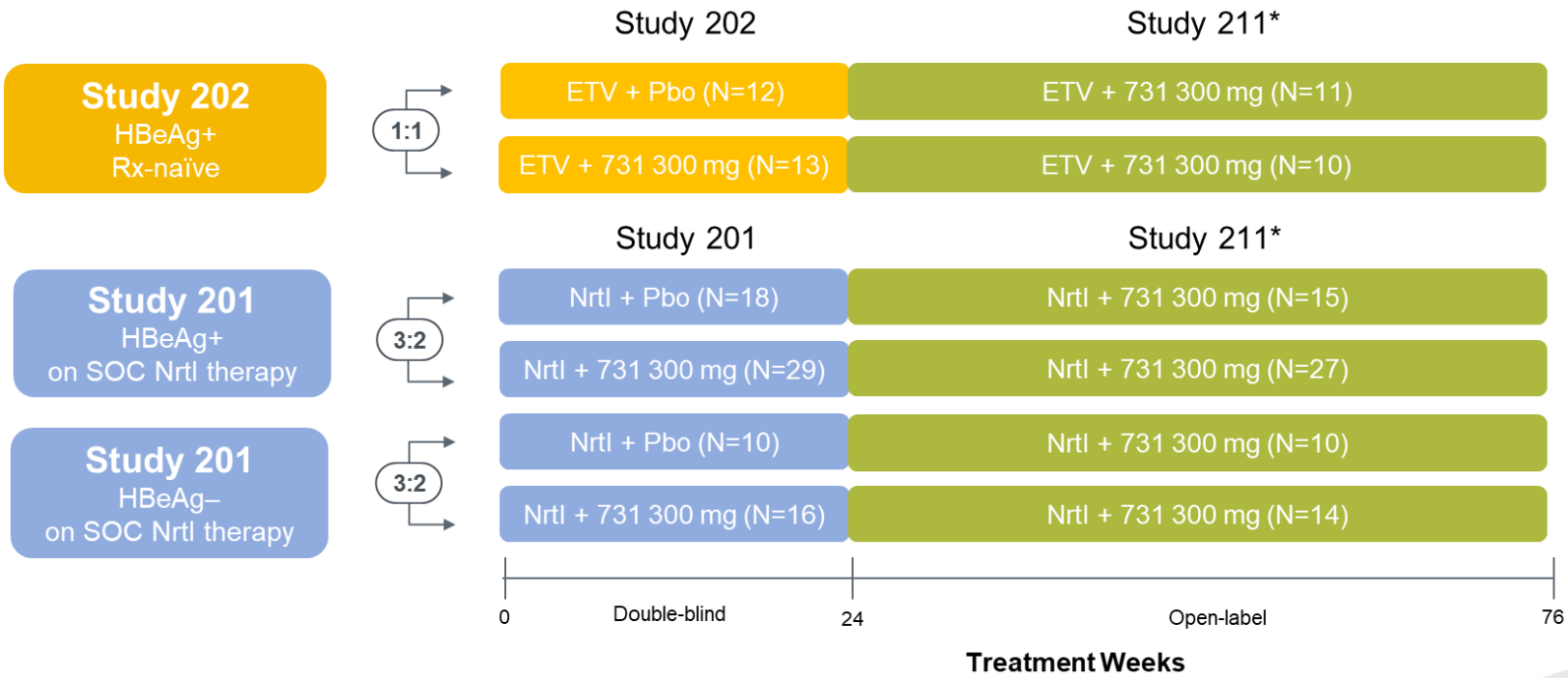
AND

- Can block the formation of cccDNA

Goal: Use combination therapy to completely inhibit viral replication and virus transmission resulting in increased cure rates with finite treatment duration

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

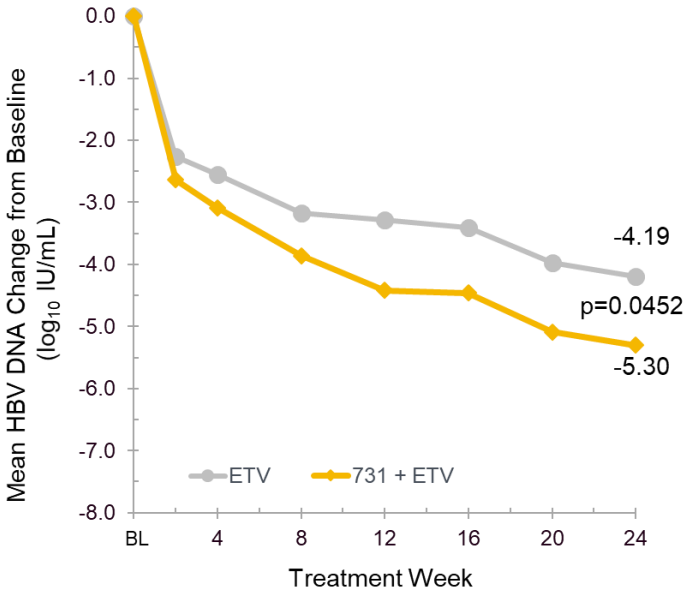
Overview of ABI-H0731 Phase 2a Clinical Studies



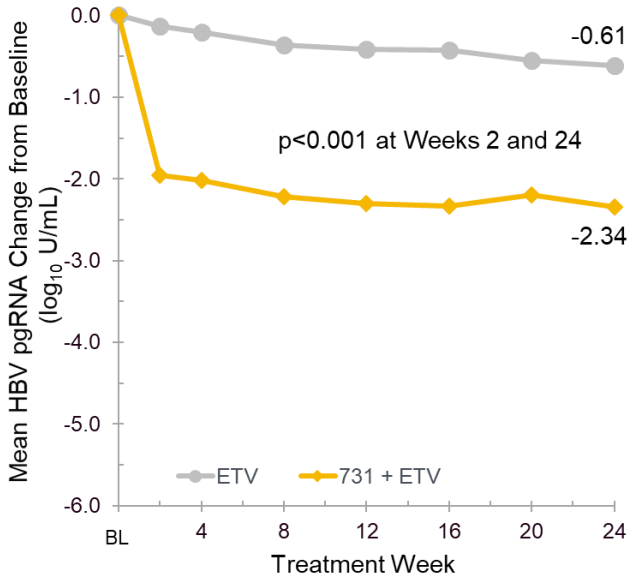
*n values represent the 87 patients who transitioned to 211 and remain on treatment and included in this analysis
ETV, entecavir, Pbo, placebo, SOC, standard of care

