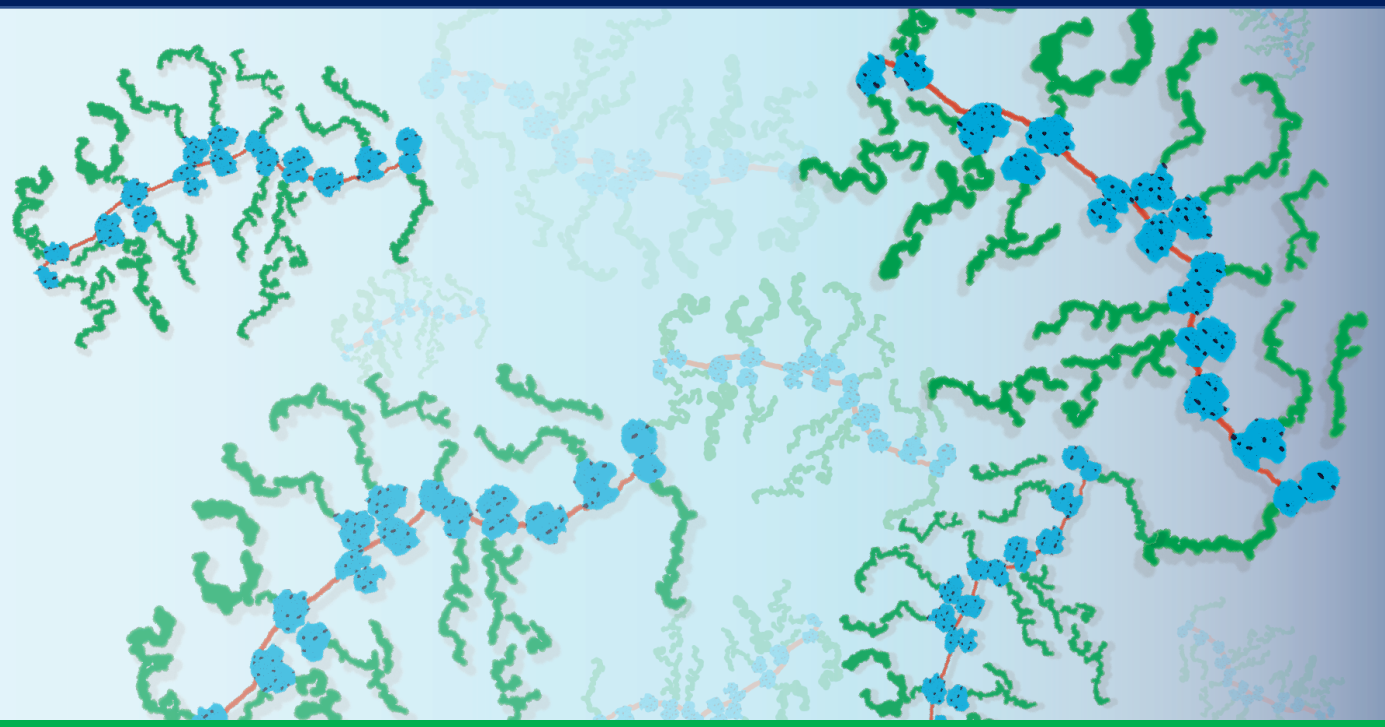
merlin BIOTECH

The Cure is in the Message



Randall N. Hyer, MD, PhD, MPH
CEO

MERLIN Biotech

- mRNA platform startup innovative biotechnology company
- MERLIN is exploiting proven mRNA technology for novel therapeutics and vaccines against targets with in-house expertise
- MERLIN has the trifecta of proven technology, IP protection, and global experts

MERLIN Biotech

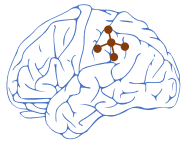
- **mRNA platform startup innovative biotechnology company**
  - Deliver novel medical therapeutics and vaccines against targets where MERLIN has recognized expertise
  - Industry and scientific experts with proven expertise and getting novel products approved
  - Launched Q2/2022, located at the PA Biotechnology Center
- **MERLIN is exploiting proven mRNA technology for novel therapeutics and vaccines against targets with in-house expertise**
  - Oncology: mRNA/LNP delivery of immunomodulator USP6 for Ewing's sarcoma, rare pediatric cancer
  - Chronic Disease: mRNA-based therapeutics for chronic hepatitis B to break immune tolerance
  - Preventive vaccines: mRNA based preventive vaccines against Lyme/TBE disease
  - mRNA/LNP platform developed for identified targets and can be leveraged against additional and novel strategies
- **MERLIN has the trifecta of proven technology, IP protection, and global experts**
  - CEO is Randall N. Hyer, MD, PhD, MPH, former SVP Vaccines at Moderna where he led global medical for the approval, launch, and implementation of the mRNA COVID-19 vaccine (SPIKEVAX®) and former VP at Dynavax where he led clinical development and medical affairs for the FDA approval of the 2-dose hepatitis B vaccine using a novel CpG adjuvant (HEPLISAV-B®)
  - CSO is Ju-Tao Guo, MD, expert on hepatitis B and co-inventor of proprietary Blumberg technology
  - Board/SAB includes Harvey Alter, Nobel Laureate and co-discover of hepatitis B/C; Stanley Plotkin, expert vaccinologist; Tim Block, leading HBV scientist; Margaret Chou, leading molecular oncologist at CHOP and Associate Professor at U Penn
  - VP Oncology: Ian Henrich, PhD, scientist from CHOP co-inventor of immunomodulatory USP6 mRNA technology

Problem Statement - Oncology

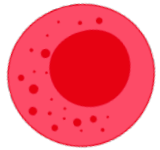
CURRENT LIMITATIONS

Tumors render themselves invisible to immune cells

Immune cells cannot find and kill tumor cells



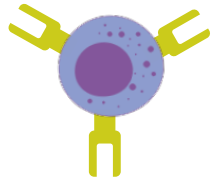
Immune cells are “hijacked” by the tumor and inactivated



