Assembly Biosciences, Inc.
Corporate Presentation

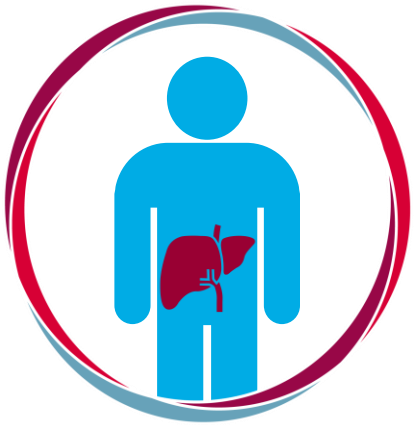
March 2018
Nasdaq: ASMB

Cautionary Note Regarding Forward-Looking Statements

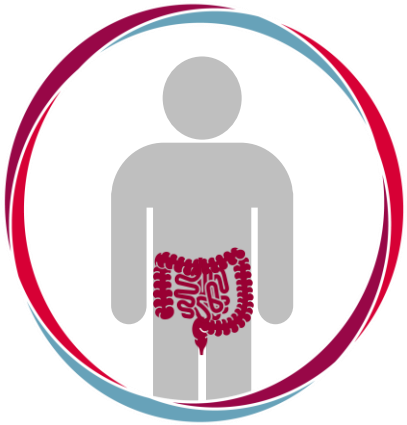
The information in this presentation contains estimates and other forward-looking statements regarding future events, including statements about the clinical and therapeutic potential of our HBV-Cure and Microbiome programs, our ability to receive payments from Allergan Pharmaceuticals International 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, 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", "should," "initiate," "potential," 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 and completion 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; our anticipated capital expenditures, 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, 2017 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 Unique Therapeutic Development Platforms

Hepatitis B



Microbiome



2018 Will be a Critical Year for Assembly

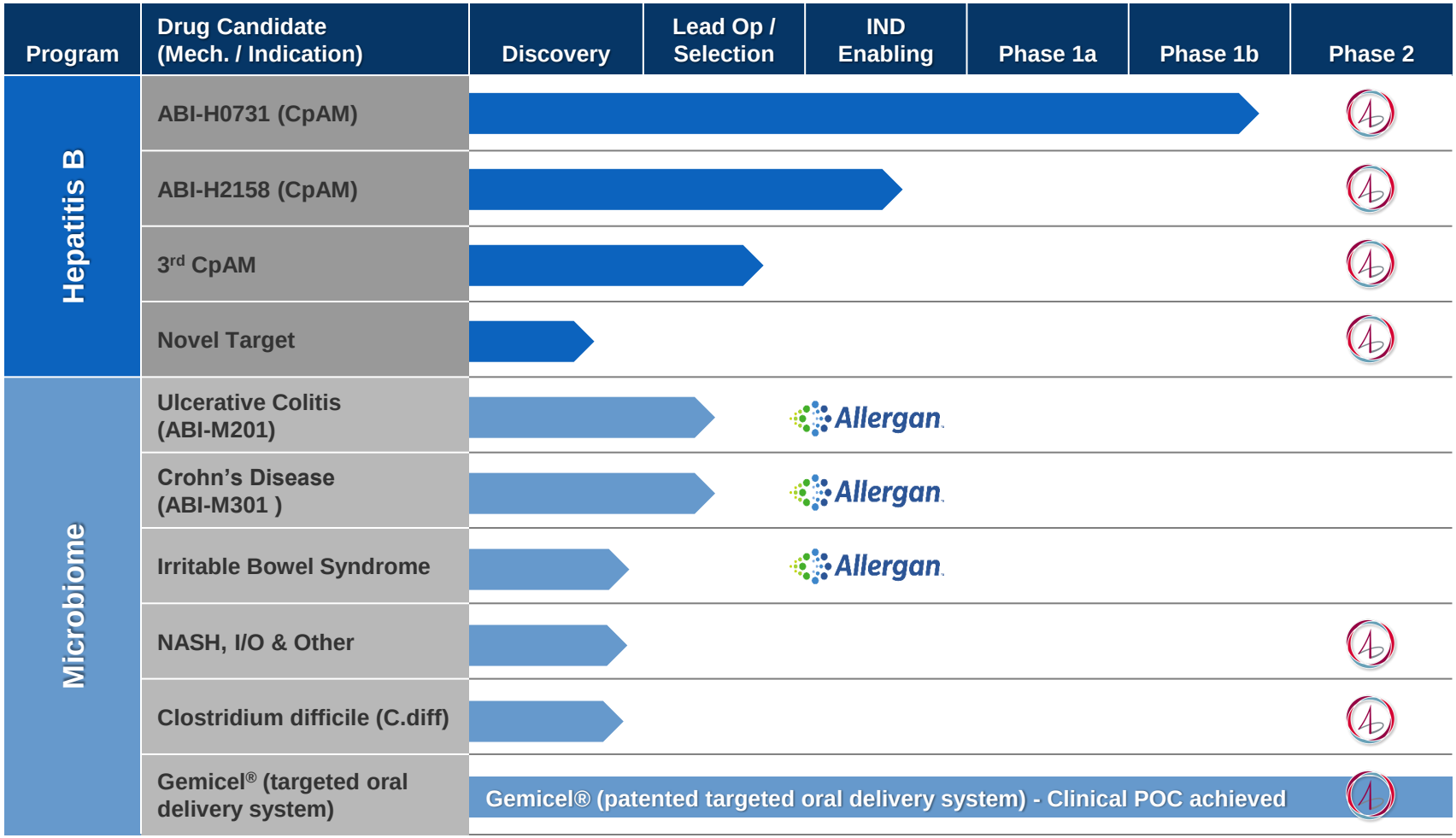
Building Out the Team and Rapidly Advancing Our Pipeline

Graham Cooper	COO / CFO	receptos
Sue Mahony, PhD	Board member	AMGEN, Lilly
Helen S. Kim	Board member	Kite, A GILEAD Company

Steady Stream of Newsflow through 2019

ABI-H0731	April 2018:	Phase 1b data at EASL
	Mid-2018:	Initiate Phase 2a clinical trial
	Early 2019:	Initial Phase 2a data expected (POC)
ABI-H2158	Initiate Phase 1a and & Phase 1b clinical study	

