Assembly Biosciences, Inc. Corporate Presentation

January 2018
Nasdaq: ASMB

Cautionary Note Regarding Forward-looking Statements

The information in this presentation contains estimates and other forward-looking statements regarding future events, including statements about the clinical and therapeutic potential of our HBV-Cure and Microbiome programs, our ability to receive payments from Allergan Pharmaceuticals International Limited ("Allergan") under the collaboration agreement, timing of the initiation of and availability of data from our ongoing and planned clinical trials in each of these programs, plans, strategies, milestones, and intentions related to our programs. Certain forward looking statements may be identified by reference to a future period or periods or by use of forward-looking terminology such as "believe," "predictive", "planned," "should," "initiate," "potential," "anticipated," or "expected." Such forward-looking statements, which we intend 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: the components, timing, patient enrolment rates, cost and results of clinical trials and other development activities involving our product candidates (including those licensed by Allergan); the unpredictability of the nonclinical and clinical development of our product candidates and of the duration and results of regulatory review of those candidates by the FDA and foreign regulatory authorities; our anticipated capital expenditures, our estimates regarding our capital requirements, and our need for future capital; and the possible impairment of, or inability to obtain, intellectual property rights and the costs of obtaining such rights from third parties. 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 Annual Report on Form 10-K for the year ended December 31, 2016 and our Quarterly Report on Form 10-Q for the quarter ended September 30, 2017 each filed with the Securities and Exchange Commission (the "SEC"). It is not possible for Assembly management to predict all risks nor can Assembly assess the impact of all factors on its 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 Assembly may make. This presentation also contains estimates and other statistical data made by independent parties and by us relating to market size. 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. Except as required by law, we assume no obligation to update publicly any forward-looking statements, whether as a result of new information, future events or otherwise.

Assembly Biosciences: Two Innovative Drug Development Platforms

Challenge	Opportunity	Rationale
		
HBV		
• SOC does NOT CURE • Eliminate cccDNA (moiety responsible for viral persistence)	• Establish Core protein Allosteric Modifiers (CpAMs) as critical component of HBV curative backbone	• Prevent replenishment of new cccDNA until established cccDNA is eliminated
Microbiome		
• FMT is inadequate as therapy	• Develop oral, synthetic, live biotherapeutics	• FMT provides clinical POC and basis for strain selection

Development Programs in Large Markets with High Unmet Need

Program	Drug Candidate (Mech. / Indication)	Discovery	Lead Op / Selection	IND Enabling	Phase 1a	Phase 1b	Phase 2
Hepatitis B	ABI-H0731 (CpAM)						
	ABI-H2158 (CpAM)						
	3rd CpAM						
	Novel Target						
Microbiome	Ulcerative Colitis (ABI-M201)			Allergan			
	Crohn's Disease (ABI-M301)			Allergan			
	Irritable Bowel Syndrome			Allergan			
	NASH, I/O & Other						
	Clostridium difficile (C.diff)						
	Gemicel® (targeted oral delivery system)	Gemicel® (targeted oral delivery system) - Clinical POC achieved					

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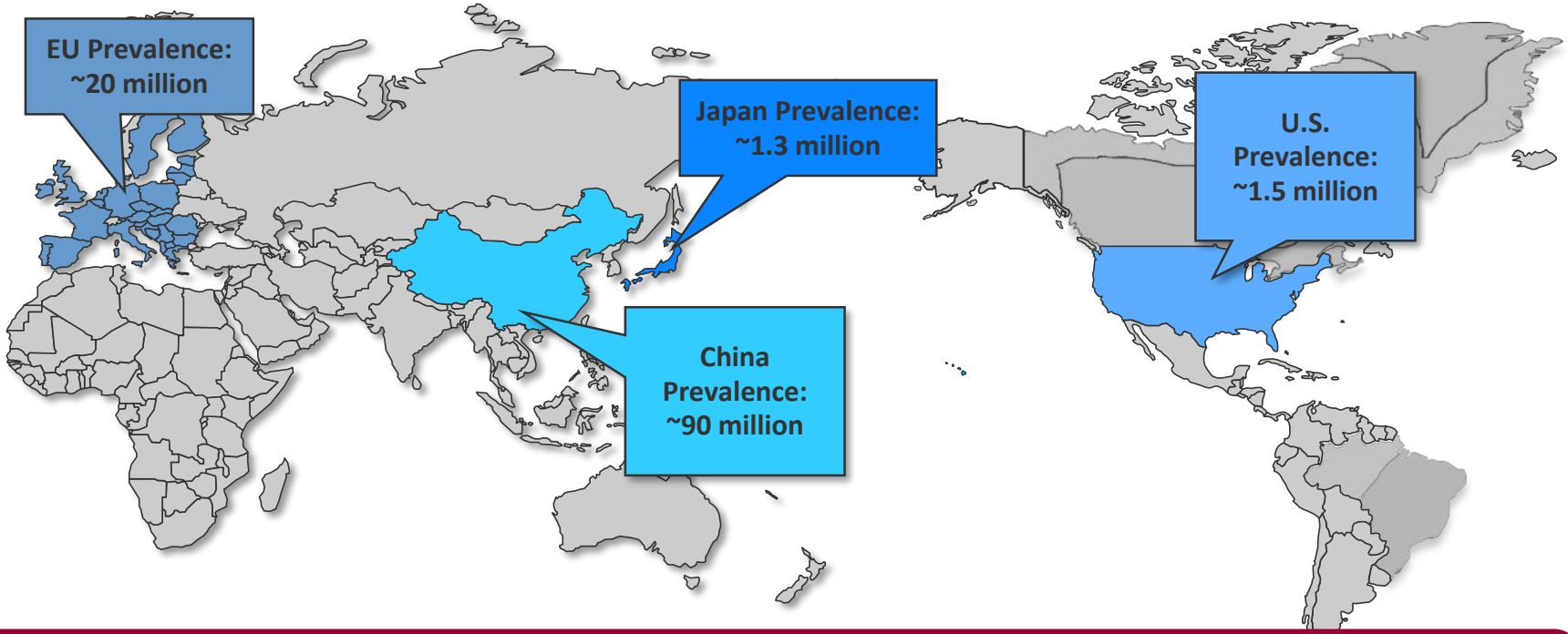
Hepatitis B: Cure Program