CURRENT APPROACHES

Cancer Vaccines

- Poor clinical response
- Requires immunogenic tumor



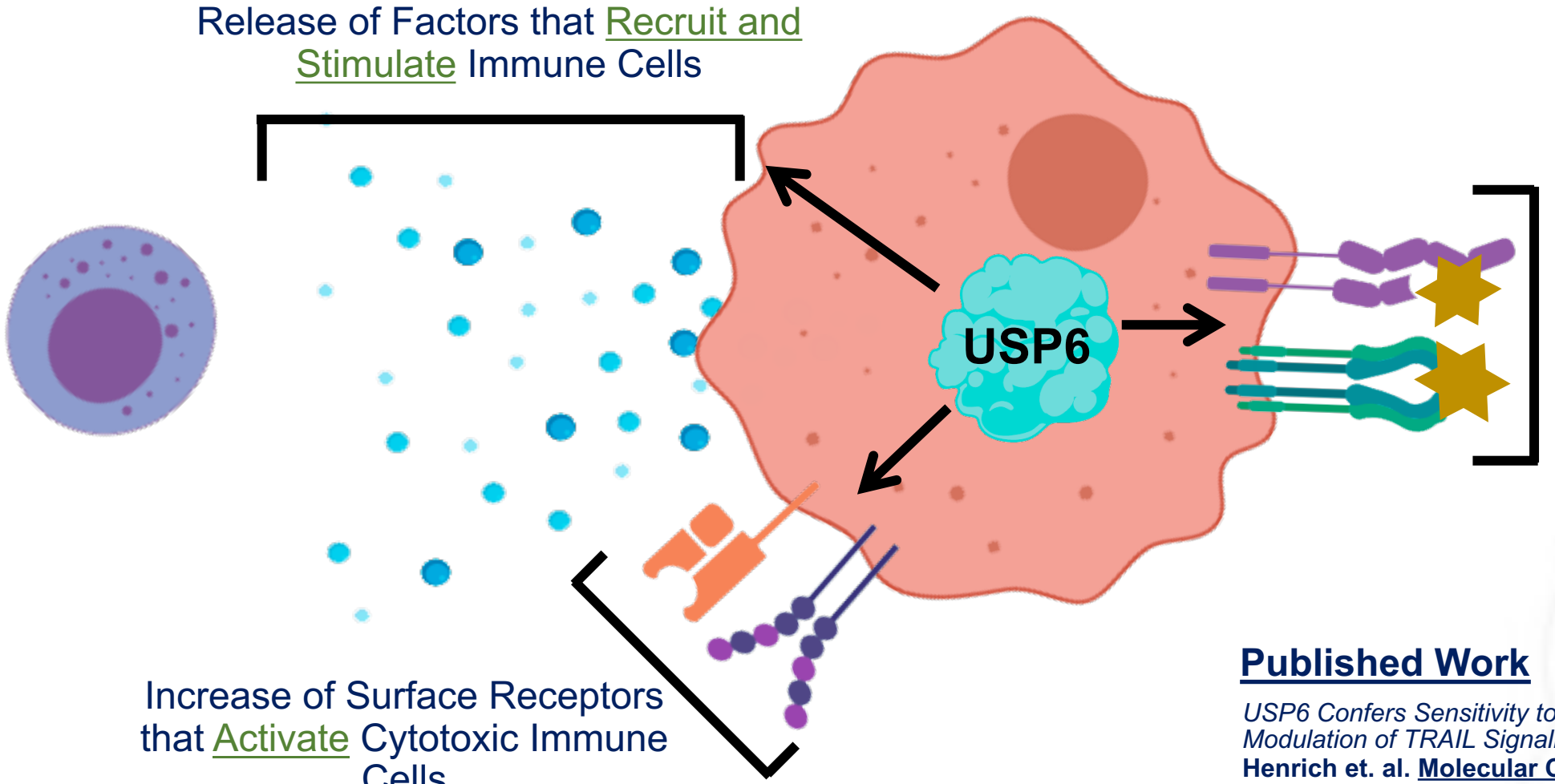
Targeted Immune Cells

- Tumor antigen loss
- Immune cell exhaustion
- Poor infiltration into solid tumors

Checkpoint Inhibitors

- Requires immunogenic tumor
- Majority of patients do not respond
- Easily bypassed by tumor resistance

MERLIN Technology – Oncology



Published Work

USP6 Confers Sensitivity to IFN-Mediated Apoptosis through Modulation of TRAIL Signaling in Ewing Sarcoma
Henrich et. al. Molecular Cancer Research

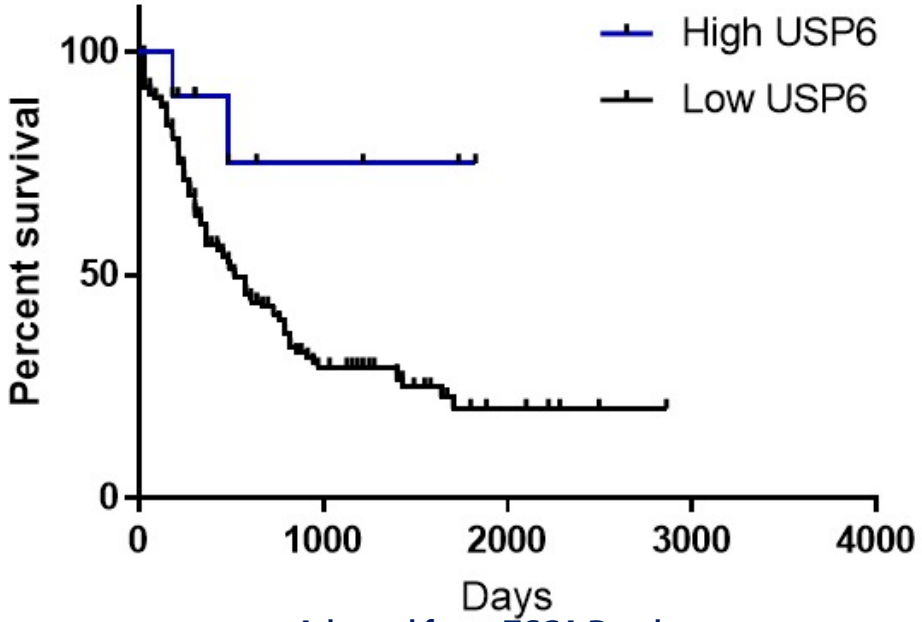
Ubiquitin-Specific Protease 6 Functions as a Tumor Suppressor in Ewing Sarcoma through Immune Activation **Henrich et. al. Cancer Research**

Expression of USP6 Associated with Survival in Multiple Cancers

Common adult blood cancer

(~20,000 US cases/year)

Acute Myeloid Leukemia (AML)