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

Faster HBV DNA Declines on Combination



Significant pgRNA Declines on Combination

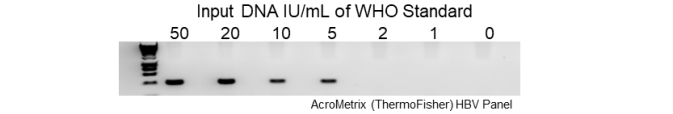


- Faster HBV DNA declines were observed with 731+ETV than with ETV alone, with statistically significant declines in HBV DNA observed in the combo arm at Week 24 (p=0.0452)
- Rapid 2-log reductions in HBV pgRNA levels by Week 2 were observed only in patients receiving combo (p<0.001)
- The initial rapid 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

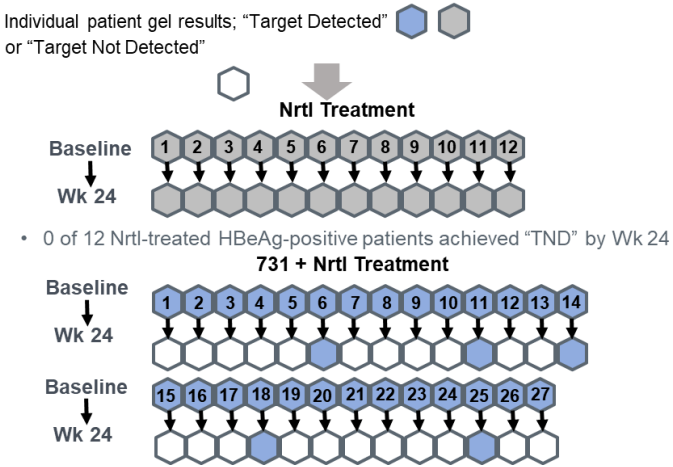
Study 201: DNA/pgRNA Declines Observed in NrtI-Suppressed, HBeAg+ Patients

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



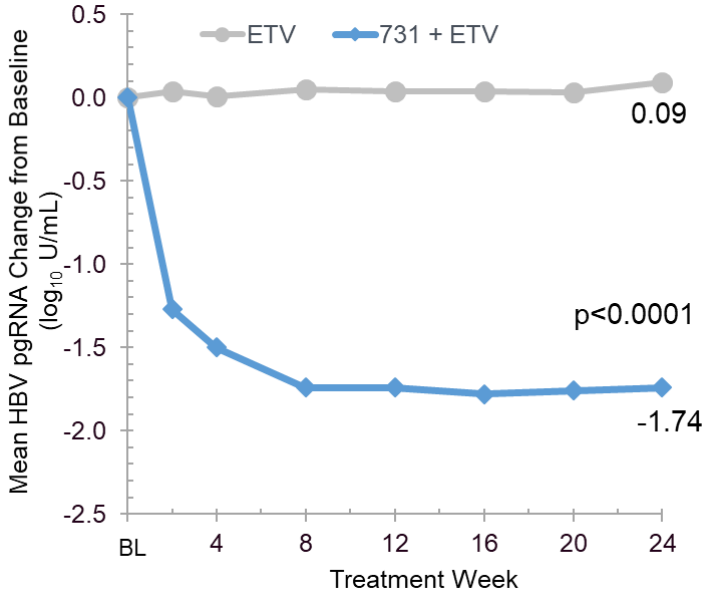
Gel Assay Standardization and Validation



- 0 of 12 Nrtl-treated HBeAg-positive patients achieved "TND" by Wk 24

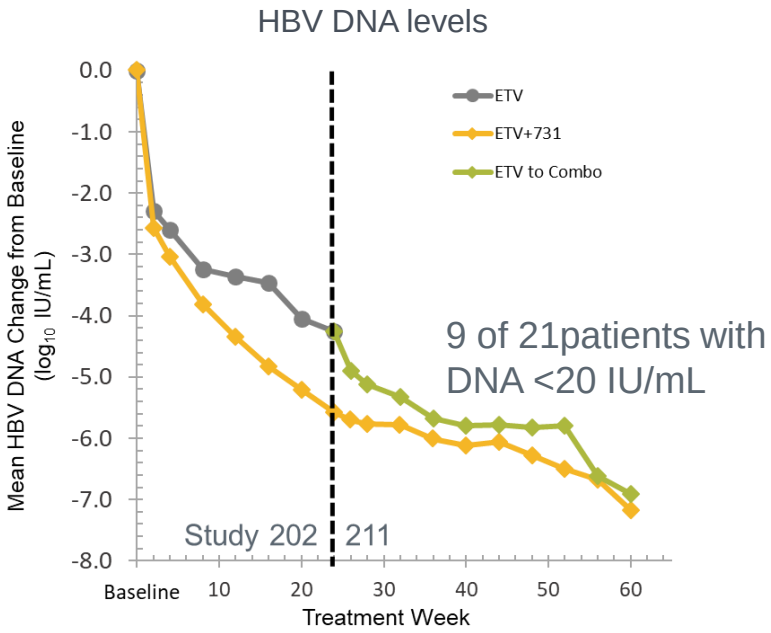
- 22 of 27 (81%) 731+Nrtl treated patients achieved TND by Week 24 (81% vs 0%, p<0.001)