HBV is Curable with a Large Treatment Population

CpAMs: ASMB's Portfolio

Over 250 Million Chronically-Infected HBV Patients Globally

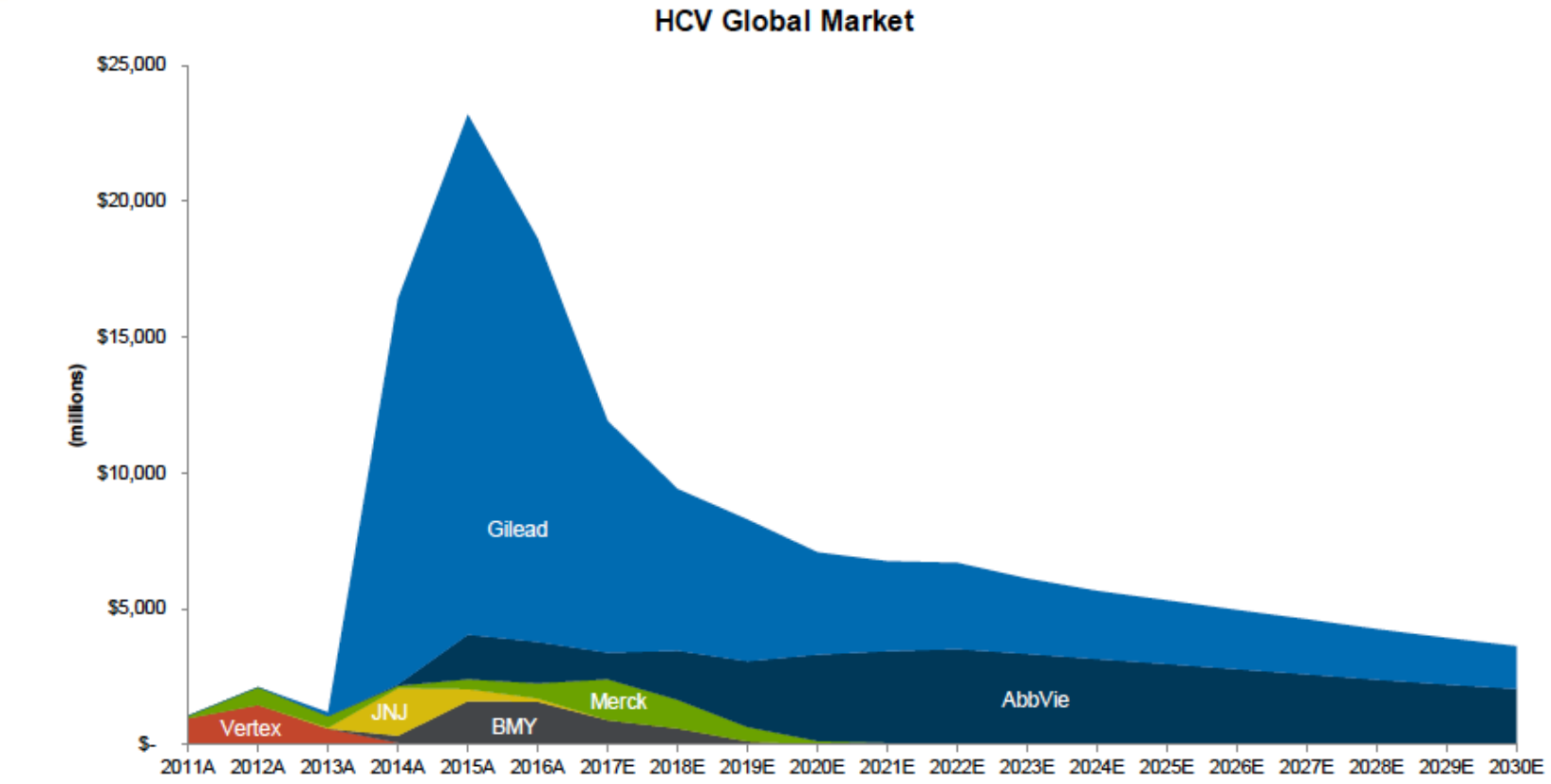
- **Low cure rates with current SOC**
- **Vaccines prevent infection, but do not cure those chronically infected**



Chronic HBV infection results in chronic inflammation and progressive liver damage, potentially leading to liver cirrhosis, HCC and ~ 1 million deaths/year

http://www.hepb.org/what-is-hepatitis-b/what-is-hepb/facts-and-figures/

Opportunity to Learn From HCV-Cure Market



Sources: Company reports and William Blair estimates

Globally, HBV has >100M more patients than HCV, with an opportunity to achieve a more growth oriented sales curve while treating many more patients per year

Source: William Blair Analyst Report

Cure is Possible: But not with SOC Alone

Currently Approved

- Nucleos(t)ide Analogs: entecavir, tenofovir, lamivudine, telbivudine, adefovir and tenofovir alafenamides
- Interferons (IFN and peg-IFN)

Entecavir and Tenofovir (Standard of Care)

- Safe, highly effective therapies and the current drugs of choice
- Target the viral polymerase, inhibiting reverse transcription to generate rcDNA
- Highly effective at eliminating and sustaining undetectable HBV DNA levels
- One pill, once-a-day dosing, very well tolerated, no meaningful resistance emergence

Unfortunately, cure rates are very low despite prolonged therapy

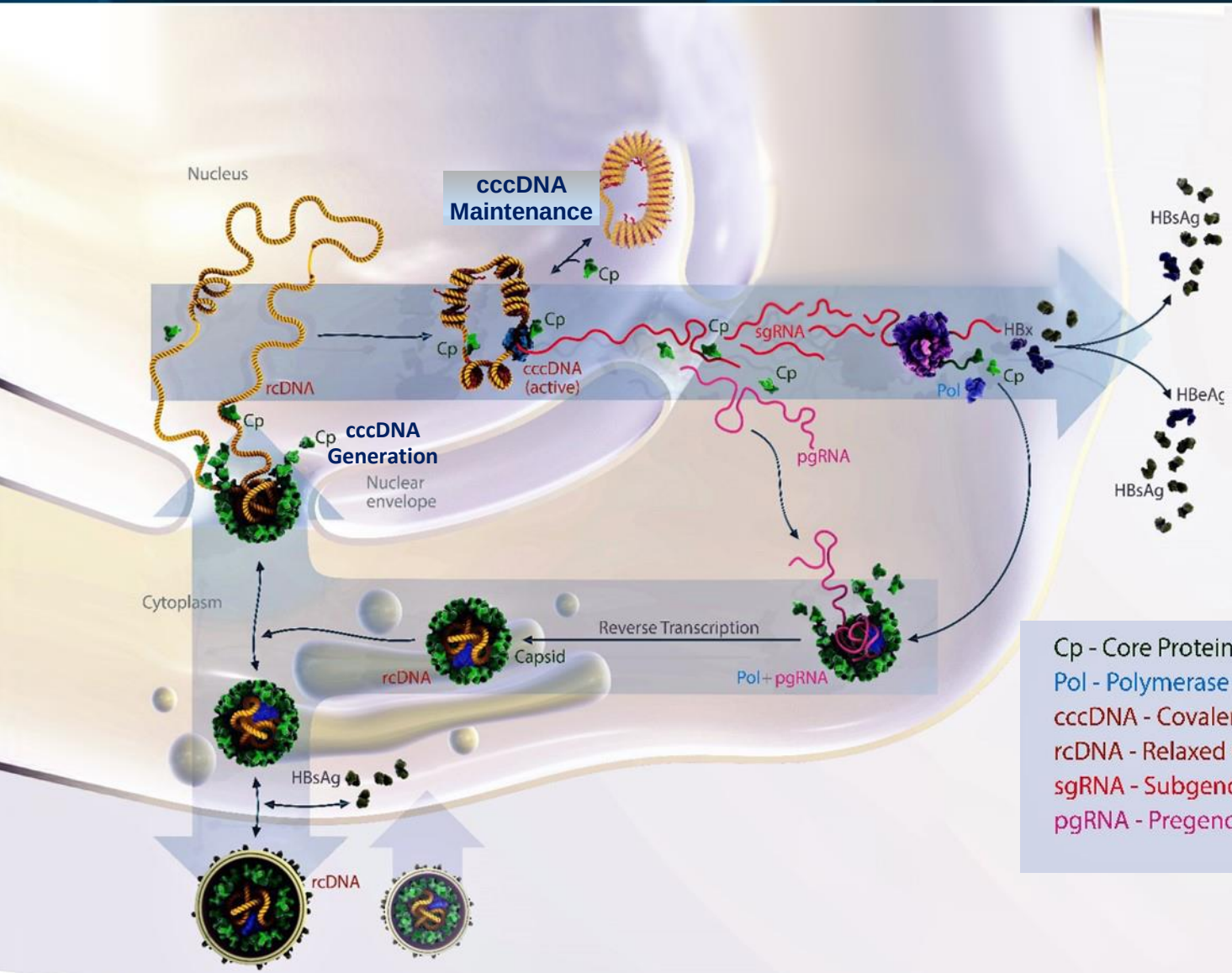
Cure is Possible!