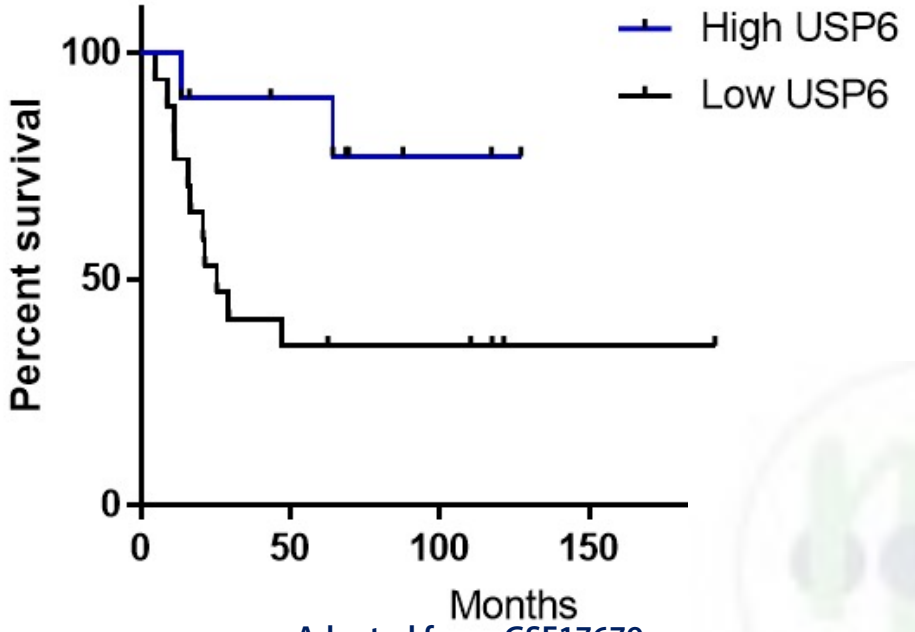
Adapted from: TCGA Database

(https://portal.gdc.cancer.gov/)

Rare pediatric bone cancer

(~500 US cases/year)

Ewing Sarcoma



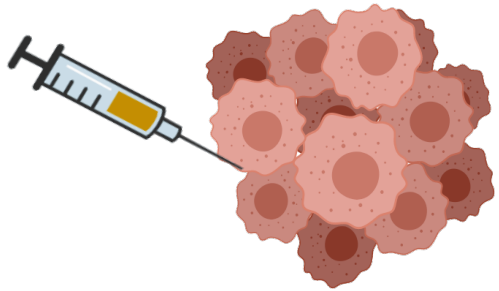
Adapted from: GSE17679

(https://pubmed.ncbi.nlm.nih.gov/33558334/)

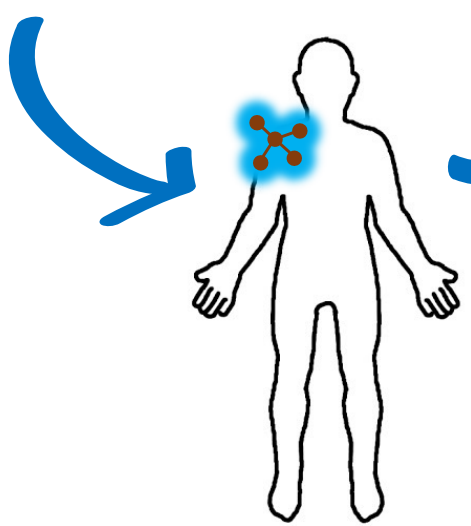
Additional cancers: pancreatic, cervical, ovarian, bladder, lung cancer, and others (unpublished)

Oncology MOA – USP6

mRNA injection produces USP6 protein that broadly upregulates immune response to tumors

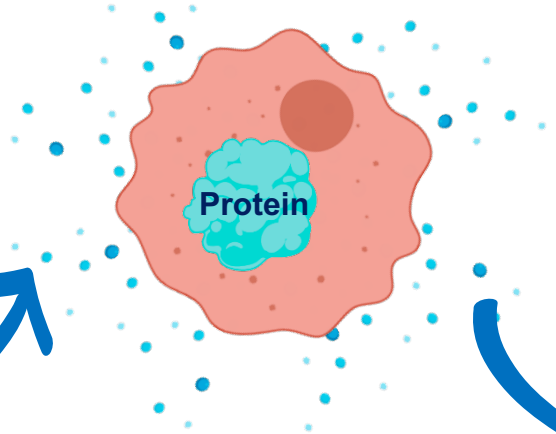


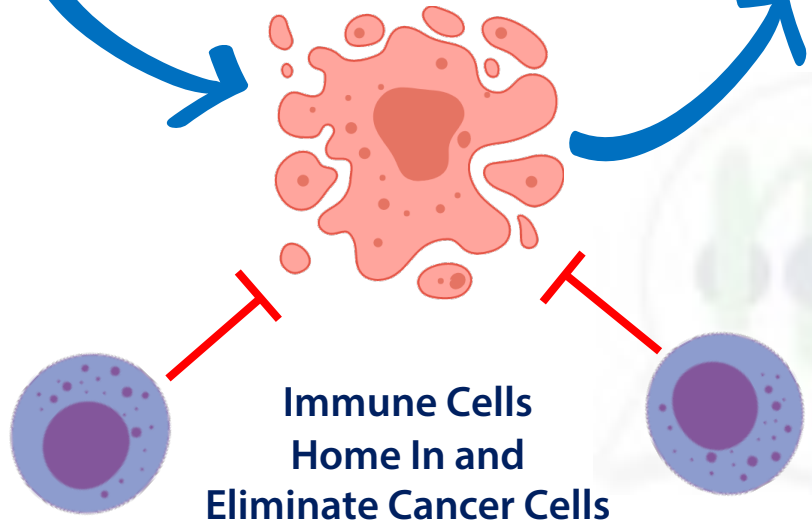
mRNA USP6 Formulation is Directly Injected into the Tumor



Treatment is Localized to the Tumor, Avoiding Traditional Nanoparticle Pitfalls

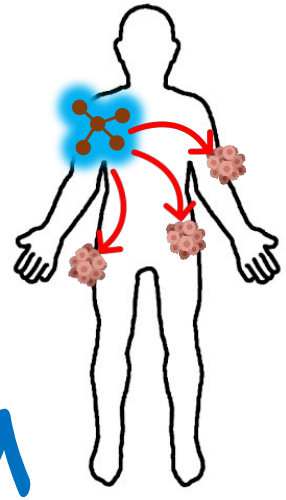
Tumor Cells are Forced to Express USP6 Which Then Produces Cancer-Killing and Immune-Activating Molecules