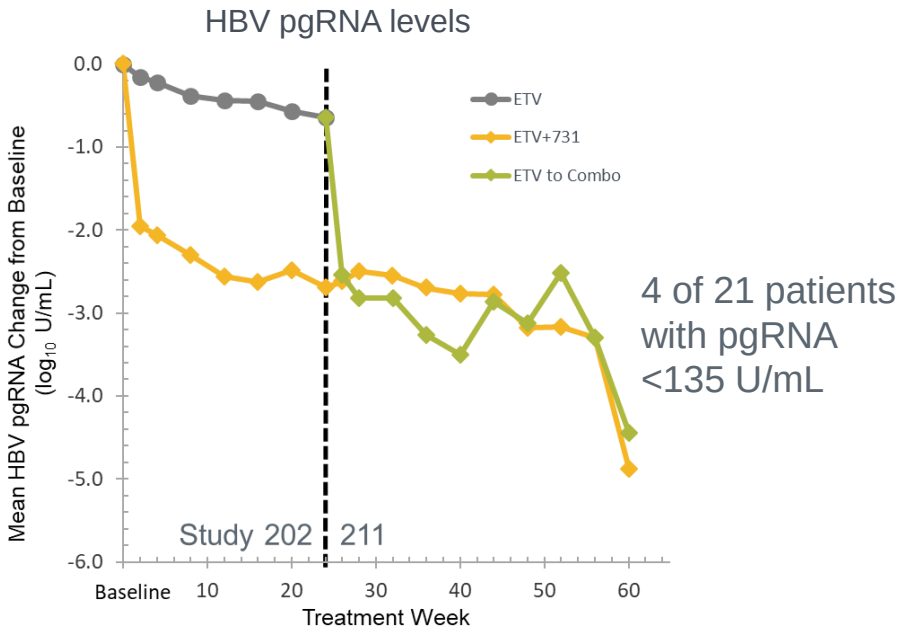
Significant pgRNA Declines on Combination



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

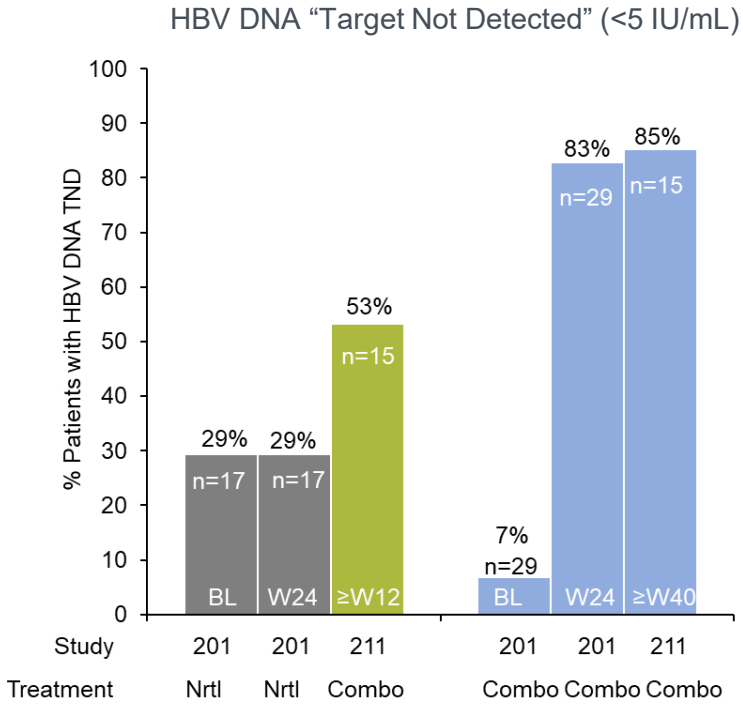
Study 202/211: Further DNA/pgRNA Declines Observed over Time

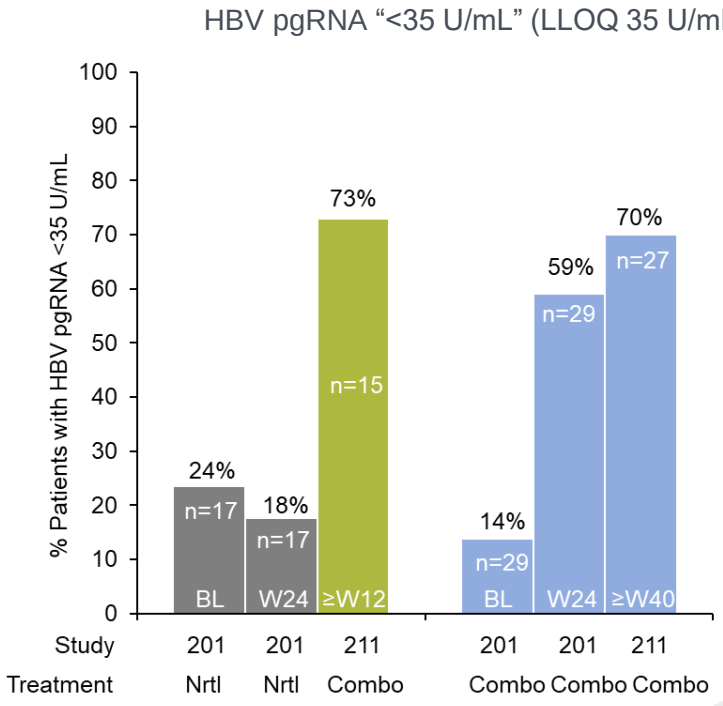




- The mean HBV DNA and pgRNA declines from baseline at Week 48 were 6.3 logs and 3.0 logs, respectively, for patients treated with 731+ETV
- The observed acceleration in second phase decline of HBV pgRNA levels likely reflects reductions of cccDNA pools

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



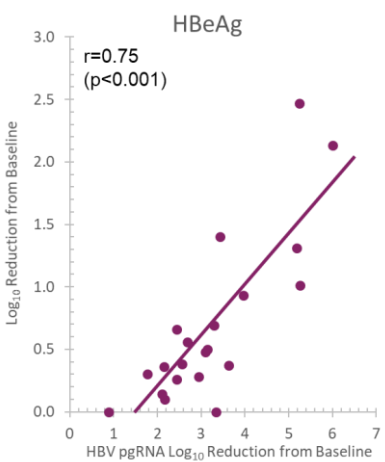


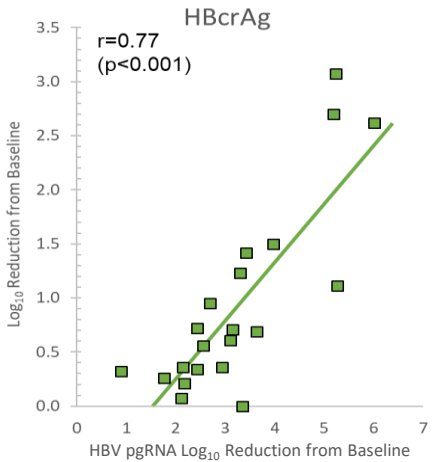
- Only patients receiving 731+ETV had reduced HBV DNA levels to TND and pgRNA levels to <35 U/mL