- Current spontaneous and treatment-related cure do occur in ~5% of HBV patients (sustained viral suppression in absence of therapy)[1]
- Chronically-infected woodchucks cured with ETV (viral DNA undetectable, cccDNA levels reduced >4 logs, HBsAg levels reduced 91% and HCC emergence prevented)[2]

[1]*Marcellin, P. et al. (2016). Combination of Tenofovir Disoproxil Fumarate and Peginterferon-2a Increases Loss of Hepatitis B Surface Antigen in Patients with Chronic Hepatitis B. Gastroenterology, 150(1), 134–144.e10. https://doi.org/10.1053/j.gastro.2015.09.043*

[2]*R. Colonno, et al. JID 2001;184:1236-45*

HBV Life Cycle: A Complex DNA Virus with Limited Targets



Cp - Core Protein
Pol - Polymerase
cccDNA - Covalently Closed Circular DNA
rcDNA - Relaxed Circular DNA
sgRNA - Subgenomic RNA
pgRNA - Pregenomic RNA

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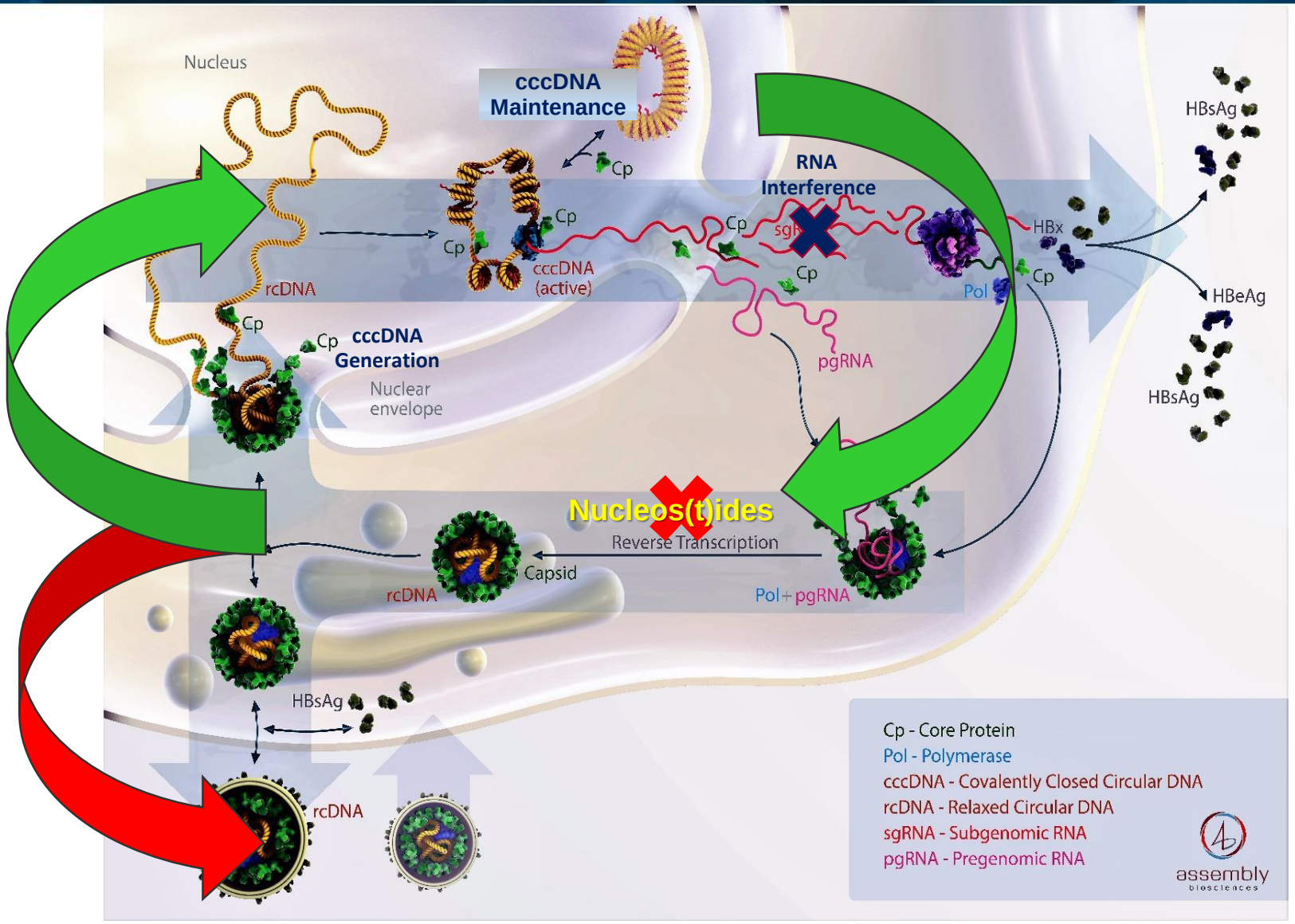
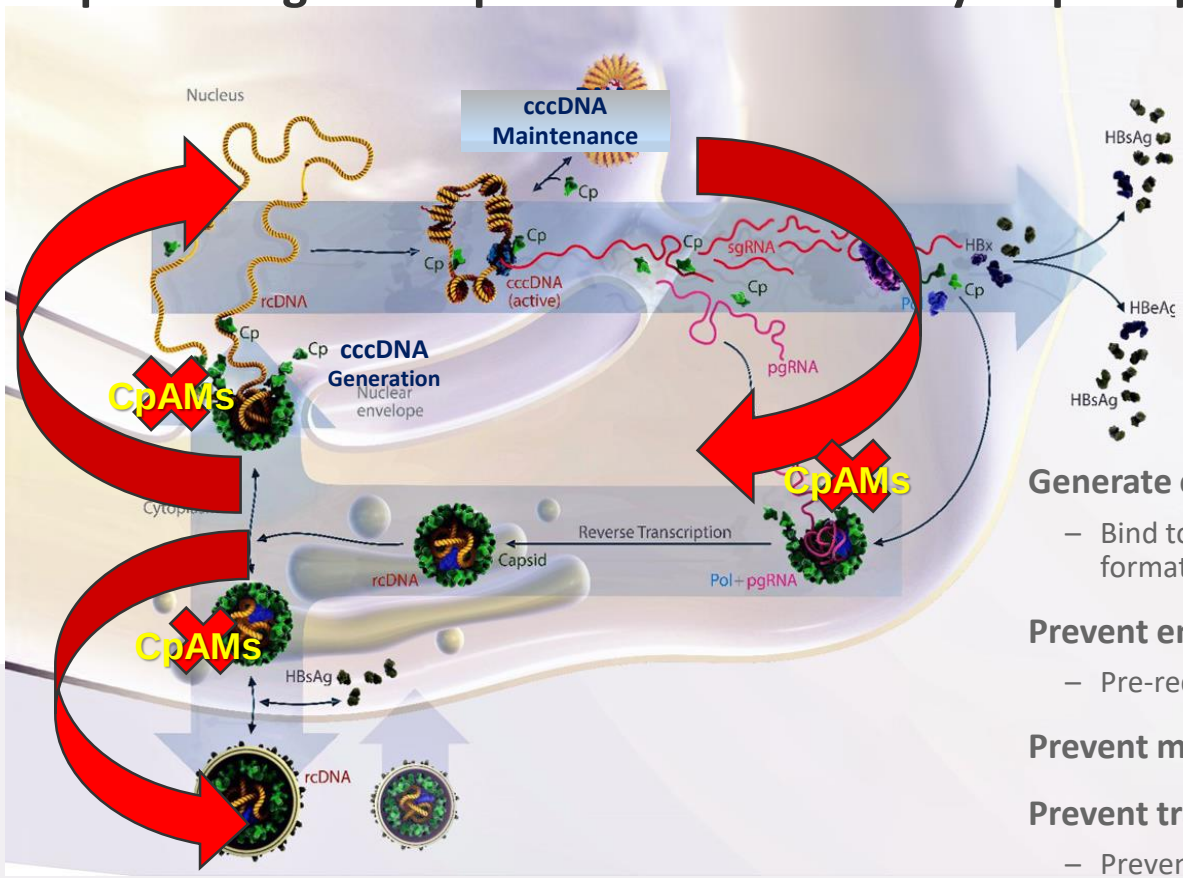
Nucs Fail to Inhibit cccDNA Establishment