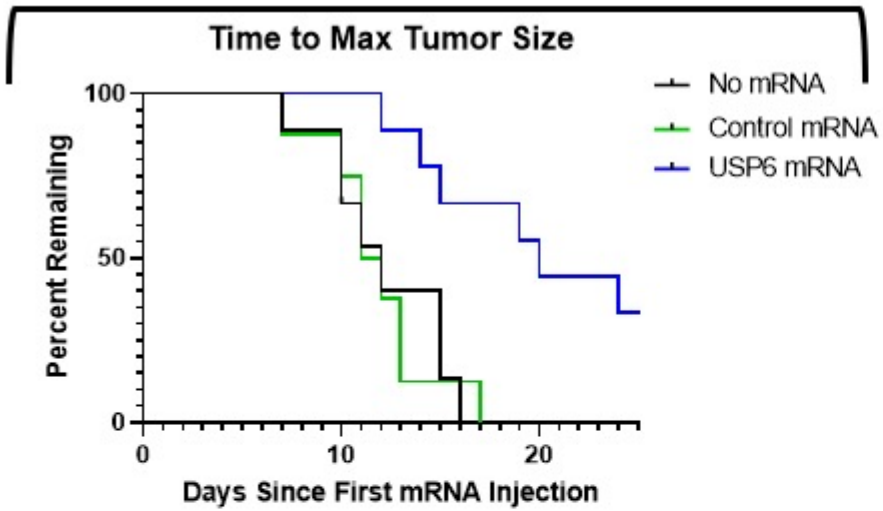
Immune Cells Home In and Eliminate Cancer Cells

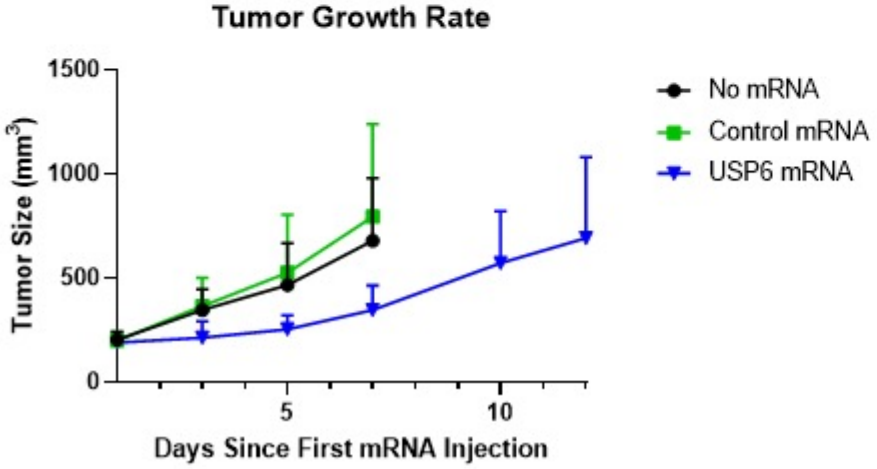
Activated Immune Cells Seek Out and Elimina Systemic Disease via Abscopal Effect



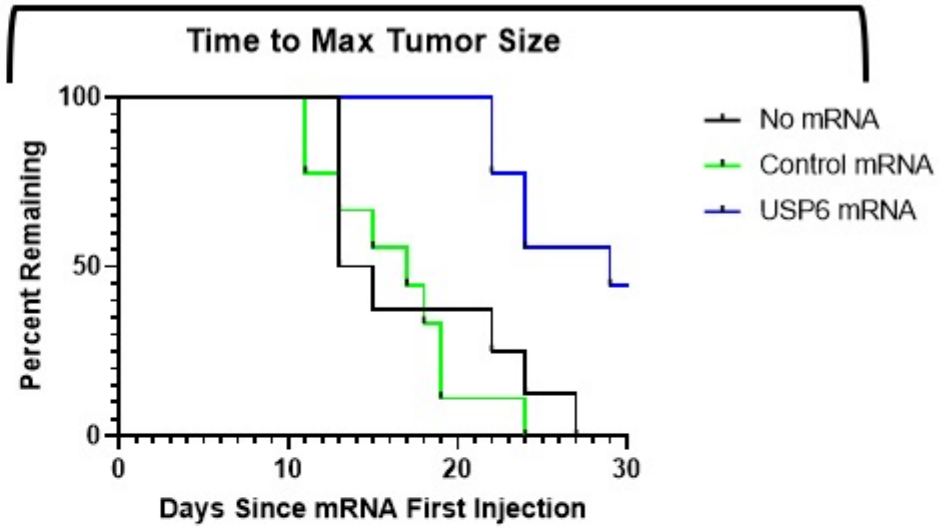
In Vivo Validation of Therapeutic USP6 mRNA
- two distinct animal models