Development Programs Focused on Large Patient Populations with High Unmet Need



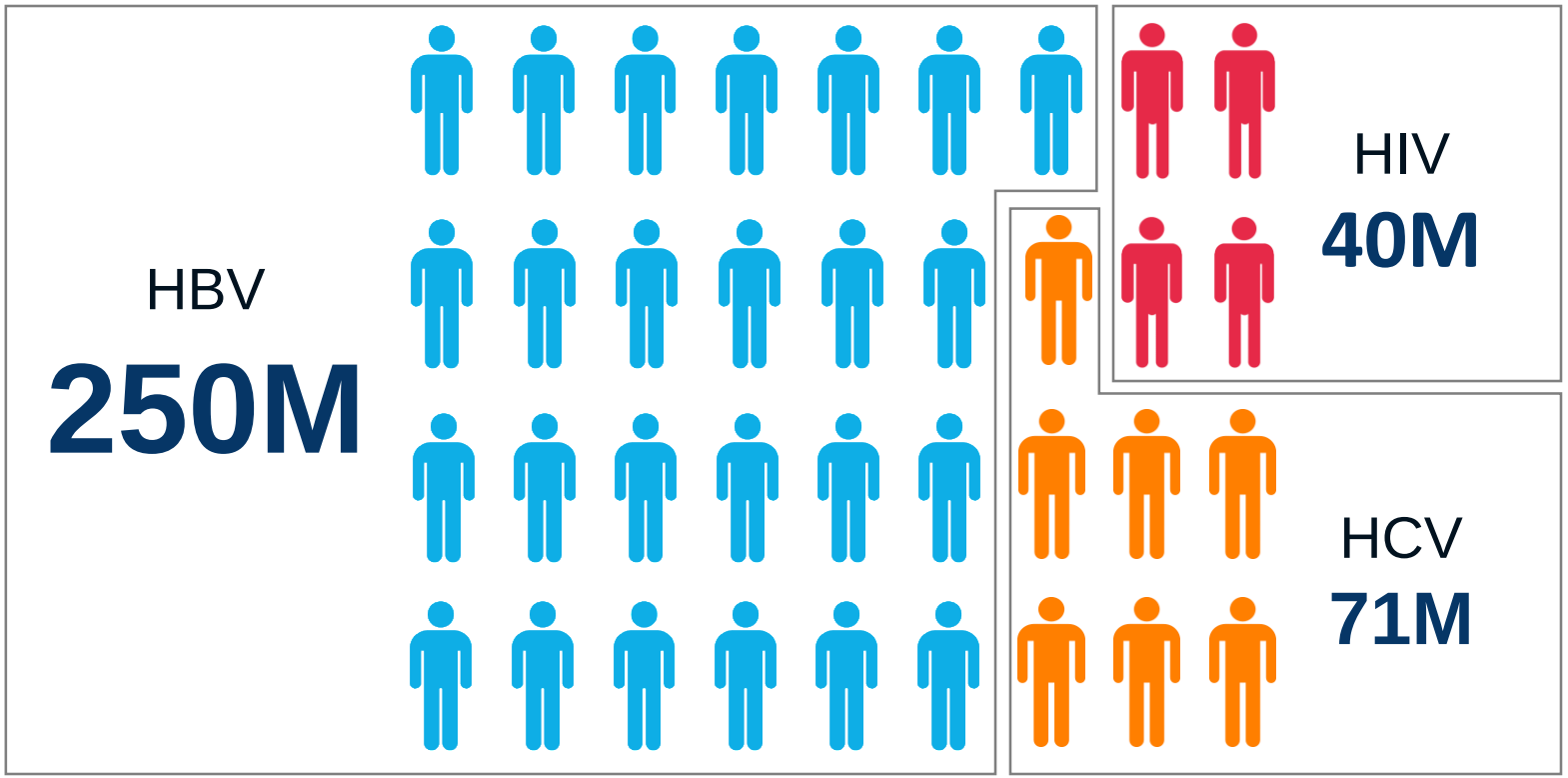
Hepatitis B: Cure Program

HBV is Curable with a Large Treatment Population

CpAMs: ASMB's Portfolio

Chronic HBV: More Patients Globally than HIV and HCV Combined

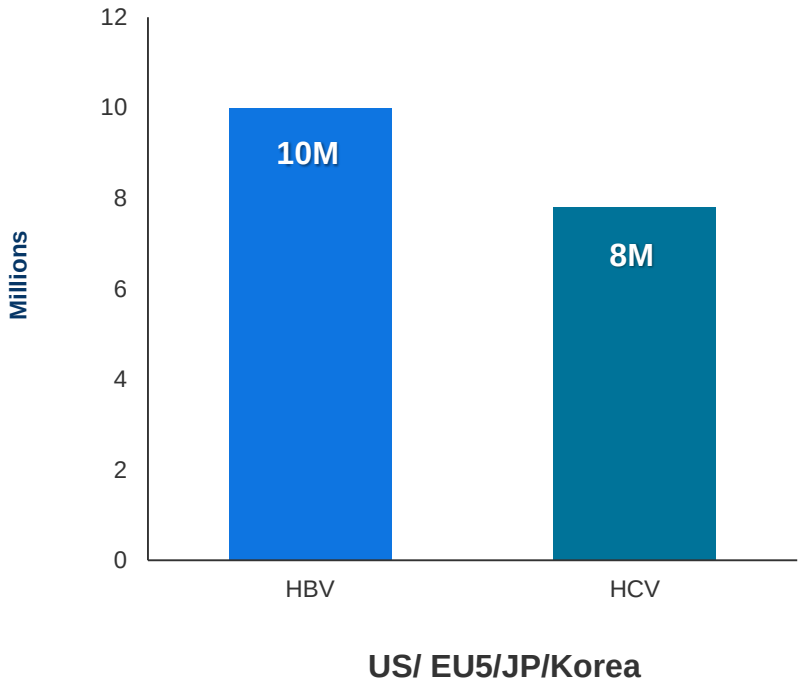
~ 1 million deaths per year due to complications from chronic HBV



hepb.org/what-is-hepatitis-b/what-is-hepb/facts-and-figures, who.int/mediacentre/factsheets/fs164/en/, who.int/gho/hiv/en/

More HBV Patients than HCV Patients in Major Geographies

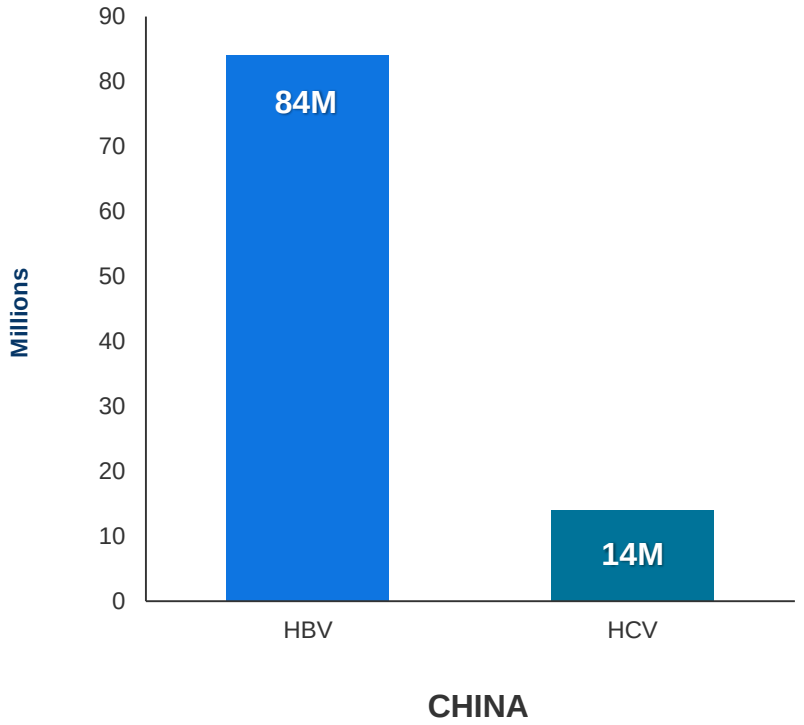
US / EU5 / Japan / Korea
There are >2 million MORE HBV patients than HCV patients