CpAMs Inhibit Several Steps of HBV Life Cycle

CpAMs target core protein and inhibit key steps required for cccDNA generation



Generate empty aberrant capsid formation

- Bind to Core protein dimer-dimer interface disrupting formation of functional nucleocapsids

Prevent encapsidation of Pol and pgRNA

- Pre-requisite for generation of rcDNA by RT

Prevent maturation of infectious viral particles

Prevent trafficking of encapsidated rcDNA to nucleus

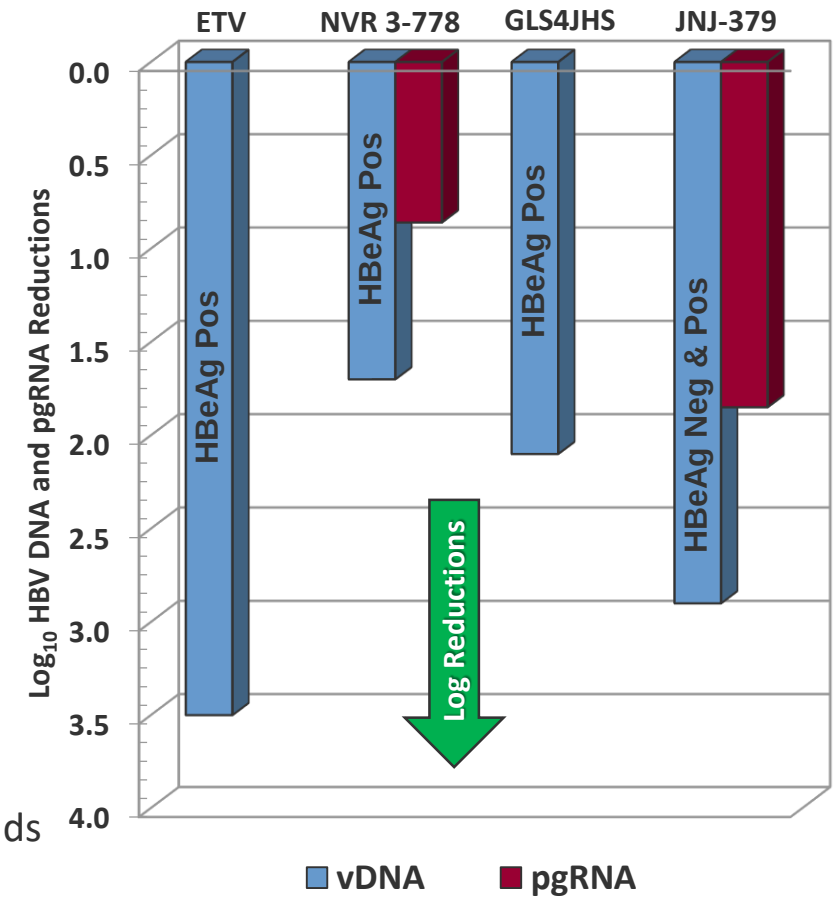
- Preventing subsequent conversion to cccDNA

Core protein Allosteric Modifiers (CpAMs) target and inhibit cccDNA generation

Clinical POC of CpAMs as Potent HBV Antivirals

Phase 1b 28-Day monotherapy studies in HBV-infected patients

- Viral DNA reductions serve as surrogate marker for effective liver concentrations in patients
- Establish safety profile in patients
- Studied CpAMs
  - NVR 3-778[1] – 600 mg BID
    → 1.72 log drop in HBeAg pos patients
  - GLS4JHS[2] – 240 mg QD + RTV
    → 2.13 log drop in HBeAg pos patients
  - JNJ-379[3] – 25 mg QD
    → 2.16 log drop in combined HBeAg pos & neg
  - JNJ-379[3] – 75 mg QD
    → 2.89 log drop in mostly HBeAg neg patients
- All HBV antivirals have reduced observed activity in HBeAg pos patients due to significantly higher viral loads



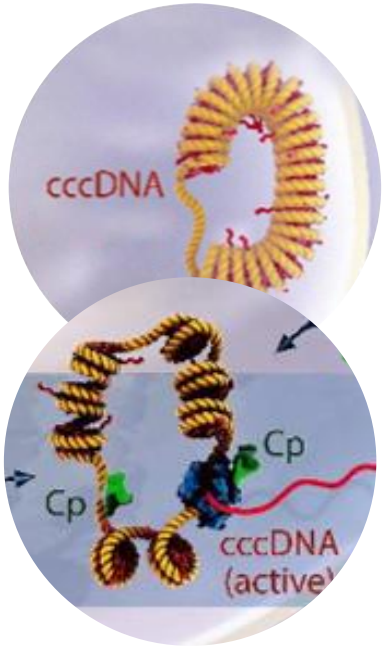
[1] *Yuen et al., AASLD Poster LB-10 11-2015*
[2] *Ding et al., AASLD Poster 920 10-2017*
[3] *Zoulim et al., AASLD Poster LB-15 10-2017*

Half-life of Existing cccDNA May be Shorter than Previously Believed

New studies show half-life of cccDNA may be on order of weeks-to-months

All biological molecules have a half-life, including cccDNA

- Longitudinal study conducted on samples (serum and biopsies) from patients with emerging resistance to LVD and TBV
- Appearance and enrichment of resistant mutations used as a genetic marker in monitoring populations of viral DNA, pgRNA and cccDNA
- Population sequences from viral DNA, pgRNA and cccDNA are similar, indicating that resistant variants result from turnover of nearly all of the pgRNA and cccDNA populations
- Serum HBV DNA and pgRNA populations can revert to or from Nuc^R populations in as few as 12 weeks
- **Existing cccDNA may decay faster than previously predicted**



Therapies inhibiting establishment of new cccDNA, while existing cccDNA pools decay over time, should lead to a higher overall cure rates