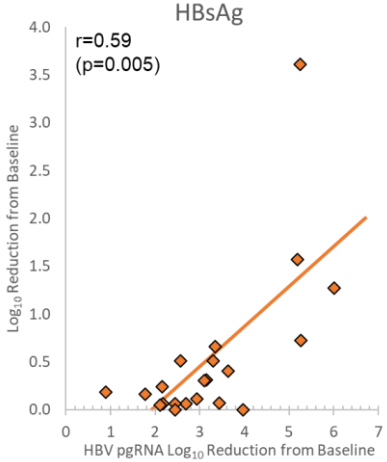
Study 202/211: Correlation Between HBV pgRNA Reductions and Viral Antigen Declines in the Absence of ALT Elevations

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 NrtI-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 NrtI 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 NrtI-suppressed patients that appears different than other viral antigens, similar to prior reports[1,2]

[1]Wooddell, C.I. et al. Sci Transl Med 2017 Sep 27;9(409). pii: eaan0241. doi: 10.1126/scitranslmed.aan0241.
[2]Podlaha, 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+NrtI demonstrated superior antiviral activity vs. NrtI 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

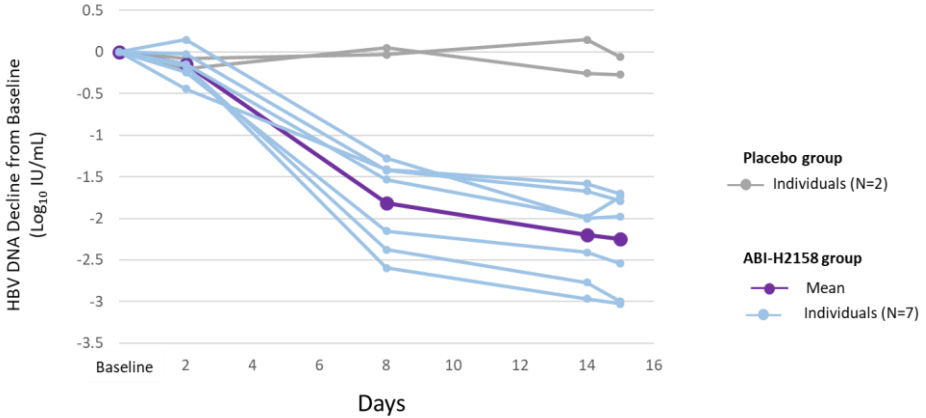
Next Generation Core Inhibitors

ABI-H2158: Interim data from ongoing Phase 1b study

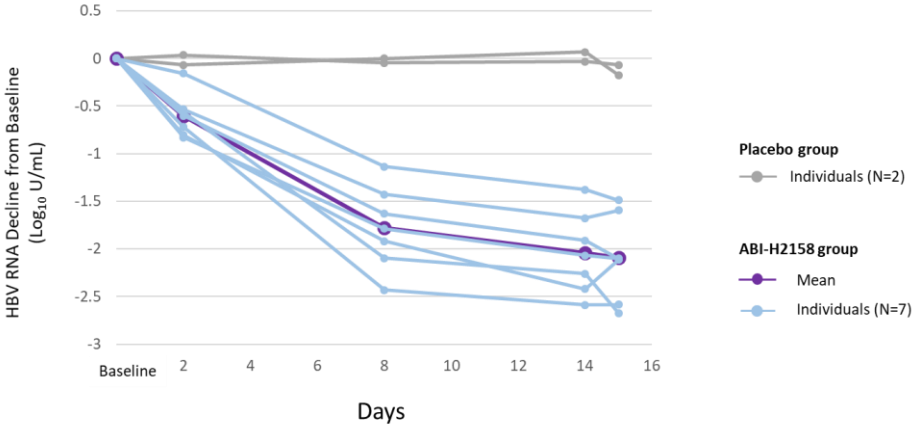
ABI-H3733: 3rd core inhibitor candidate

2158: Interim Phase 1b Antiviral Activity Data

HBV DNA Change from Baseline, Cohort 1 (100mg QD)

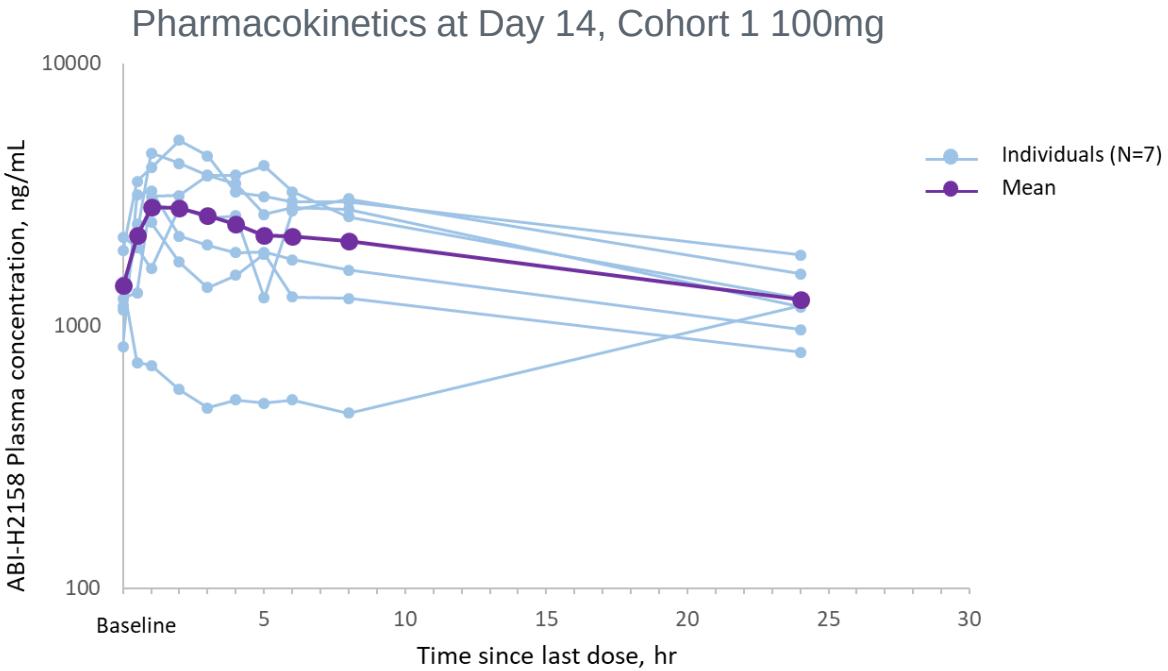


HBV pgRNA Change from Baseline, Cohort 1 (100mg QD)