US/ EU5/JP/Korea

China

HBV is a public health Epidemic



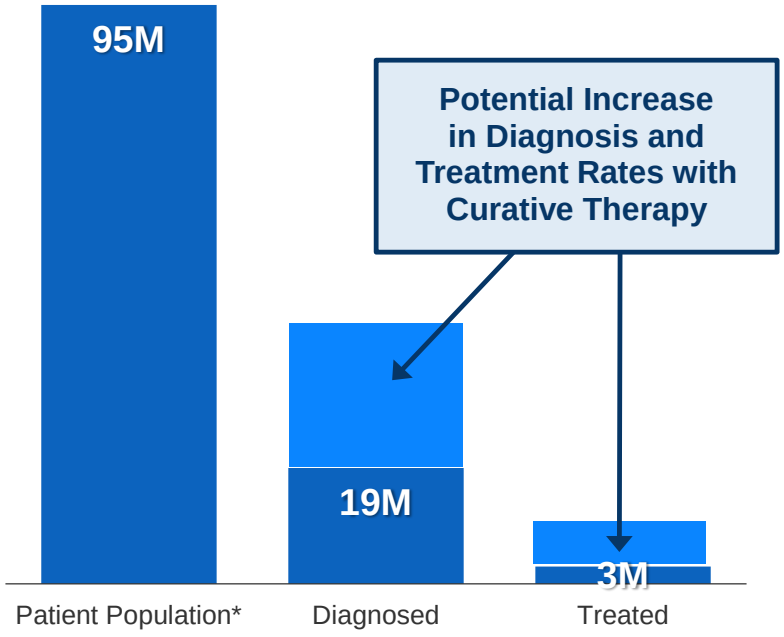
CHINA

cdc.gov/hepatitis/statistics/index.htm, ecdc.europa.eu/en/publications-data/world-hepatitis-day-2017-infograph, wpro.who.int/hepatitis/data/hepatitis_data_statistics/en/, wpro.who.int/china/mediacentre/factsheets/hepatitis/en/

Learning from HCV

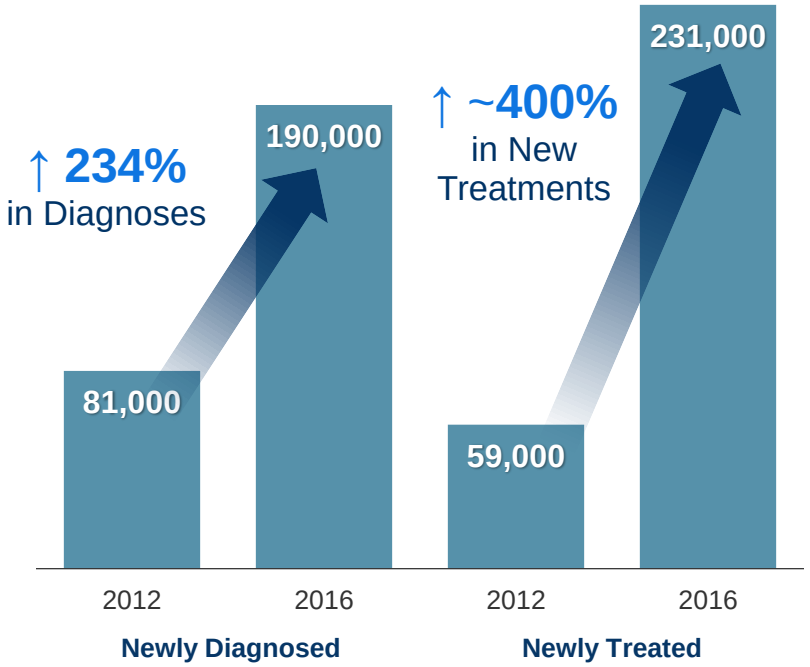
Increase in Cure Rates Facilitates Increase in Diagnosis and Treatment

Significant Opportunity to Increase Diagnoses and Treatment Rates with Curative Therapy



* US, EU5, China, JP, Korea

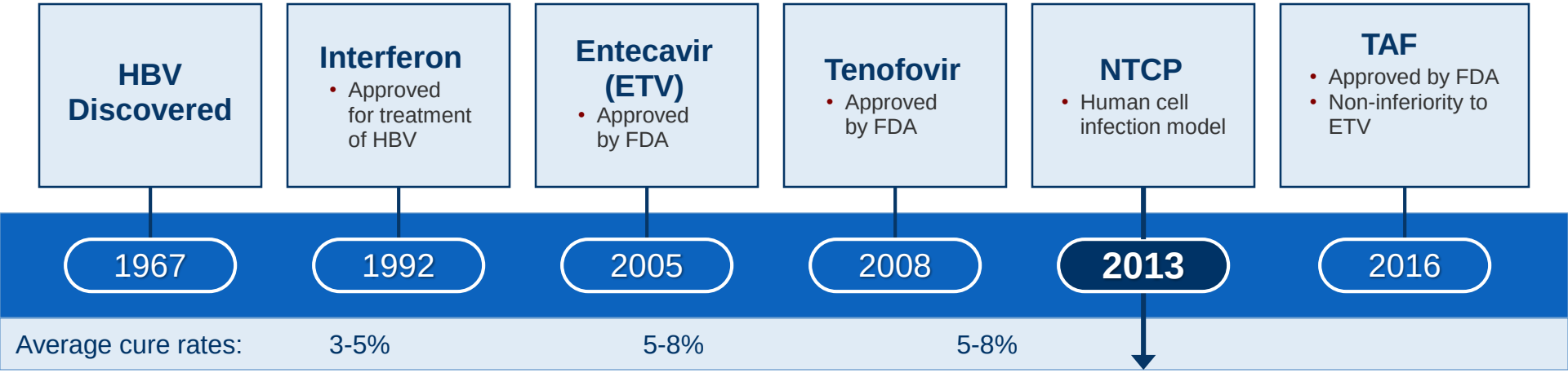
Increasing HCV Cure Rates Significantly Increased Diagnosis and Treatment Rates