Huang et al., AASLD 2017

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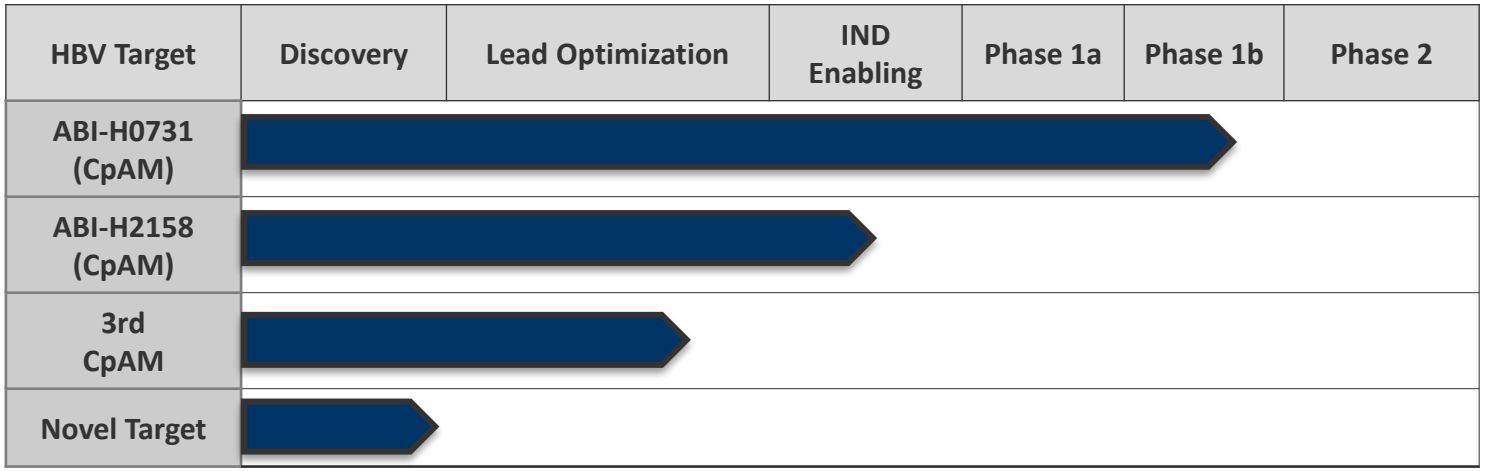
Hepatitis B: Cure Program

HBV is Curable with a Large Treatment Population

CpAMs: ASMB's Portfolio

ASMB Portfolio of HBV Antivirals

Novel molecules, with distinct IP discovered at Assembly



- Optimized CpAMs that exhibit **potent inhibitory activity against cccDNA generation and establishment** in HBV infected cells
- Observed to be **metabolically stable** in liver hepatocytes, enabling potent and sustained inhibition
- PK profiles predictive of **once a day dosing, limited potential for drug-drug interactions**
- **Clinical candidates have exhibited good safety profile in animal studies**, supporting prolonged dosing in patients

CpAMs designed to be potent with once a day dosing

ABI-H0731: Candidate Summary

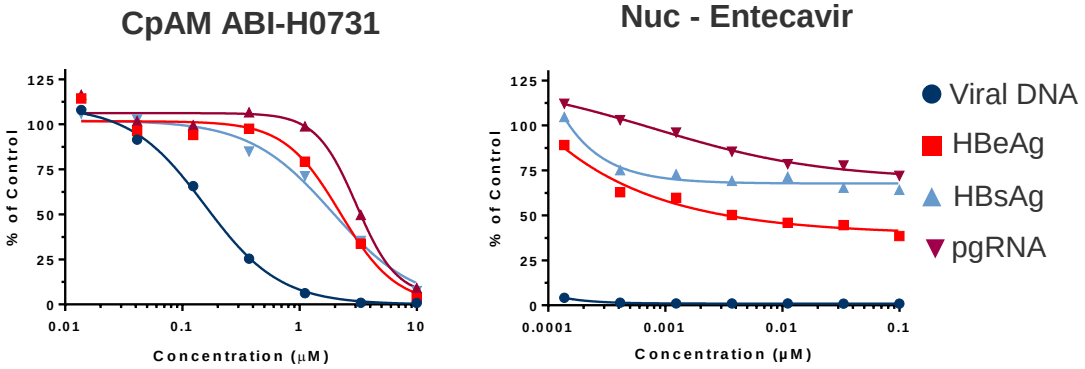
Lead molecule from a deep pipeline of CpAMs

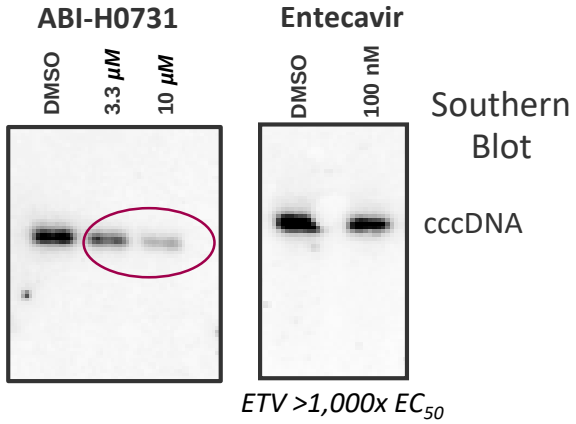
- Phase 1b ongoing
- Phase 1a Complete: Dose ranging study was well tolerated in all cohorts
  - Favorable PK profile with a half-life (~24 hr) predictive of ***QD dosing***
  - Well absorbed and associated with plasma concentrations that we believe will be sufficient to suppress viral replication and ***cccDNA generation***
  - ***No SAEs***, no clinically significant AEs and no withdrawals due to AEs in Phase 1a study
- Potent and selective activity against all major HBV genotypes

Topline Phase 1b data expected Q1 2018

ABI-H0731 Inhibits cccDNA Establishment in PHH

Assays in HBV Infected Primary Human Hepatocytes (PHH)





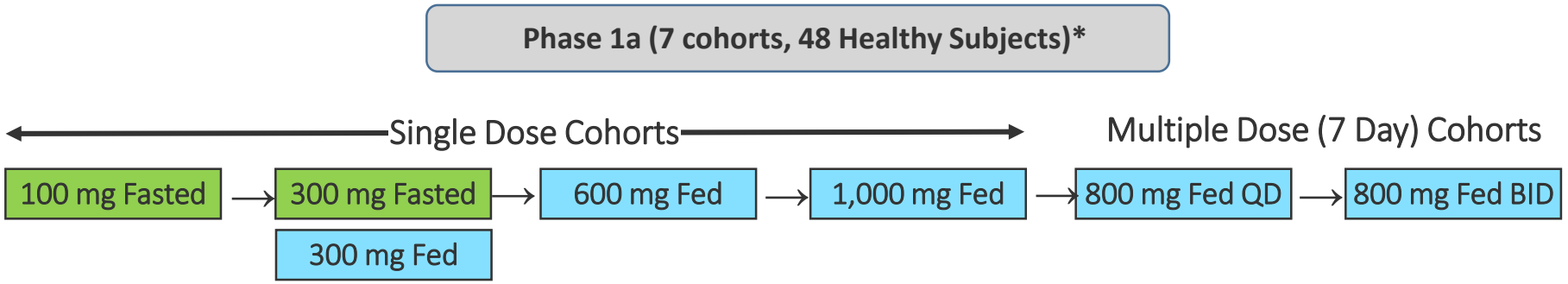
Compound	Viral DNA	HBeAg	HBsAg	pgRNA
ABI-H0731	154	2,210	3,000	1,840
ETV	<0.1	Incomplete	Incomplete	Incomplete