- In patients receiving ABI-H2158, mean declines from Baseline to Day 15 in HBV DNA and pgRNA levels were 2.3 log10 IU/mL (range 1.7–3.0) and 2.1 log10 IU/mL (range 1.5–2.7), respectively

2158: Interim Phase 1b Pharmacokinetics Data



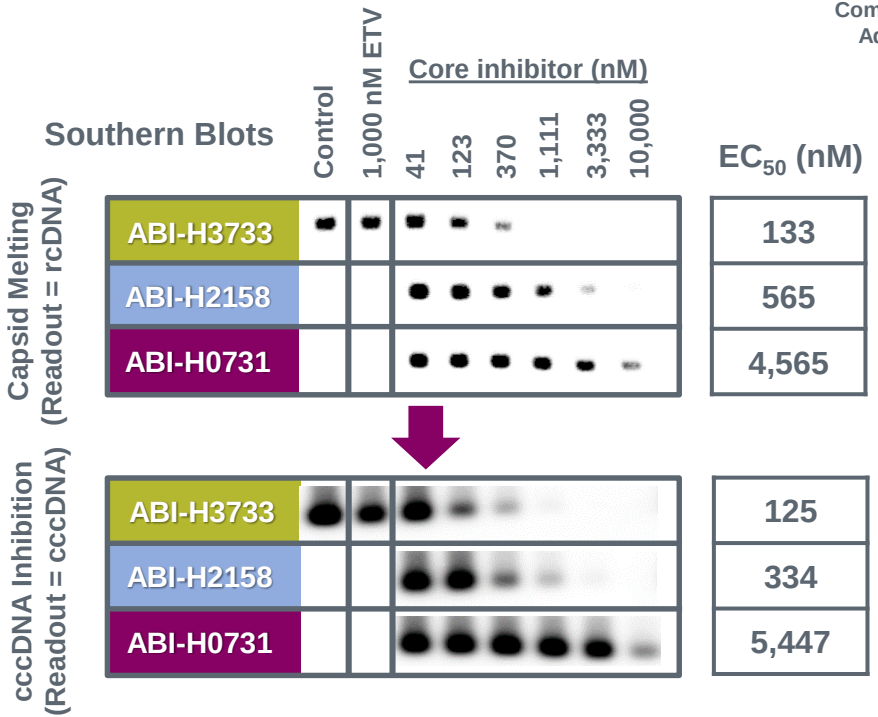
- Steady-state exposures observed at the lowest dose level of 100 mg QD are in excess of the EC_{90} values for *in vitro* antiviral and cccDNA assays

We believe that these data support once daily oral administration

ABI-H3733: Relative Potency in Blocking cccDNA Generation Observed in Preclinical Studies

HBV Infection of HepG2-NTCP Cells

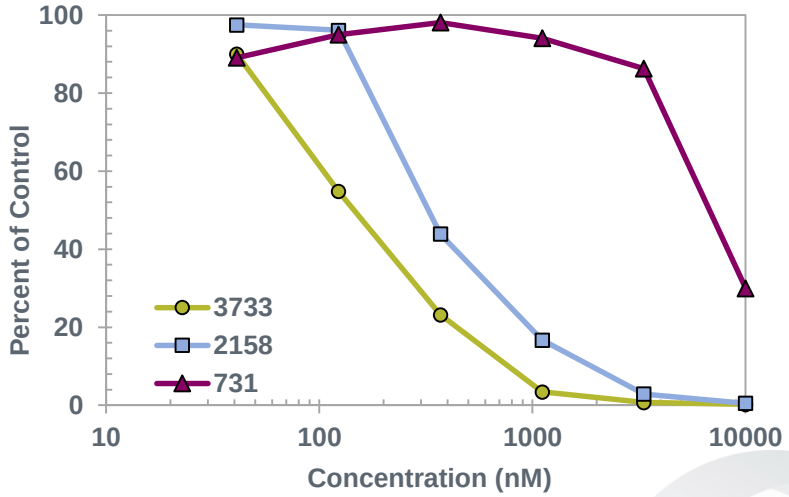
Southern Blots



	EC_{50} (nM)
ABI-H3733	133
ABI-H2158	565
ABI-H0731	4,565

ABI-H3733	125
ABI-H2158	334
ABI-H0731	5,447

Inhibition of cccDNA Establishment



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)