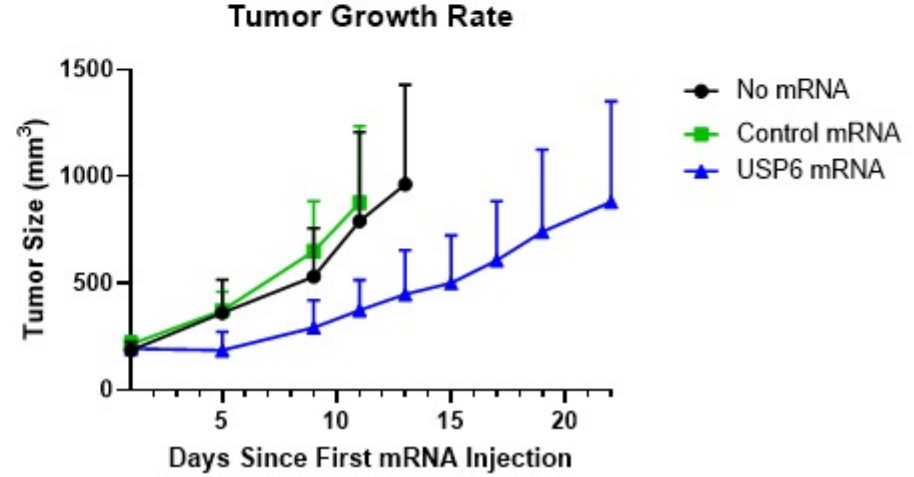
Childhood Sarcoma





Adult Leukemia

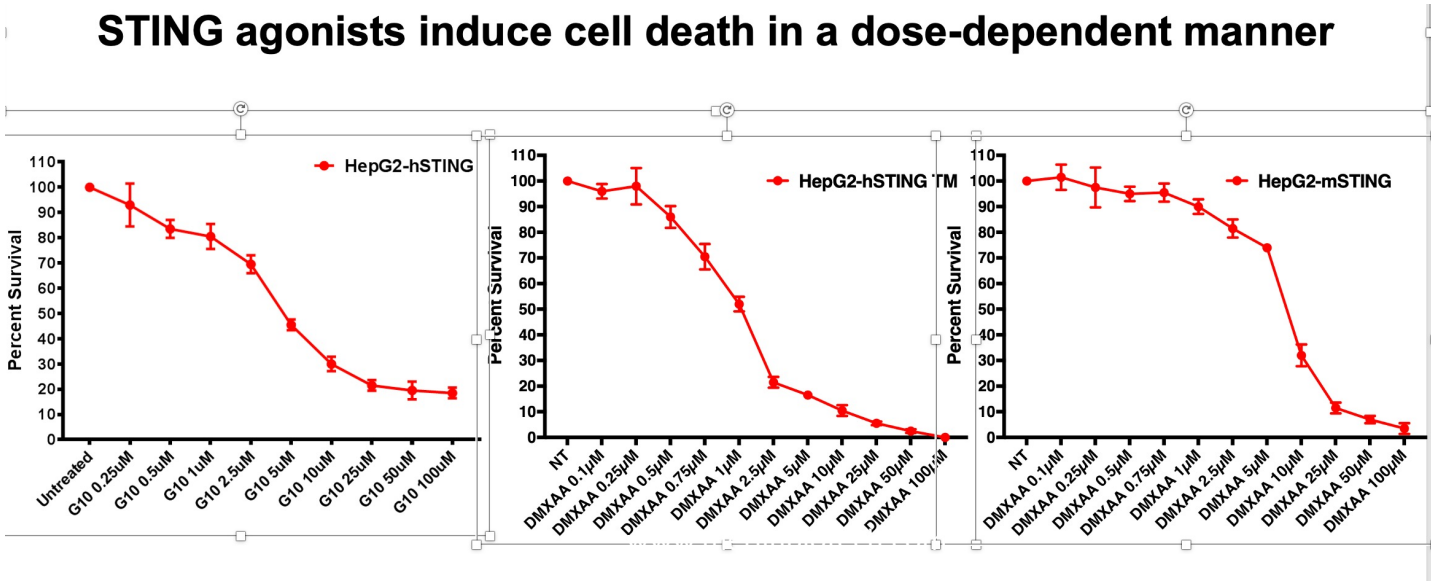




Data on file

MERLIN's mRNA Technology – Oncology

- *STING (stimulator of interferon genes) – innate immunity against infection and cancer, activated by cyclic dinucleotide (CND) – synthetized in response to cytosolic DNA as a danger signal*
  - *Activation of STING mediates a multifaceted type-I interferon (IFN-I) response*
  - *Promotes the maturation and migration of dendritic cells (DCs), and primes cytotoxic T lymphocytes and natural killer (NK) cells for spontaneous immune responses*
- *Many tumors have insufficient levels of STING and cannot benefit from the CND-based STING agonist therapeutic modalities.*
- *Expression of wild-type or mutant human STING in tumor tissues by mRNA and co-delivery of desired STING agonists will create a therapeutic suitable for all the solid tumors, with or without expression of endogenous STING.*



Problem Statement – Chronic Hepatitis B

Chronic hepatitis B

- *Direct-acting antivirals*
  - Potently inhibit viral replication, but fail to cure the chronic HBV infection
  - Life-long antiviral therapy is required
  - Even after 10 years of treatment, mortality is only reduced by 50%
- *Restoration or activation of a functional antiviral immune response is essential for the functional cure*
  - High viral antigen load, particularly HBsAg
  - Immune cell exhaustion
- *Immunotherapy*
  - Innate immune activators: lower efficacy and poor tolerability
  - Checkpoint inhibitors: lower efficacy
- *Therapeutic vaccination*
  - Poor clinical efficacy to induce HBV-specific immune response
  - Low antiviral activity of induced immune responses

Chronic Hepatitis B Strategies

- *Therapeutic mRNA vaccination of patients after reduction of viral load and HBsAg antigenemia by DAA therapies*
  - Reduction of viral loads by viral DNA polymerase inhibitors and/or capsid assembly modulators
  - Reducing viral antigen load by siRNA therapies
- *Therapeutic mRNA vaccination*
  - mRNA vaccination platform for efficient expression of viral proteins
  - Co-expression of multiple engineered viral proteins prone of degradation via distinct pathways to yield epitopes by-passing the tolerated HBV-specific T and B cell clones
  - STING agonists and engineered STING molecules as adjuvants for more efficient activation of HBV-specific T and B cells
  - Combination with checkpoint inhibitors to prevent the tolerance of activated HBV-specific T cells

MERLIN's mRNA Technology to Treat CHB

Problem:

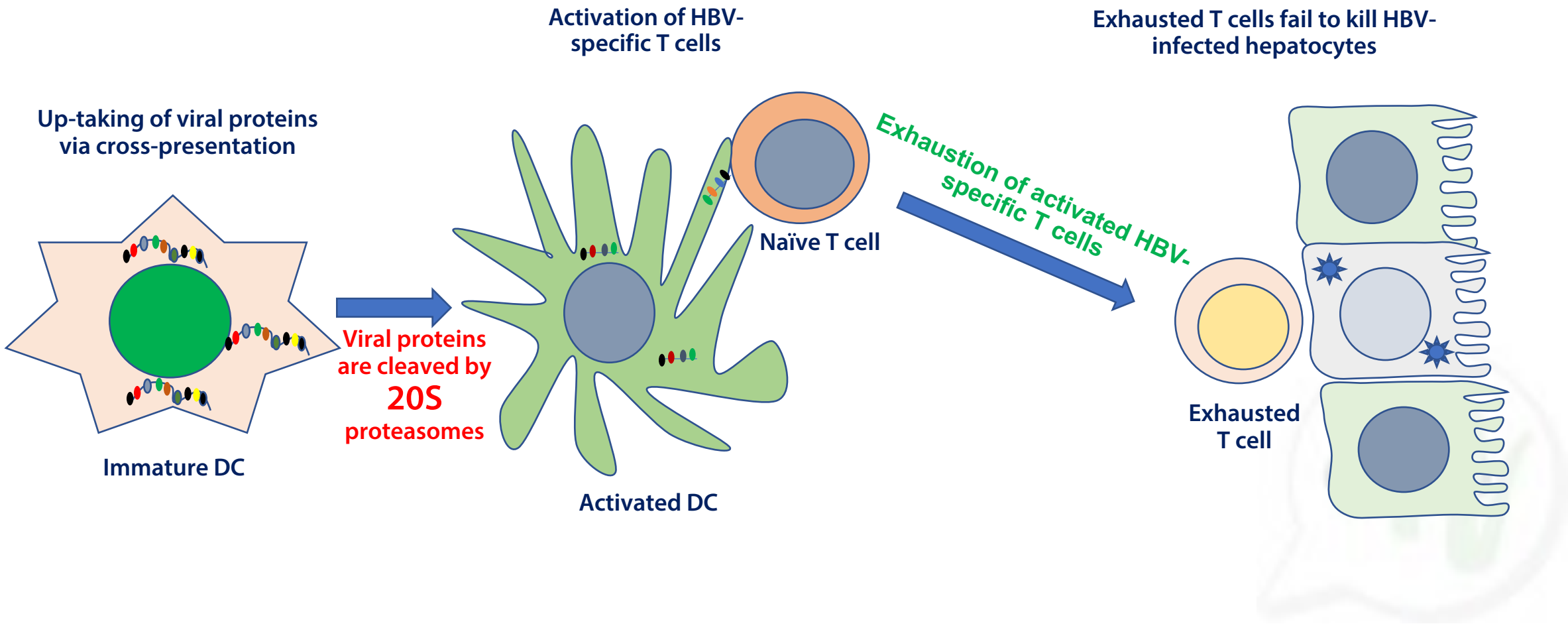
- T cells recognizing dominant epitopes are exhausted and cannot kill or cure HBV infected hepatocytes

Solution:

- mRNA expressed engineered HBV proteins that are degraded differently to produce a different set of peptides
  - Naïve T cells recognize the subdominant epitopes will be activated to control HBV infection

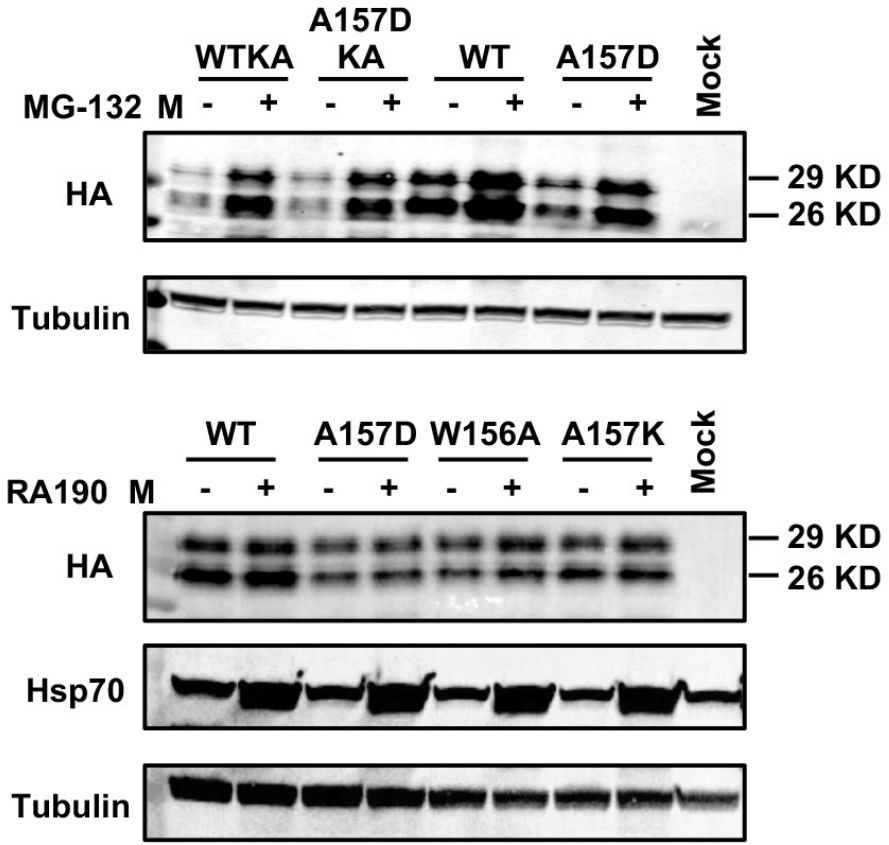
Chronic Hepatitis B MOA

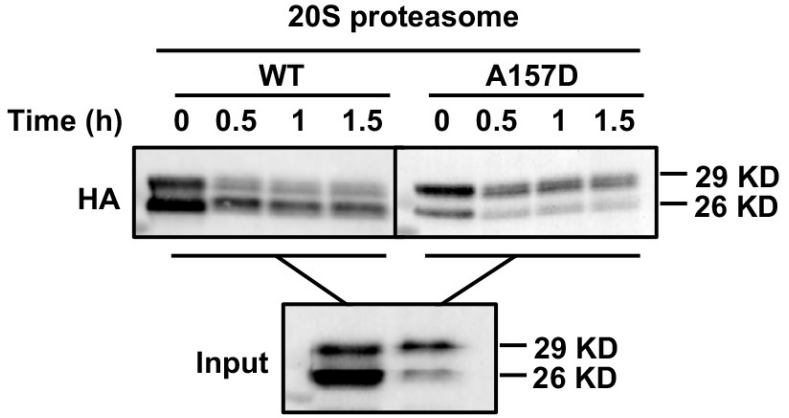
T cells are exhausted and don't recognize HBV proteins



HBV Envelope Proteins Primarily Degraded by 20S Proteasomes

Degradation of HBV S protein in hepatocytes can be inhibited by a pan-proteasome inhibitor (MG-132), but not a 26S proteasome-specific inhibitor (RA190)