Observations

- ABI-H0731 reduced viral HBV DNA levels in addition to known surrogate markers for cccDNA (HBeAg, HBsAg and pgRNA)
- ETV was highly effective at inhibiting HBV DNA levels, but exhibited modest effects on inhibition of cccDNA establishment

Huang et al., EASL Poster 104 4-2016

ABI-H0731 – Phase 1a Trial Design



- **Primary Objective – Dose-related safety and tolerability**
  - No treatment-emergent laboratory abnormalities deemed clinically significant were observed
  - Most treatment-emergent adverse events occurred as single events – with possible exception of Grade 1 rashes in highest dosed cohorts
- **Secondary Objective – Human PK**
  - Low subject-to-subject variability
  - Administration with food resulted in a ~45% increase in AUC
  - Half-life ~24 hours → potential for once daily dosing

**Gane et al., AASLD Poster 926 10-2017*

ABI-H0731 – Phase 1b Trial Design

Phase 1b – Dose-ranging, HBeAg negative & HBeAg positive patients

28 Day Patient Cohorts

X mg Fed QD → Y mg Fed QD ..... Z mg Fed QD

- **Primary Objective**
  - Dose-related safety and tolerability in HBV patients
- **Secondary Objective**
  - Selection of optimum dose
  - Relative degree of declines in viral load and pgRNA
- **Study is ongoing and remains blinded**

Topline Phase 1b data expected Q1 2018

ABI-H0731: Clinical Investigational Plan

Study	Duration	# treated	Endpoint(s)
Phase 1a	1 or 7 days	48 Subjects	Safety and PK (completed)
Phase 1b Monotherapy (nuc naïve pts)	28 days	≤ 50 Patients	Safety and declines in viral load and pgRNA (ongoing)
Phase 2a Combination POC Study	6 -12 months	≤ 100 Patients	Safety in combination with Nuc and declines in pgRNA and viral antigens
Phase 2b Combination Curative Study	12-18 months	TBD	% patients with sustained response

Potential for initial POC data in H2 2018

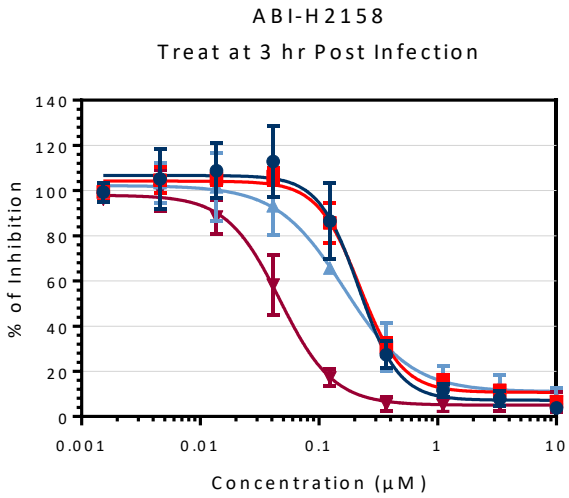
ABI-H2158: Candidate Summary

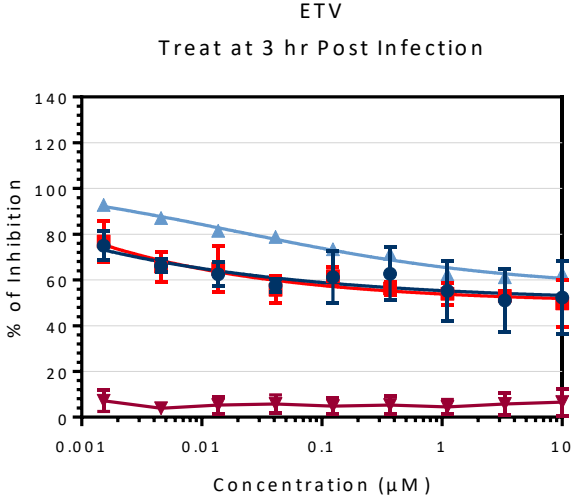
Potent candidate from a deep pipeline of CpAMs

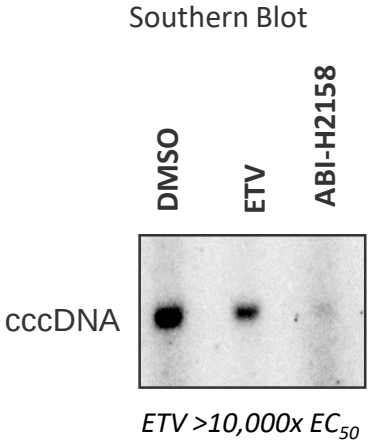
- Distinct and proprietary chemical scaffold
  - All ASMB CpAMs are differentiated from each other and from other classes (i.e. HAPs)
  - Unique patent estate for each ASMB CpAM (applications)
- ***Enhanced potency*** in reducing viral DNA levels in *in vitro* studies
  - Potential to "melt" capsids trafficking to nucleus
- Precise potency needed to fully shut down cccDNA generation in HBV patients remains unknown
- Maintains favorable drug-like characteristics, with potential for QD dosing

Second generation CpAM to initiate clinical trials in 2018

ABI-H2158 Inhibition in HBV Infected PHH Cells







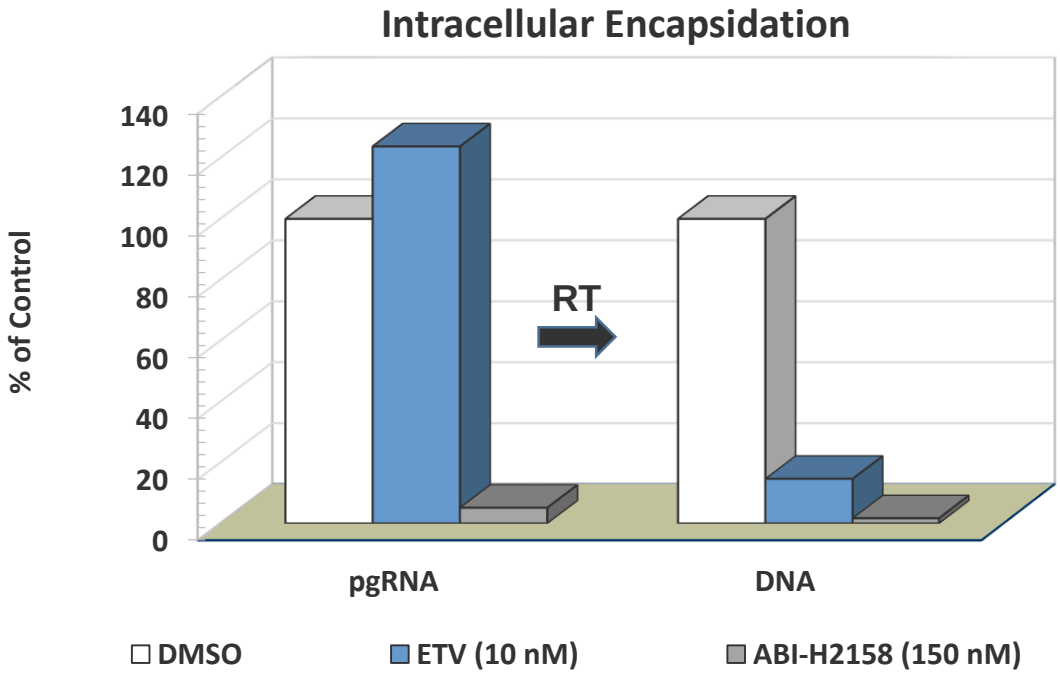
Parameter	PHH EC_{50} (nM) (Treatment 3 hr Post Infection)		
	ETV	ABI-H2158	ABI-Nx
Viral DNA	< 0.025	49	11
HBeAg	>10,000	242	60
HBsAg	>10,000	231	50
pgRNA	>10,000	193	72