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

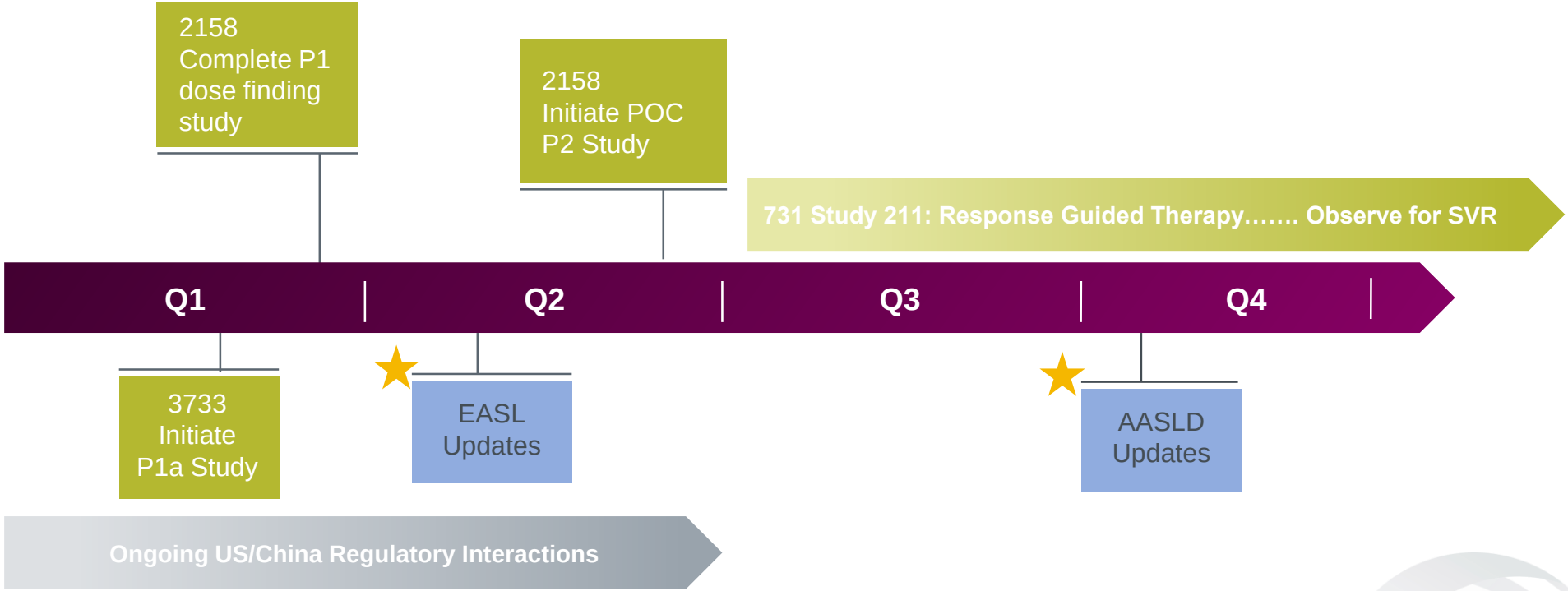
GOAL (PHASE 2):

Demonstrate further decline of viral antigens during consolidation

GOAL (PHASE 2):

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

2020: Anticipated HBV Milestones



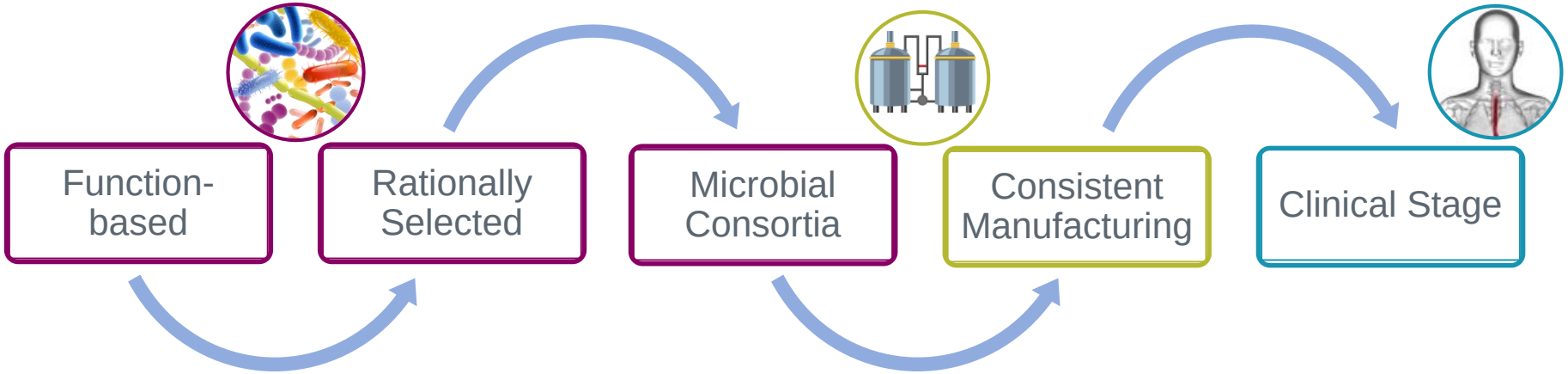
STRONG BALANCE SHEET: ~$157 M in cash (as of 9/30/2019)*