Source: Gilead, Healthcare Analytics

HBV Drug Discovery Models only Recently Advanced

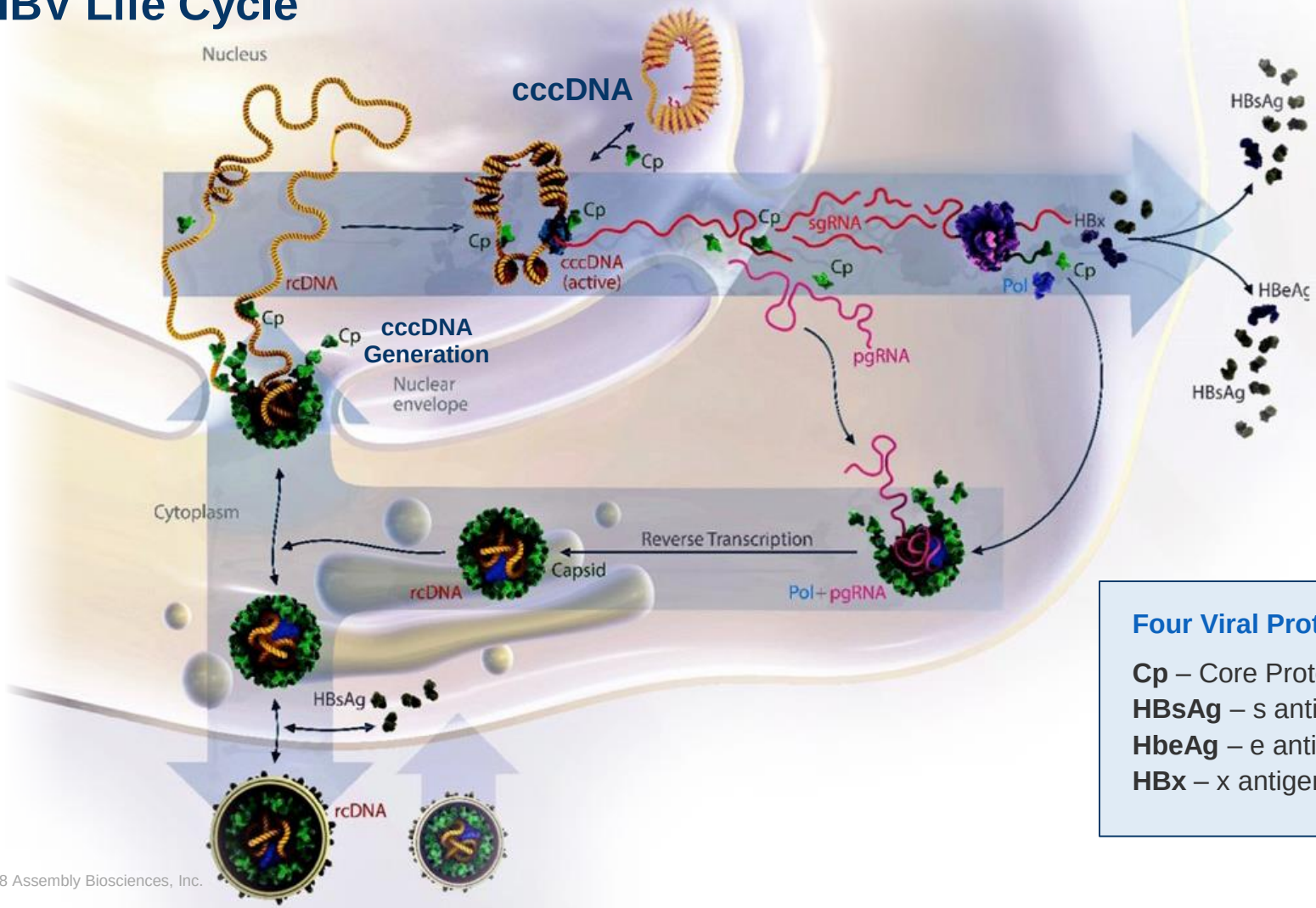
Assembly is leading the next generation of HBV R&D



- **Assembly among the first to establish an industry-caliber human liver infection model**
- **Enabled screening of HBV drug candidates**