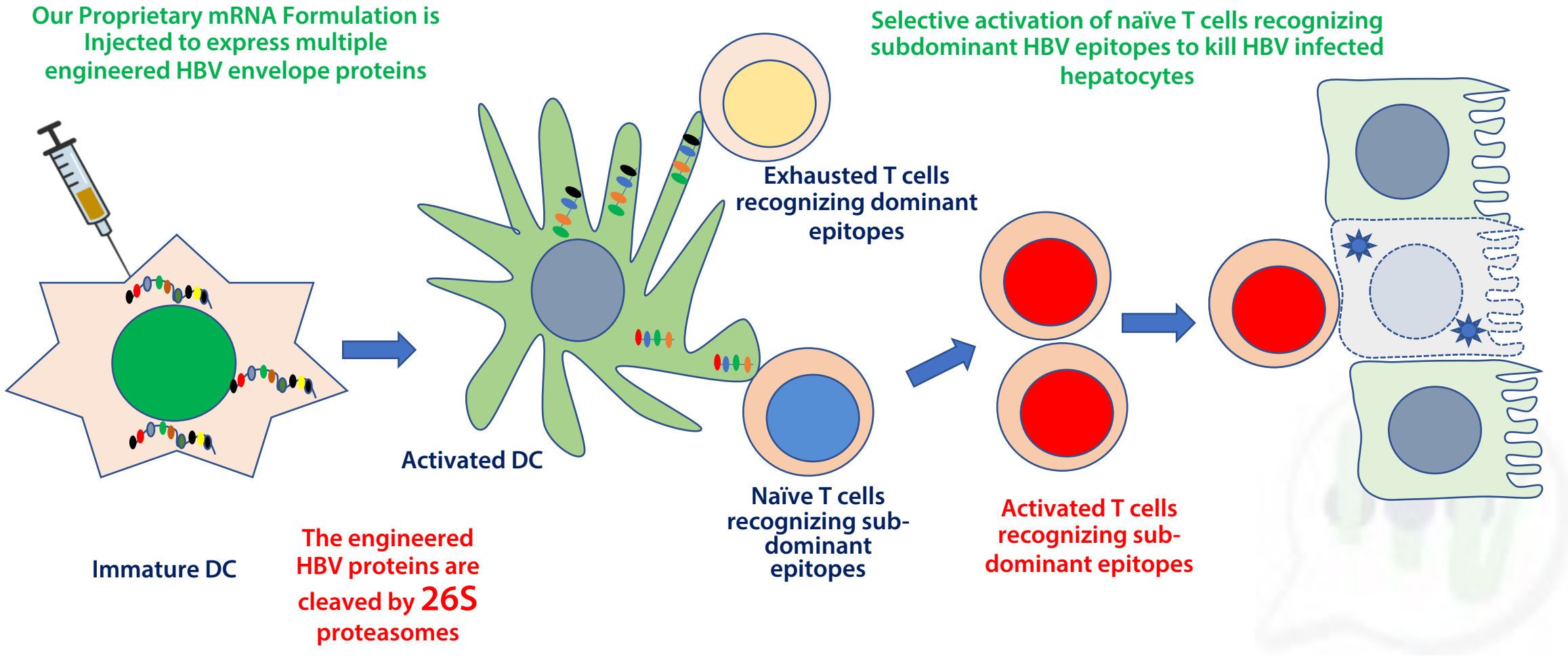


HBV S protein can be degraded in vitro by 20S proteasomes

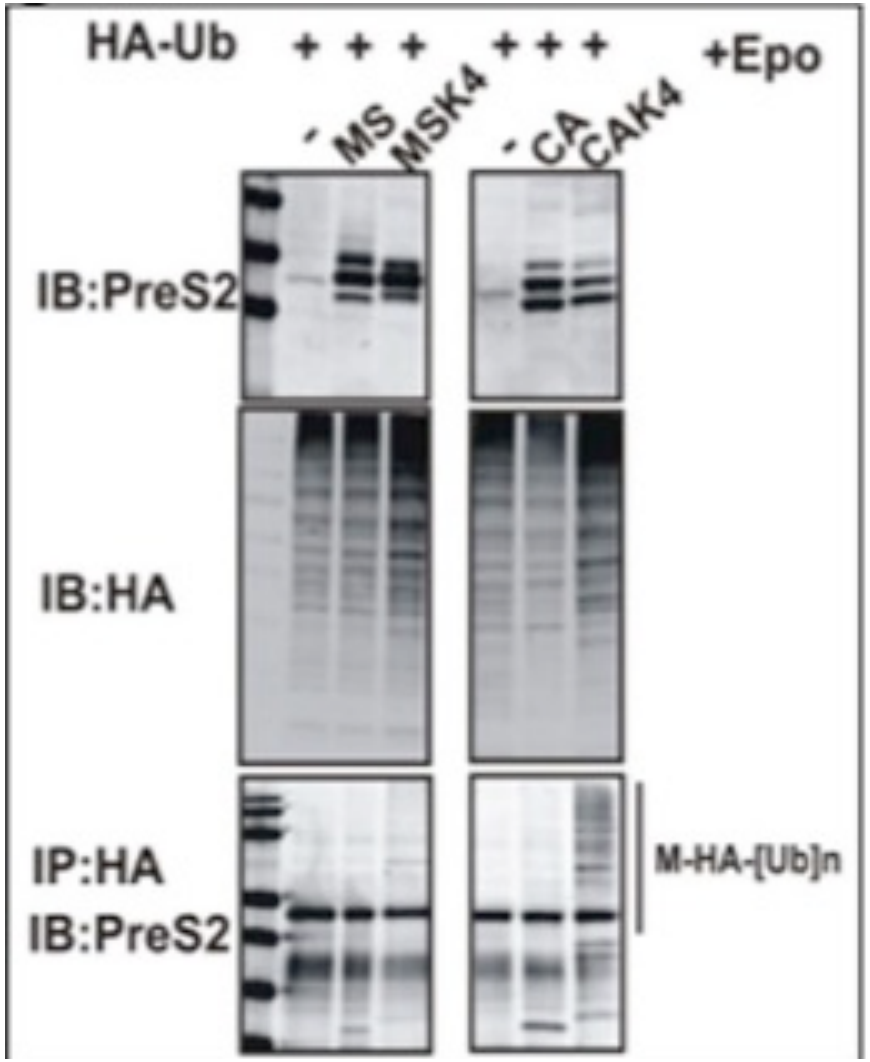
Sisi Yang, et al. Journal of Virology 2020

Chronic Hepatitis B MOA

mRNA specifying aberrant HBV proteins now recognized by T cells



Engineered Vaccine Candidate HBV Envelope Proteins Degraded by 26S Proteasomes



Introduction of two additional lysine residues (R73K and R122K) into WT (MS) or mutant (CA) M protein increases M protein ubiquitination