**Does not include gross proceeds of $143.7M from a follow-on closed 12/16/19*

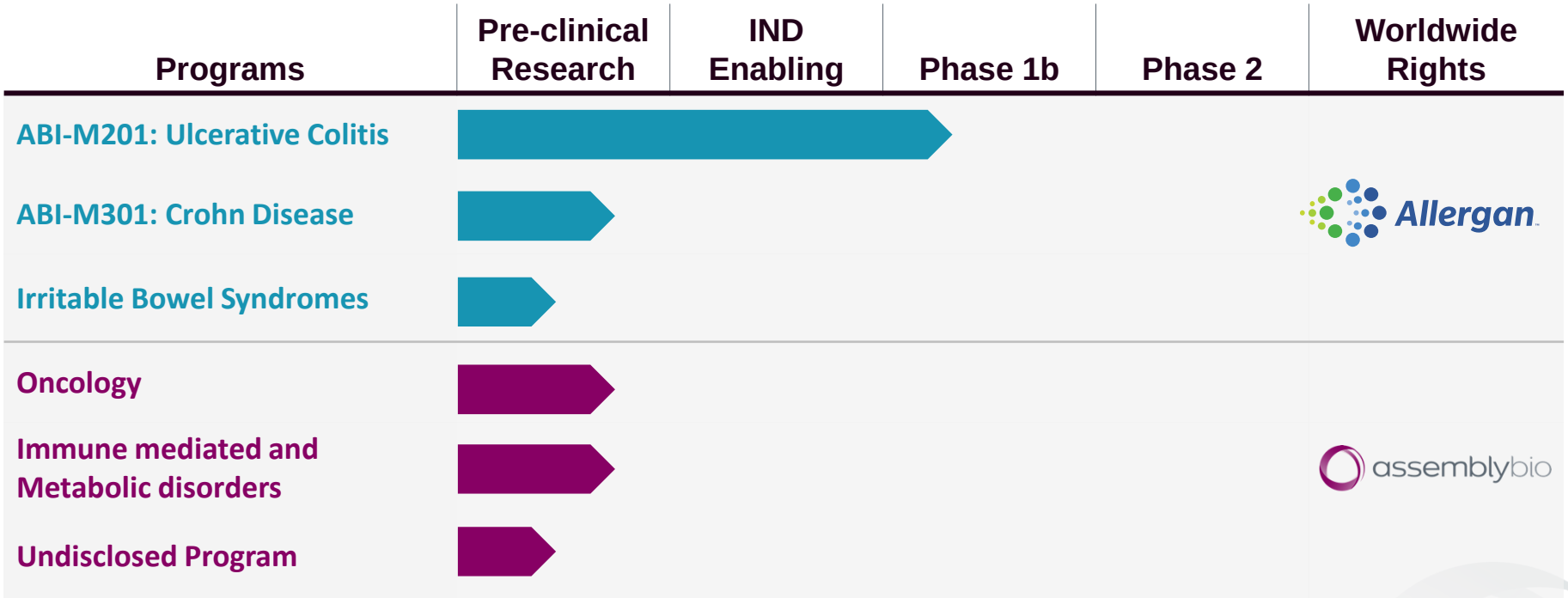
Microbial Biotherapeutics

Harnessing the therapeutic potential of the human microbiome

Developing Best-in-Class Microbial Biotherapeutic Candidates



Broad Biotherapeutic Candidate Pipeline

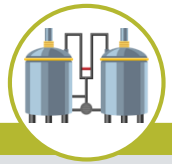


Concept-to-Clinic R&D Platform

Integrated therapeutic candidate discovery and development capabilities

Rationally Selected Bacterial Consortia

- Commensal bacterial library isolated from healthy human donors
- Rigorous human cell-based assays with MOA's relevant to disease
- Microbial phenotyping & genomic analysis support, selection & IND filing
- *In vivo* biologic models to evaluate live microbes in context of relevant biology

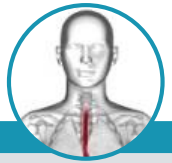


Differentiated Manufacturing

- Optimized growth methodologies for anaerobic bacteria
- Lyophilized formulation development
- Process scalability and high quality GMP production
- Manufacturing capabilities for in-house drug product

Gemicel® Targeted Oral Delivery Technology

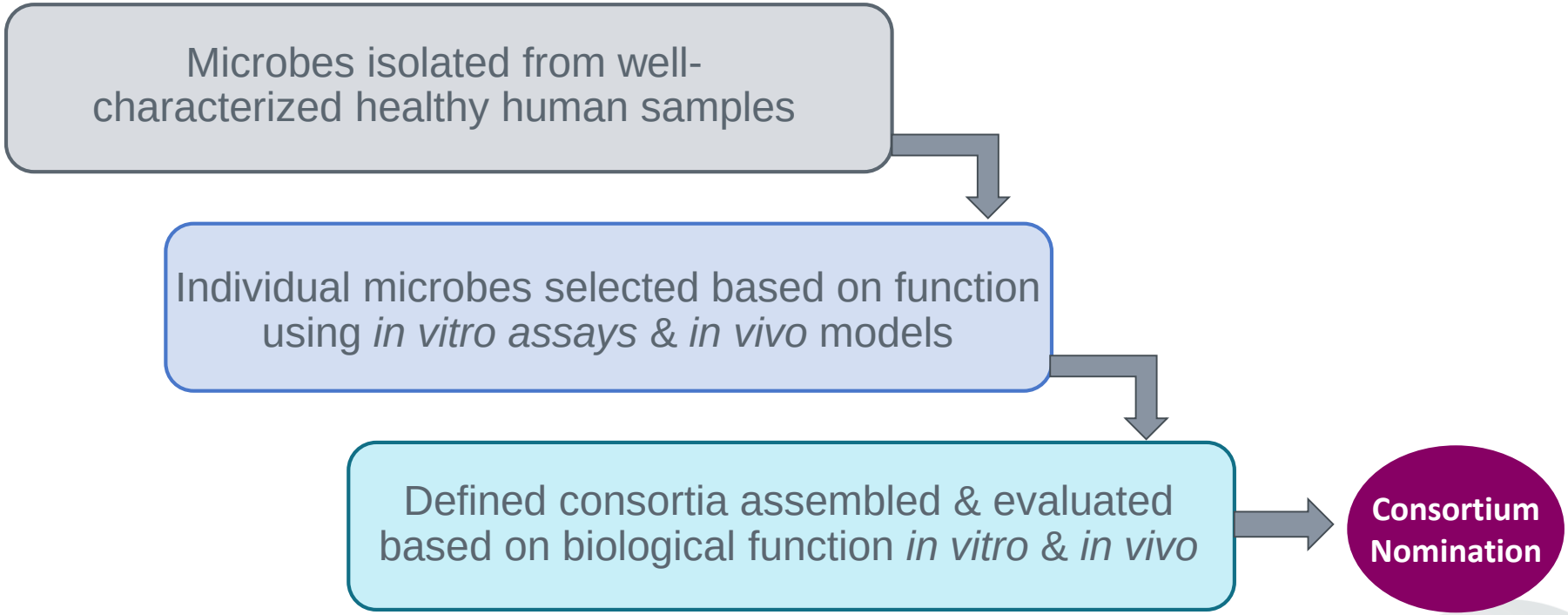
- Novel dual release technology
- Designed to deliver vegetative bacteria to specific intestinal regions
- Two different doses of same drug or two different drugs



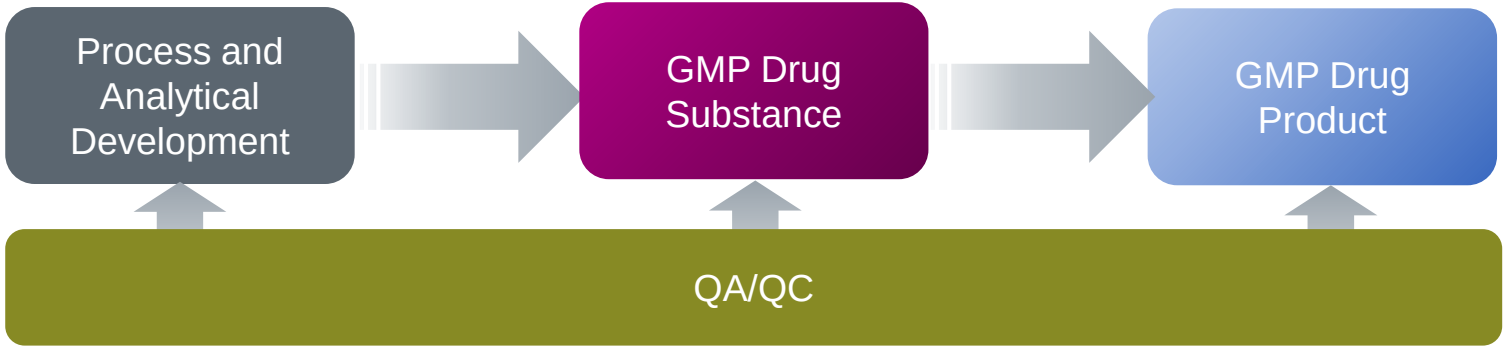
Clinical Development

- Ph1b in progress for M201 in patients with UC

Rationally Selecting Consortia of Live Microbes with Pharmacological and Biological Functions