Turning Off the Replication Engine of HBV: cccDNA

HBV Life Cycle

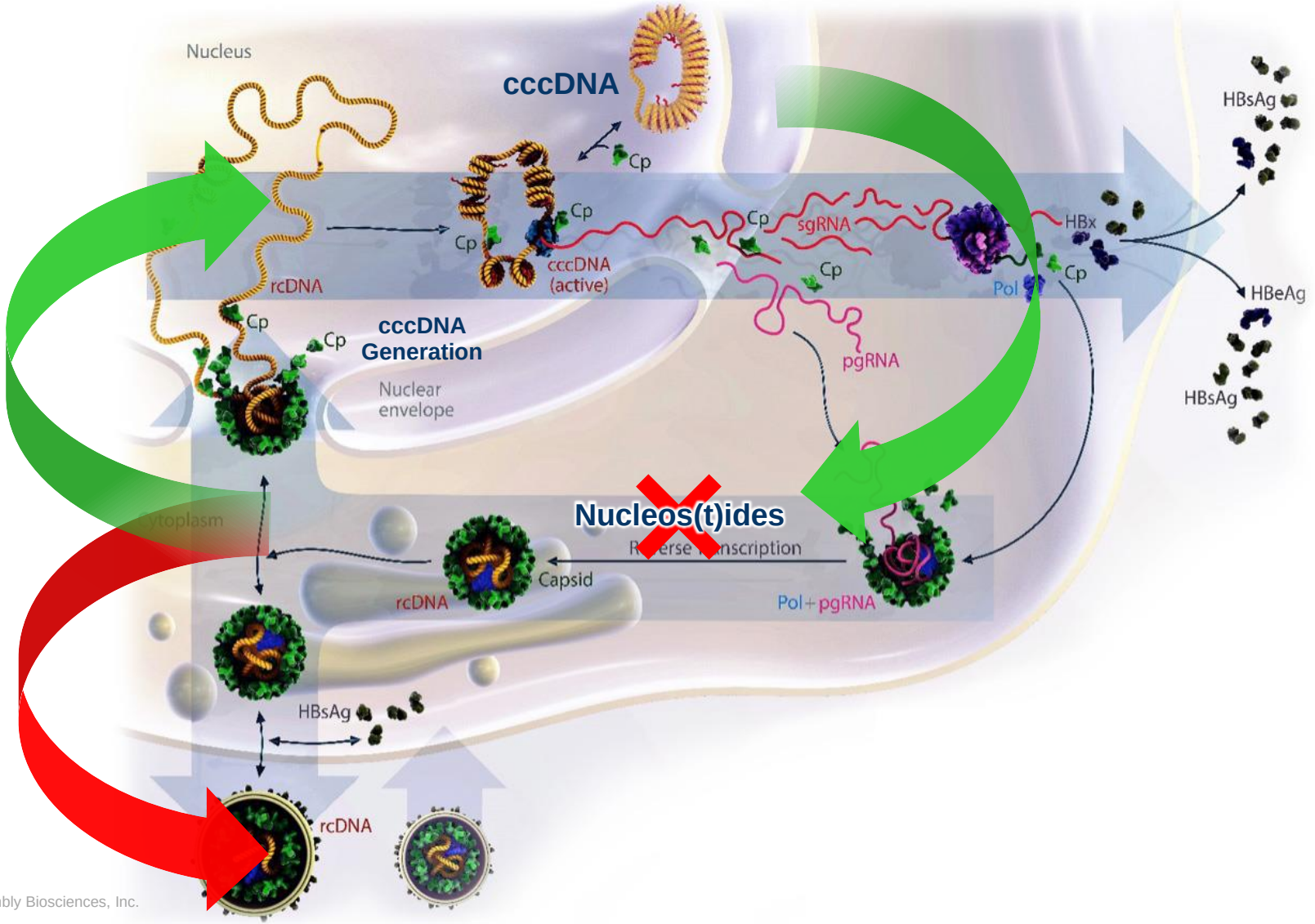


Four Viral Proteins

Cp – Core Protein
HBsAg – s antigen
HbeAg – e antigen
HBx – x antigen

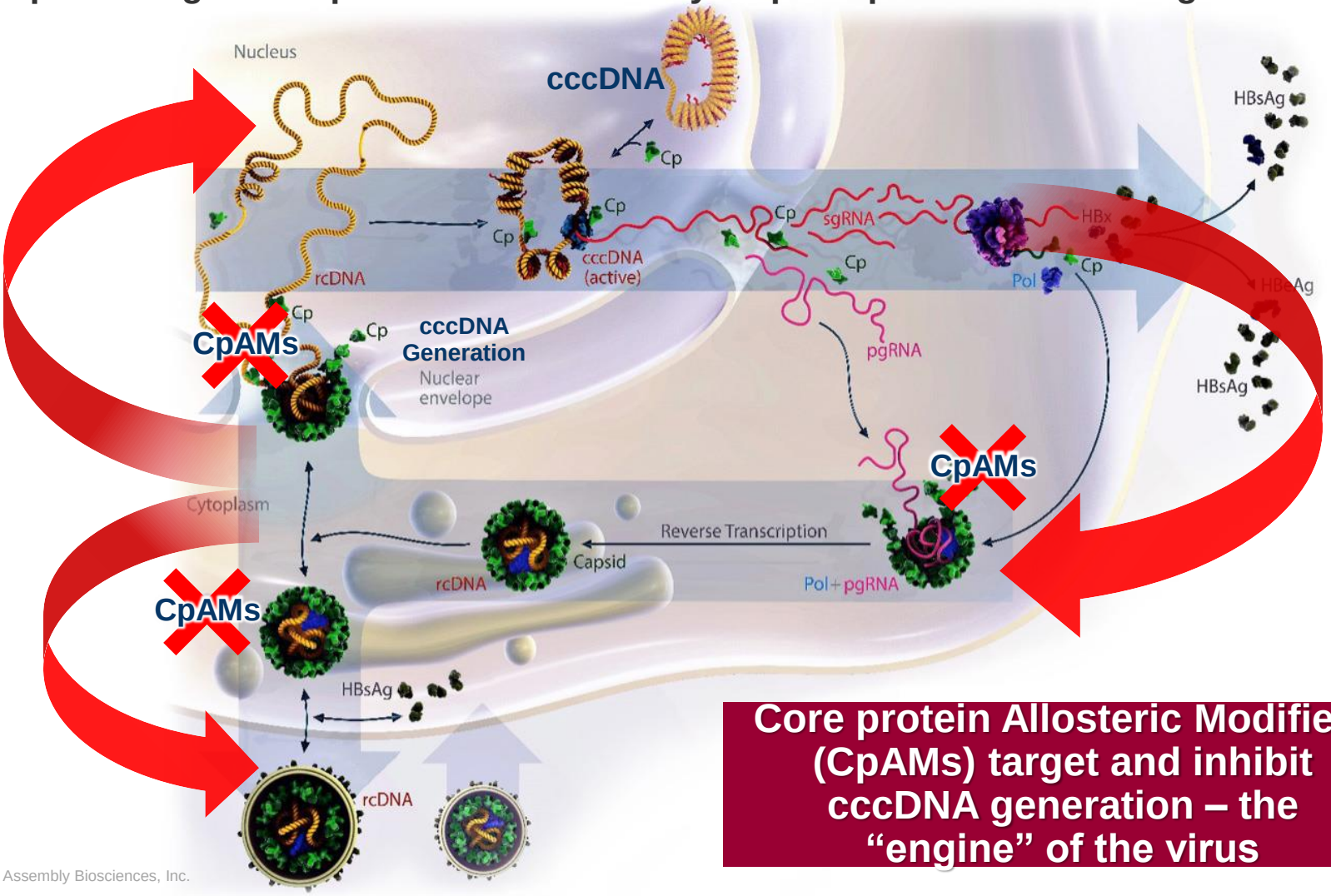
Nucs – Standard of Care

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



Core protein Allosteric Modifiers (CpAMs) target and inhibit cccDNA generation – the "engine" of the virus

Cure is Possible: But Not with SOC Alone

Currently Approved

- Nucleos(t)ide Analogs: entecavir, tenofovir, lamivudine etc…
- Interferons (IFN and peg-IFN)

Entecavir and Tenofovir (Standard of Care)

- Safe and highly effective
- Highly effective at eliminating and sustaining undetectable HBV DNA levels
- One pill, once-a-day dosing, very well tolerated, no meaningful resistance

Unfortunately, cure rates are very low despite prolonged therapy

Cure is Possible!

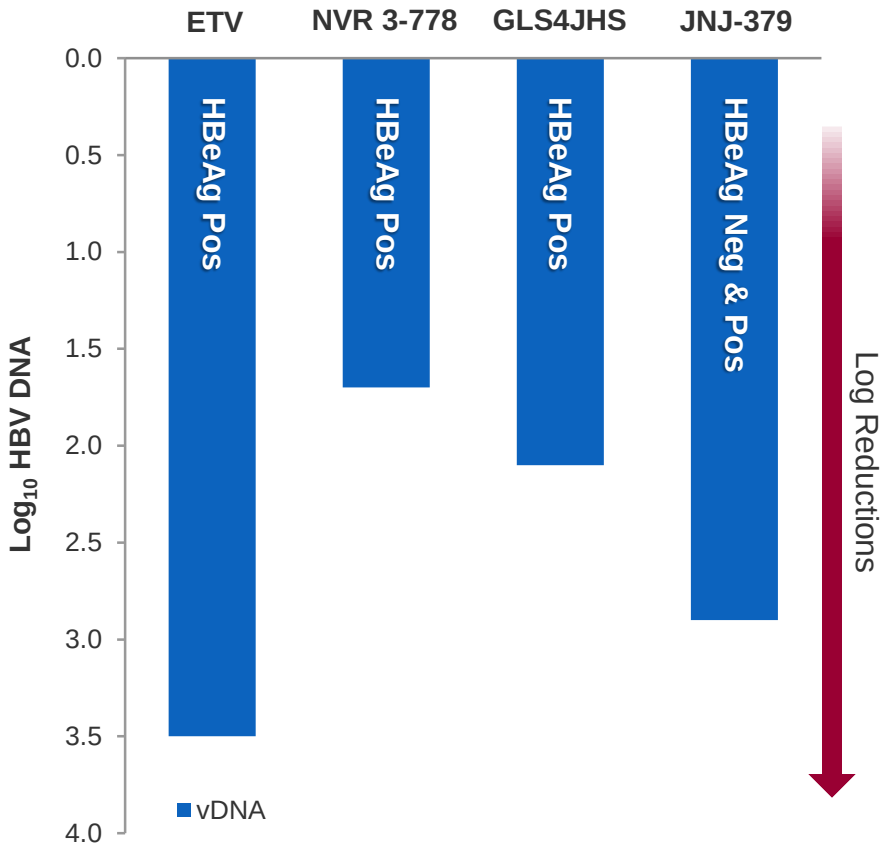
- Spontaneous and treatment-related cure do occur in ~5% of HBV patients[1]
- Chronically-infected woodchucks cured with ETV (viral DNA undetectable, cccDNA and HBsAg levels reduced and HCC emergence prevented)[2]

[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

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
- All HBV antivirals have reduced observed activity in HBeAg pos patients due to significantly higher viral loads