Observations

- ABI-H2158 inhibits viral replication in HBV-infected PHH cells, indicating good stability in human hepatocytes
- Next generation CpAMs exhibit enhanced potency in reducing HBeAg, HBsAg and pgRNA levels, as well as blocking cccDNA establishment

Huang et al., AASLD Poster 922 10-2017

CpAMs Block pgRNA Encapsidation



- Induced HepAD38 cells were treated at 10x EC_{50} levels
- CpAMs prevent encapsidation of pgRNA and subsequent Pol synthesis of rcDNA in nucleocapsids
- ETV inhibited conversion of pgRNA to rcDNA in nucleocapsids, stabilizing and *increasing* the levels of encapsidated pgRNA observed

Huang et al., AASLD Poster 922 10-2017

ASMB CpAM Program Summary

- ✓ CpAMs ***disrupt viral replication*** at multiple steps
- ✓ Importantly, CpAMs ***block the generation of new cccDNA*** molecules (SOC/Nuc's do not effect cccDNA)
- ✓ ***Multiple distinct and proprietary chemical scaffolds***
- ✓ ASMB CpAMs exhibit a balance of ***potency AND favorable drug-like properties***
- ✓ ***ABI-H0731***
  - Favorable safety and PK properties predictive of ***QD dosing*** in patients
  - Ongoing Phase 1b study in chronically-infected patients
- ✓ ***ABI-H2158***
  - Second generation candidate exhibited ***enhanced potency*** while retaining ***favorable drug-like properties*** in *in vitro* studies
  - Clinical trials expected to initiate in 2018
- ✓ ***3rd CpAM*** to be nominated for potential development

Combination of a Nuc + CpAM has the potential to show strong antiviral activity, have a high resistance barrier, decrease cccDNA levels and most importantly, has potential to improve CURE RATES

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Microbiome Program

The Microbiome: Realizing the Promise

Modulating the gut microbiome has the potential to revolutionize the management of a broad range of therapy areas

- Infectious diseases
- GI disorders
- Oncology
- Metabolic diseases
- Neurosciences/CNS

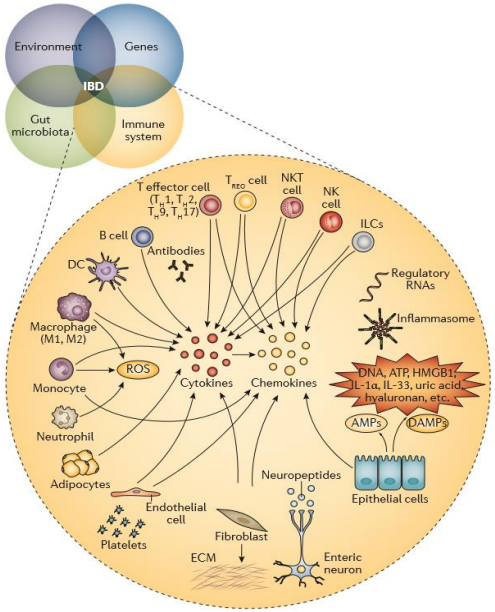
POC data in fecal microbiota transplants (FMT) have shown restoration of a dysbiotic microbiome to health

But, FMT is inadequate as a therapy: lack of consistency, not scalable, not controlled, unreliable, poor route of administration safety risk

The Microbiome: Challenges

Strain selection

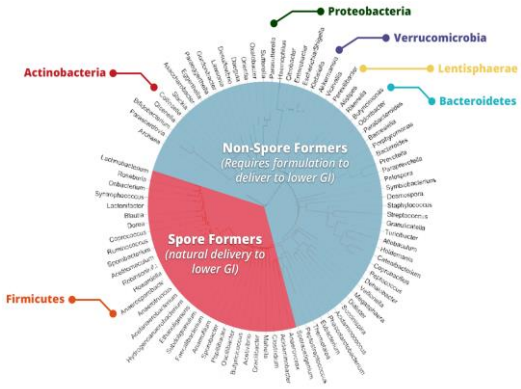
Mechanisms of disease pathology must be considered in context with environment, genome and microbiota



Manufacturing

Lack of consistency, not scalable, not controlled, unreliable, poor route of administration

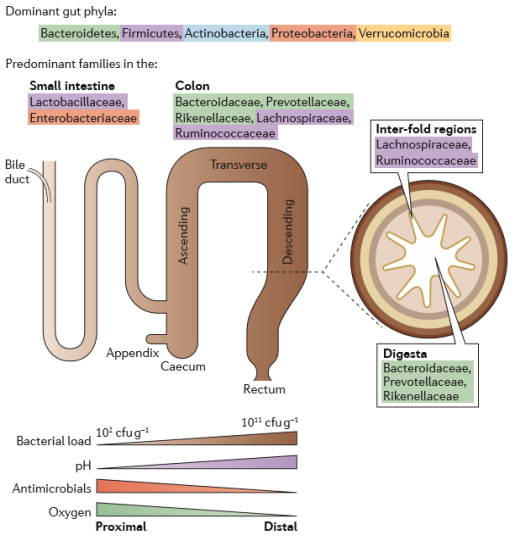
Diversity is needed for optimal microbiotic therapeutics



Targeted delivery

Unique microhabitats require targeted delivery

- pH
- Oxygen
- Antimicrobials
- Nutrients



ASMB Solution: Proprietary Microbiome Platform

Our differentiated and fully-integrated platform to deliver synthetic live biotherapeutics (LBT)

Strain Selection	cGMP Manufacturing	Targeted Drug Delivery	Rapid Clinical Development