Scalable GMP-Compliant Drug Manufacturing Processes and Encapsulation

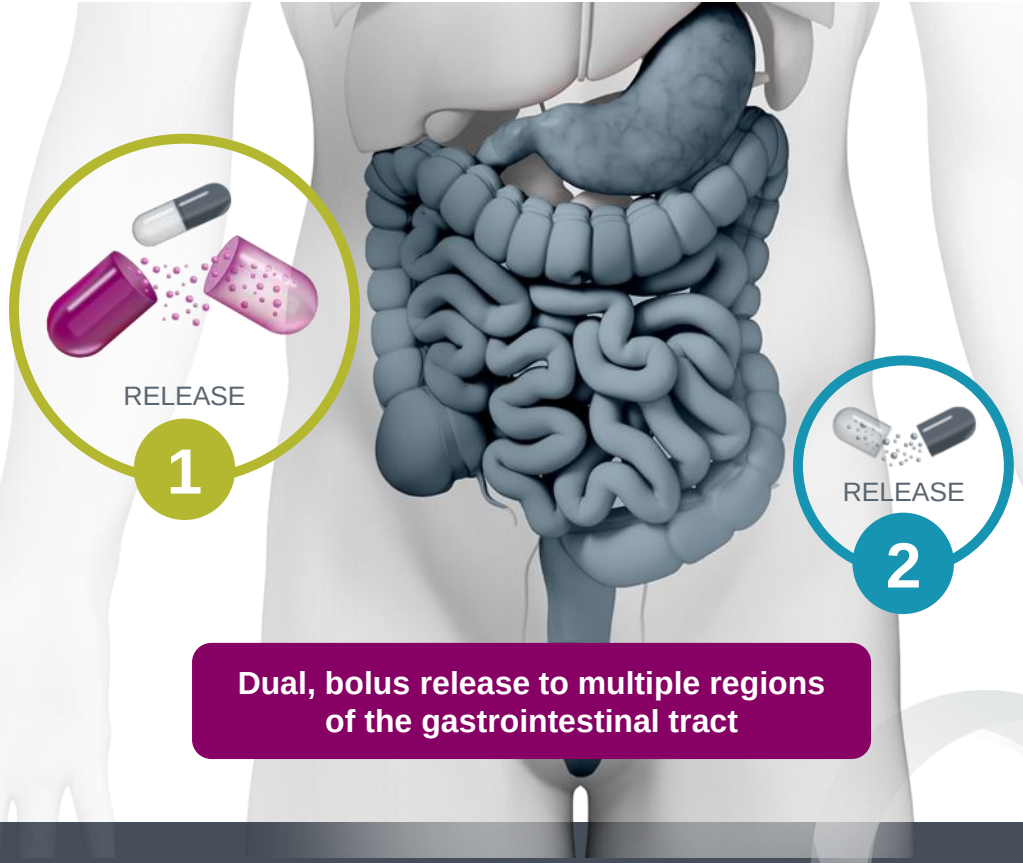


- Fully integrated CMC capabilities for live microbial biotherapeutics
- Maintain microbial viability and biological function
- Reproducible process batch to batch using proven technology
- Taxa from any bacterial phyla are candidates for use

Gemicel® Capsule-In-Capsule Delivery Technology

Oral delivery of viable vegetative bacteria with dual release

Gemicel® capsule



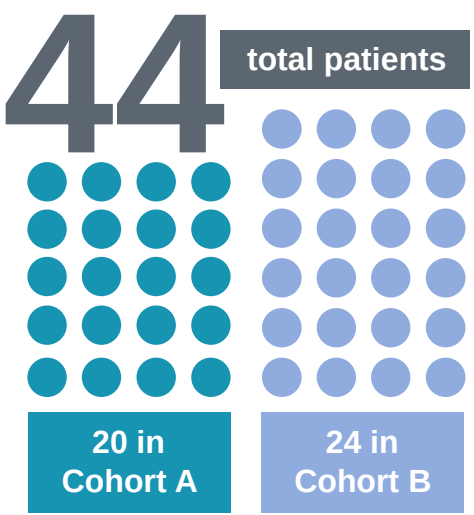
Dual, bolus release to multiple regions of the gastrointestinal tract

API = active pharmaceutical ingredient.

ABI-M201
Ongoing Phase 1b in Ulcerative Colitis Patients

About the study

- ✓ Phase 1b
- ✓ Randomized
- ✓ Double-blind
- ✓ Placebo-controlled
- ✓ Patients with mild-moderate UC



8-week treatment with QD orally administered ABI-M201 or placebo

8-week clinical endpoints

Safety and tolerability

Induction of clinical remission

Endoscopic improvement

Gastrointestinal Collaboration with Allergan

assembly bio

- Responsible for discovery and development through proof of concept (POC)
  - Ulcerative Colitis
  - Crohn's disease
  - Irritable Bowel Syndromes
- ABI-M201 Phase 1b in patients with mild-to-moderate UC underway

Allergan

- Develops programs post-POC
- Reimburses ASMB two-thirds of R&D cost up to $75 million collectively

Financial Highlights

- **$50 million up-front** payment
- **$75 million in R&D** funding
- Up to **~$2.8 billion in development** and commercial milestones
- Tiered royalties up to midteens

Key Achievements of Microbiome Program

- **Partnership with Allergan** in IBD & IBS – up to $2.8 billion in milestone payments
- **Phase 1b clinical trial underway** for ABI-M201 in patients with ulcerative colitis
- **M201 discovery to IND in less than 12 months –** Established R&D roadmap
- **6 pipeline programs** in high value indications
- **High quality, scalable manufacturing** facility and processes established

Thank you