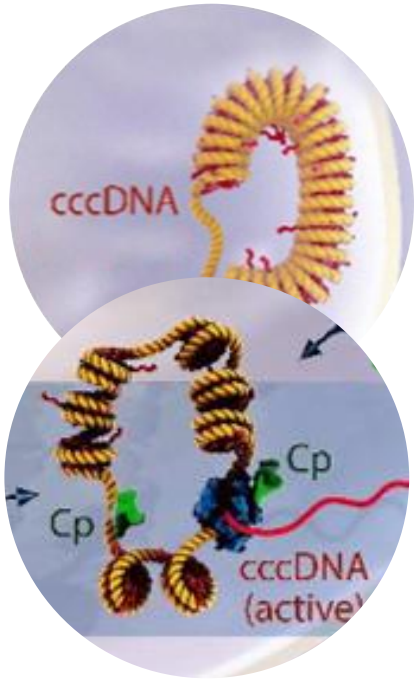
[1] Yuen et al., AASLD Poster LB-10 11-2015
[2] Ding et al., AASLD Poster 920 10-2017
[3] Zoulim et al., AASLD Poster LB-15 10-2017

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 rate

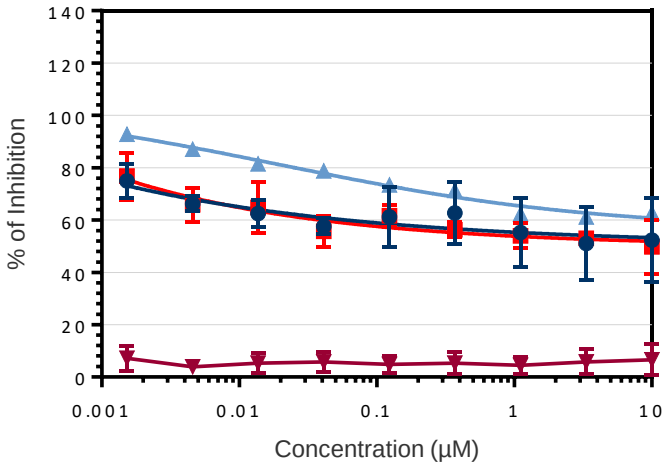
Huang et al., AASLD Poster 1503 10-2017

CpAMs Can Do What Nucs Do Not:

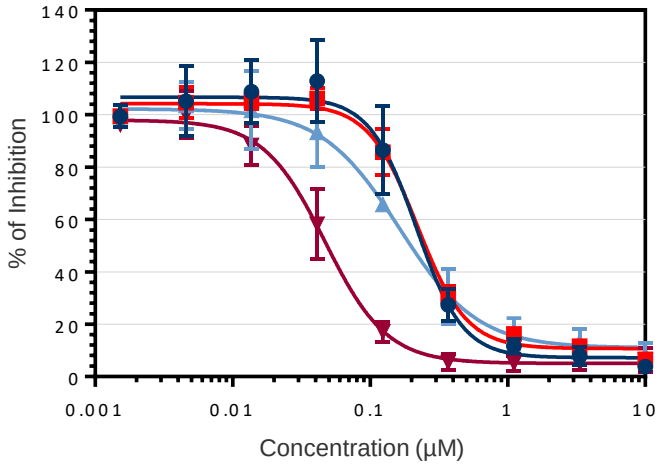
Inhibit ALL Viral Antigens in Primary Human Hepatocyte Cells