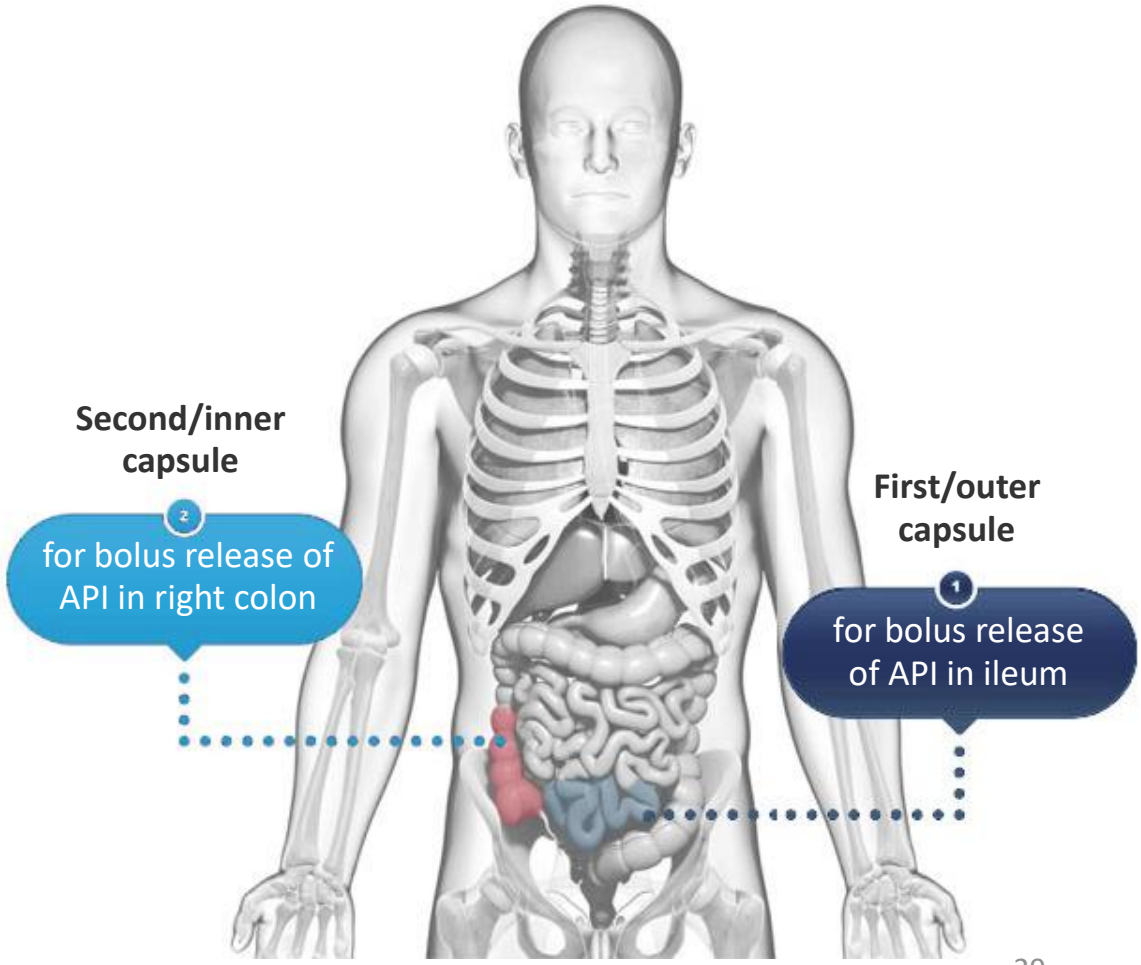
Proprietary & scientifically rigorous, rational strain selection methodologies, including:
• Human FMT studies
• Sequencing and analysis protocols
• Pathology-driven mechanisms
• In vitro and in vivo models
	Differentiated Manufacturing Approach
	• Isolation
	• Development of appropriate culture media & cultivation conditions
	• Scale up
	• GMP cell banking of pure strains and bulk drug substance
		Gemicel® delivery technology
		• Designed to enable targeted delivery to specific regions of the colon
		• Designed to deliver select strains of vegetative bacteria
		  • Spores
		  • Non-spores
			Commensal organisms viewed as safe
			• Potentially shortens time to clinical trials
			• Robust CMC data

GEMICEL®: ASMB's proprietary targeted delivery technology

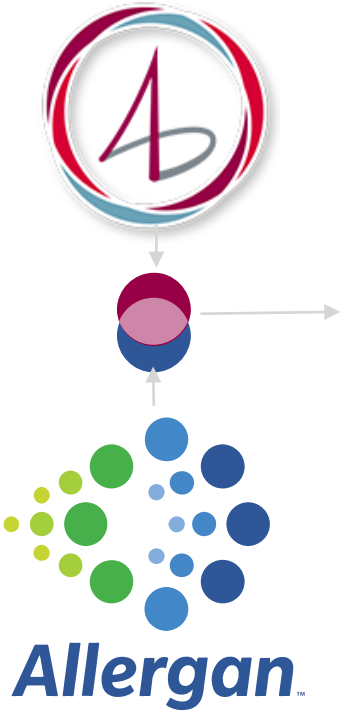
The colon is an attractive site for drug delivery, particularly for microbiotic therapies if they can be delivered reliably.

GEMICEL® Capsule

- Manufacturing designed to be amenable to biologic products



Allergan/Assembly Microbiome Collaboration



Collaboration Summary

- **Expedites our efforts into multiple GI indications**
- **Leverages our end-to-end microbiome technology platform**
- **Advances our ability to move microbiome candidates rapidly into clinical development with strategic partners**
- **Aligns with our strategic goals for the company**
  - Leverages both our Microbiome and HBV programs long term financially, commercially, and globally

Key Disclosed Terms

Rights for GI development programs
- ABI-M201 for Ulcerative Colitis (UC)
- ABI-M301 for Crohn's Disease (CD)
- 2 compounds targeting Irritable Bowel Syndrome (IBS)
- ASMB has limited option to co-promote in US and China

Financial Highlights
- $50M upfront payment

Milestones & Royalties
- Up to ~$630M in development milestones
- Up to ~$2.15B in commercial milestones
- Tiered royalties up to mid-teens on net sales

Development Funding
- $75M R&D funding through POC (shared 2/3 by AGN, 1/3 by ASMB)
- AGN assumes all post-POC development costs

We intend to continue identifying appropriate development and commercial partners to rapidly advance our Microbiome program into other indications
Such as liver disease/NASH, immuno-oncology, metabolic diseases, *C.diff*, CNS, etc.

Microbiome Platform

Capturing the potential of the human microbiome for development of novel therapeutics

Drug Candidate (Mech. / Indication)	Discovery	Lead Op / Selection	IND Enabling	Phase 1
Ulcerative Colitis ABI-M201				Allergan
Crohn's Disease ABI-M301				Allergan
Irritable Bowel Syndrome				Allergan
NASH				
Immuno-oncology				
Clostridium difficile (C.diff)				
Gemicel® (targeted oral delivery system)	Clinical POC achieved			

Leveraging our Microbiome Platform to Expand to Other High-rationale Indications in Metabolic Diseases and Central Nervous System diseases

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Company Summary

ASMB 2018 Milestones & Financial Summary

2017	2018 Upcoming Milestones
✓ Up to $2.8B microbiome collaboration for GI indications ✓ Initiated ABI-H0731 Ph 1b portion of trial ✓ AASLD: 3 Posters: ✓ ABI-H0731 Ph 1a safety and PK profile ✓ Next generation CpAM profiles ✓ cccDNA half-life study ✓ ABI-H2158 selected as 2nd CpAM clinical candidate	❑ Q1 2018: 3rd CpAM candidate selection ❑ Q1 2018: ABI-H0731 Phase 1b data (topline interim) ❑ H1 2018: ABI-H0731 Phase 1b data (full) ❑ H1 2018: ABI-H0731 initiate Phase 2a trial ❑ H2 2018: Initial POC HBV clinical data expected ❑ H2 2018: Initiate clinical study of next-gen CpAM ❑ 2018: Select next indications (non-GI) in microbiome ❑ 2018: Advancements with collaboration partners in microbiome

Nasdaq	Cash, cash equivalents & marketable securities	Shares outstanding	Fully diluted
ASMB	~$132M as of November 6, 2017*	~20.1M**	~25M

**Includes $65M from financing closed on Nov. 6, 2017*
*** As of Jan, 4 2018*

Assembly Biosciences: Summary

Clinical stage company focused on two key innovative areas of drug development

HBV	ASMB believes CpAMs will be the backbone drug class for increasing cure rates ASMB has a robust and proprietary pipeline of CpAMs
Microbiome	Delivering oral, synthetic live biotherapeutics to targeted location Allergan partnership for GI assets, rest of pipeline wholly owned
Team	Industry leaders w/ expertise in drug discovery → drug development

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Thank You