Pre-Clinical Data from AASLD 2017 in HBV Infected PHH Cells

Entecavir (Baraclude™)
Treat at 3 hr Post Infection



ABI-H2158
Treat at 3 hr Post Infection

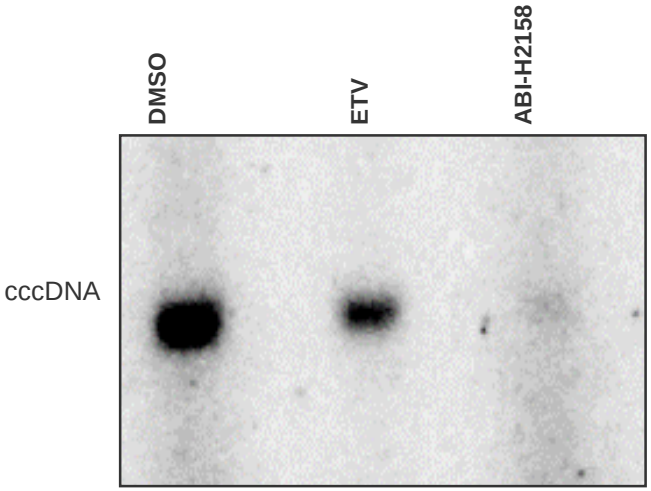


HBeAg HBsAg pgRNA VL

Huang et al., AASLD Poster 922 10-2017

CpAMs Inhibit the Establishment of cccDNA

Southern Blot Gel of cccDNA from PHH Cells Treated with ETV or CpAM



ETV >10,000x EC_{50}

Huang et al., AASLD Poster 922 10-2017

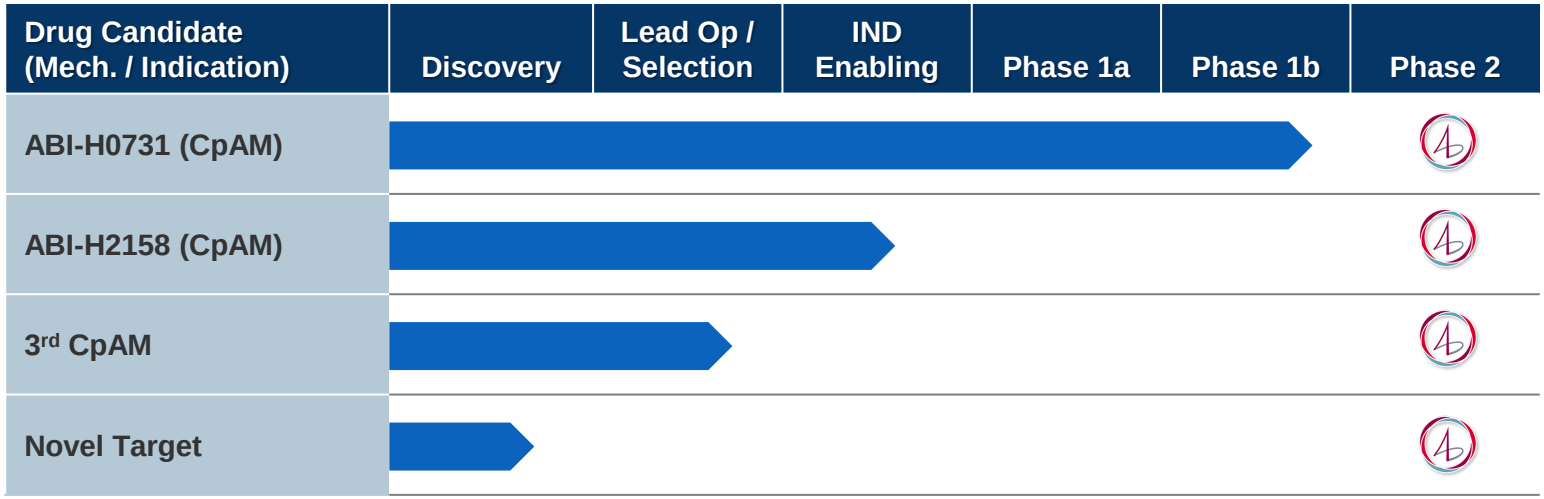
Hepatitis B: Cure Program

HBV is Curable with a Large Treatment Population

CpAMs: ASMB's Portfolio

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: Key Takeaways

Lead Molecule from a Deep Pipeline of CpAMs

- Phase 1b ongoing

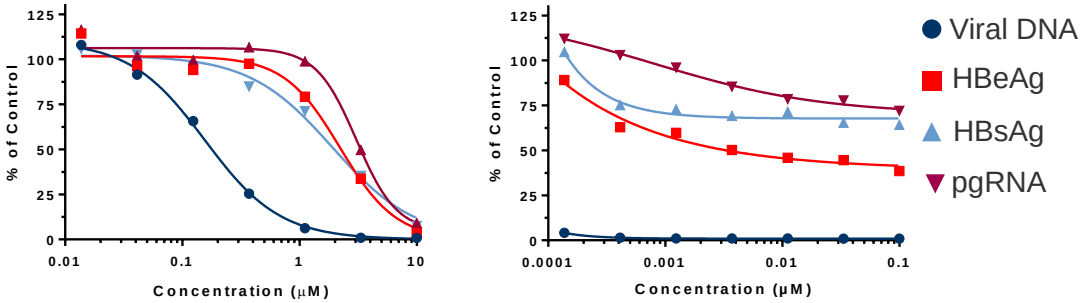
- Phase 1a Complete: Dose ranging study was well tolerated in all cohorts
  - Favorable PK profile with a half-life (~24 hr) predictive of ***QD dosing***
  - Well absorbed and associated with plasma concentrations that we believe will be sufficient to suppress viral replication and ***cccDNA generation***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

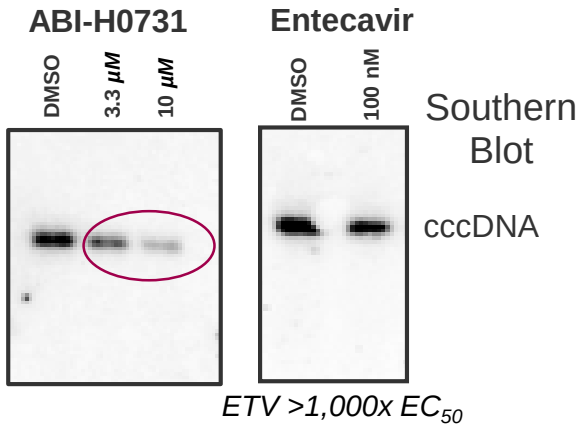
- Potent and selective activity against all major HBV genotypes

Phase 1b Data Expected H1 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: 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 2 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 Phase 2 POC Data Early 2019

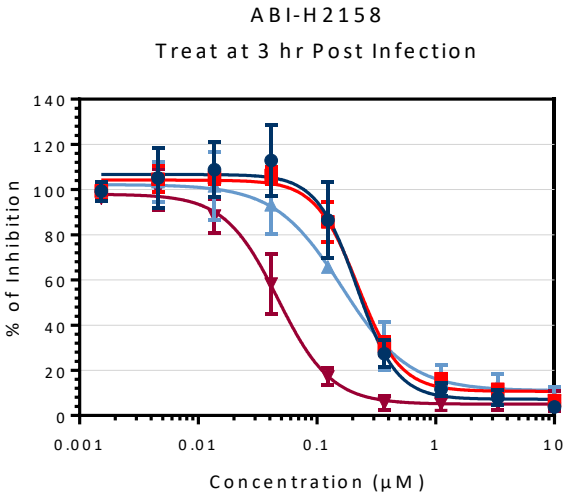
ABI-H2158: Candidate Summary

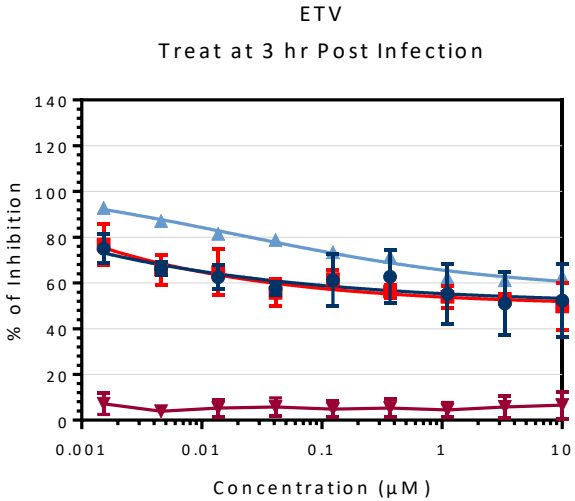
Potent 2nd Generation Candidate From a Deep Pipeline of CpAMs

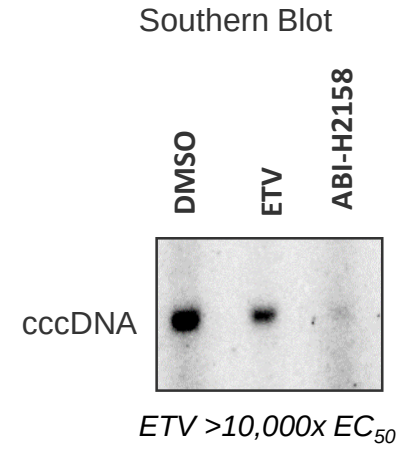
- Distinct and proprietary chemical scaffold
  - All ASMB CpAMs are differentiated from each other and from other classes (i.e. HAPs)
  - Unique patent estate for each ASMB CpAM (applications)
- ***Enhanced potency*** in reducing viral DNA levels in *in vitro* studies
  - Potential to “melt” capsids 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

Expected to Initiate Clinical Trials in H2 2018

ABI-H2158 Inhibition in HBV Infected PHH Cells







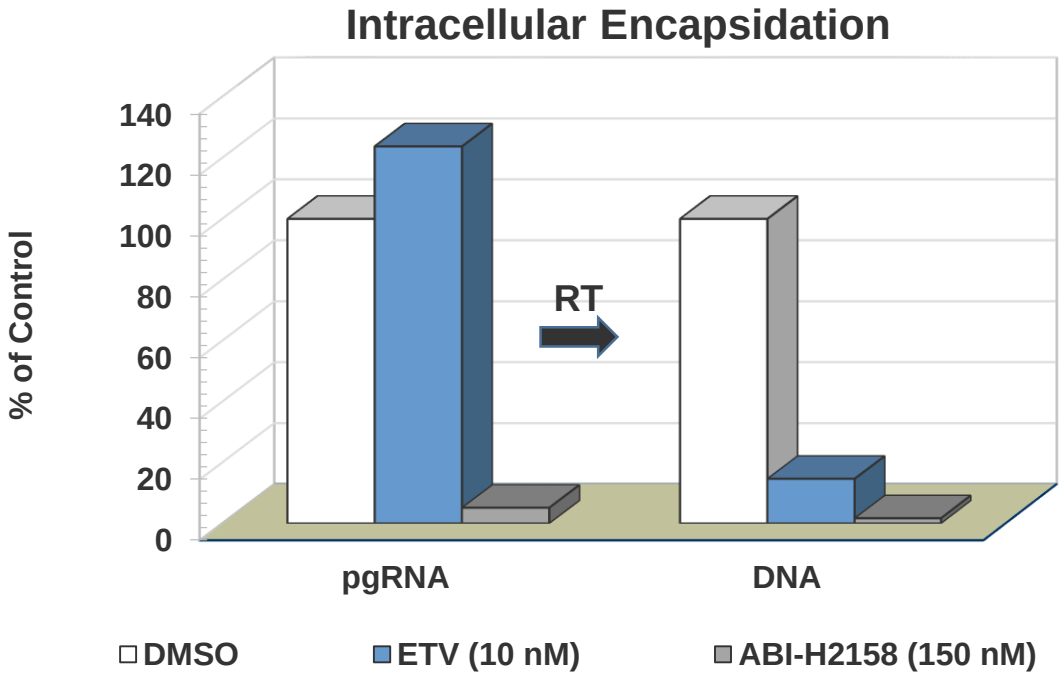
Parameter	PHH EC_{50} (nM) (Treatment 3 hr Post Infection)		
	ETV	ABI-H2158	ABI-Nx
Viral DNA	< 0.025	49	11
HBeAg	>10,000	242	60
HBsAg	>10,000	231	50
pgRNA	>10,000	193	72

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

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

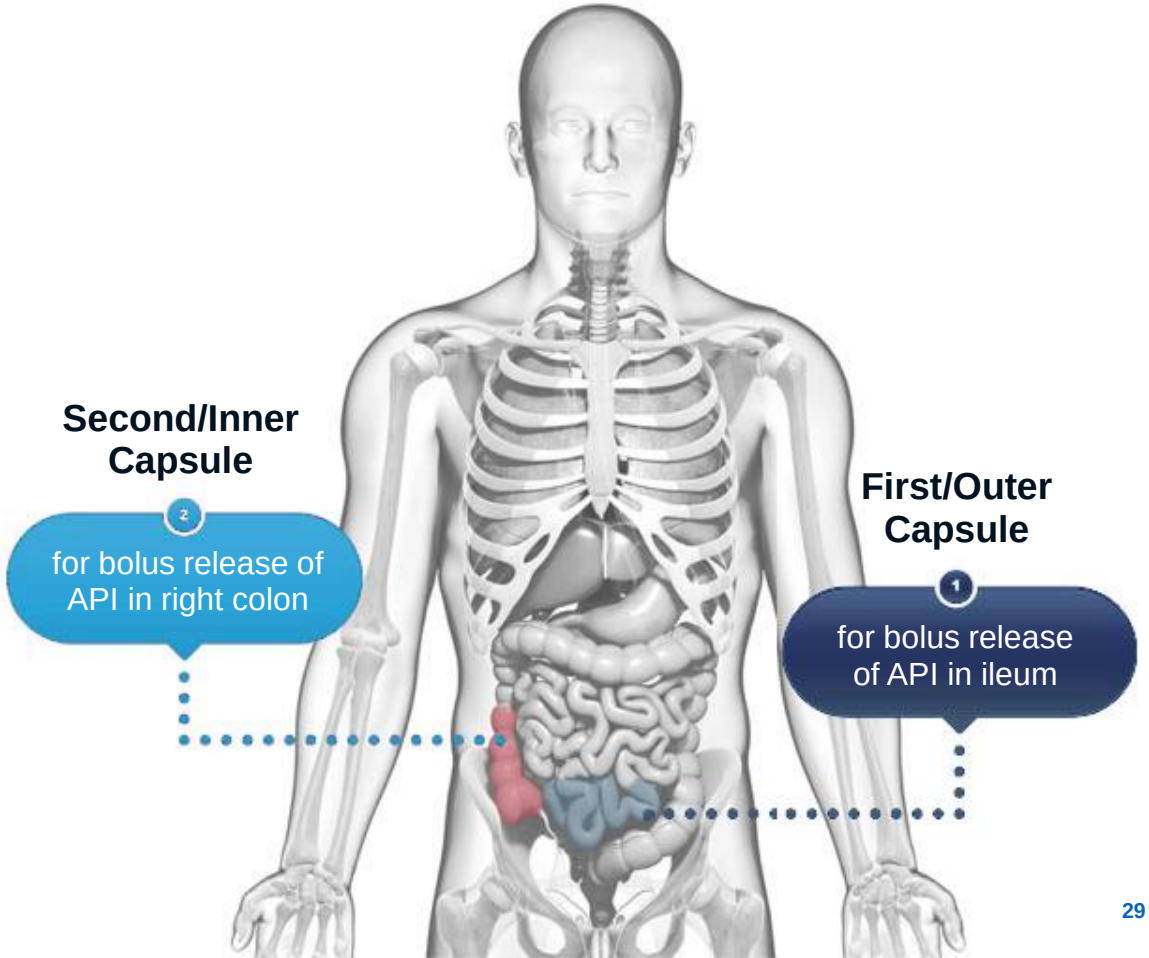
But, FMT is Inadequate as a Therapy: Lack of Consistency, Not Scalable, Not Controlled, Unreliable, Poor Route of Administration Safety Risk

GEMICEL®: ASMB's Patented Targeted Delivery Technology

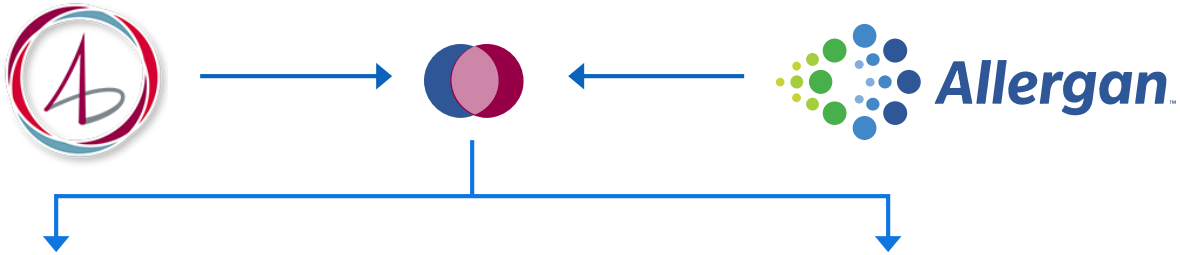
The colon is an attractive site for drug delivery, particularly for microbiotic therapies if they can be delivered reliably

GEMICEL® Capsule

- Manufacturing designed to be amenable to biologic products



Allergan/Assembly Microbiome Collaboration



Collaboration Summary

Speed

- Expedites our efforts into multiple GI indications

Platform

- Leverages our end-to-end microbiome technology platform

AGN Development Expertise

- Advances our ability to move microbiome candidates rapidly into clinical development with strategic partners

Value: Up to $2.8B + Royalties + R&D

Rights for GI Development Programs

- Ulcerative Colitis (UC)
- Crohn's Disease (CD)
- Irritable Bowel Syndrome (IBS)

Financial Highlights

- $50M upfront payment
- Up to ~$2.8 B in dev. & comm. milestones
- Tiered royalties up to mid-teens on net sales

Development Funding

- $75M R&D funding through POC
- AGN assumes all post-POC development costs

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® (Patented Targeted Oral Delivery System)	Clinical POC Achieved			

Leveraging our Microbiome Platform to Expand to Other High-Rationale Indications

Assembly Biosciences at a Turning Point

Team and Board Additions

- Graham Cooper (CFO/COO)
- Helen Kim (Board)
- Sue Mahony (Board)

HBV Medicines Advancing

- ABI-H0731 – Phase 1b data (April) and initiate Phase 2a
- ABI-2158 – Initiate clinical study

Microbiome Platform Progress

- Gemicel® – Patented targeted delivery technology
- Allergan partnership for GI assets

Strong Balance Sheet

- ~$120M in current assets as of December 31, 2017

assembly biosciences

Thank You