Liu, Y., et al. PLoS ONE, 2011

Problem Statement - Lyme

Lyme disease

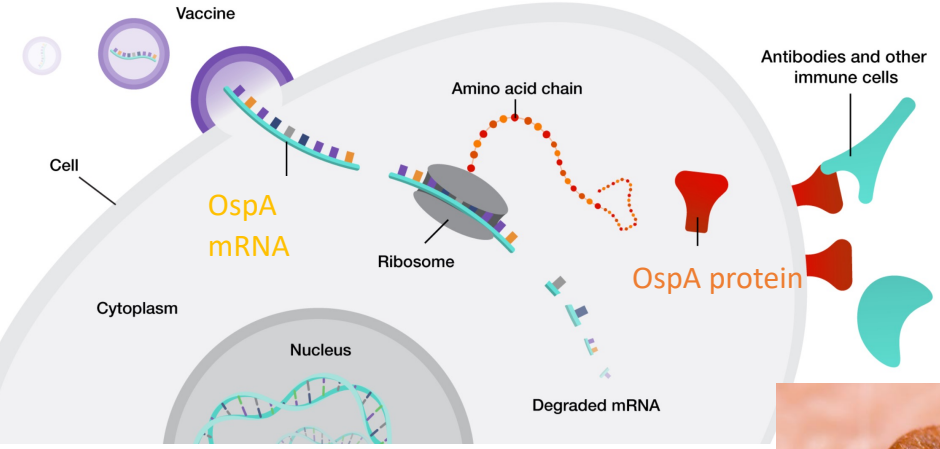
- *Lyme cases, ~300K US alone, increasing in endemic areas*
- *No approved vaccine nor effective treatment*
- *TBE (tick borne encephalitis) widespread in Europe*

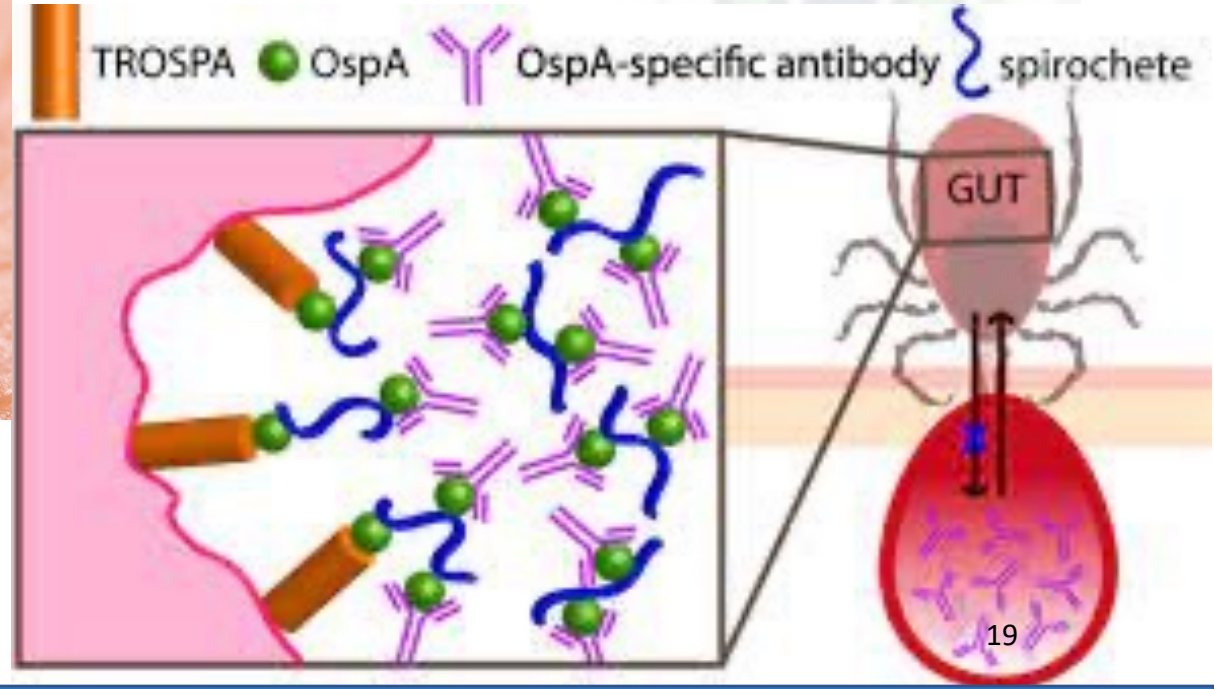
MERLIN Technology – Lyme vaccine

- Strategy is de-risked
  - IM injection of mRNA enclosed in LNPs to induce antibody production
- Development pathway is clear
  - Recognized correlate of protection
- Likely require annual boosters to maintain protection
- Antibody response to tick protein likely to also confer protection to tick borne encephalitis (TBE)

Lyme Vaccine MOA

mRNA induced antibody to Tick gut protein (OspA) blocks transfer of bacteria





Looking forward

- MERLIN's primary focus is mRNA delivered USP6 for the rare pediatric cancer, Ewing's sarcoma

- MERLIN has world class LNP platform
- MERLIN has demonstrated ability to manufacture mRNA and deliver in vivo
- mRNA/LNP platform developed for identified targets and can be leveraged against additional and novel strategies

Summary

- mRNA platform startup innovative biotechnology company
- MERLIN is exploiting proven mRNA technology for novel therapeutics and vaccines against targets with in-house expertise
- MERLIN has the trifecta of proven technology, IP protection, and global experts

Forward Looking Statement

The updates presented in these pages may contain forward-looking statements. These statements may relate to future events or future financial performance. Any statements that are not statements of historical fact (including without limitation statements to the effect that MERLIN Biotech Inc. (“The Company”) or its management "believes", "expects", "anticipates", “possibly” “hope” "plans" “may” (and similar expressions) should be considered forward-looking statements. There are a number of important factors that could cause MERLIN Biotech Inc. actual results to differ materially from those indicated by the forward-looking statements. The Company does not intend to update or otherwise revise such forward-looking statements, whether as a result of new information, future events or otherwise. As a result of these and other risks, uncertainties and assumptions, forward-looking events and circumstances discussed herein might not occur in the way the Company expects, or at all. Accordingly, you should not place reliance on any forward-looking information or statements. All forward-looking statements herein are qualified by reference to the cautionary statements set forth in this section.

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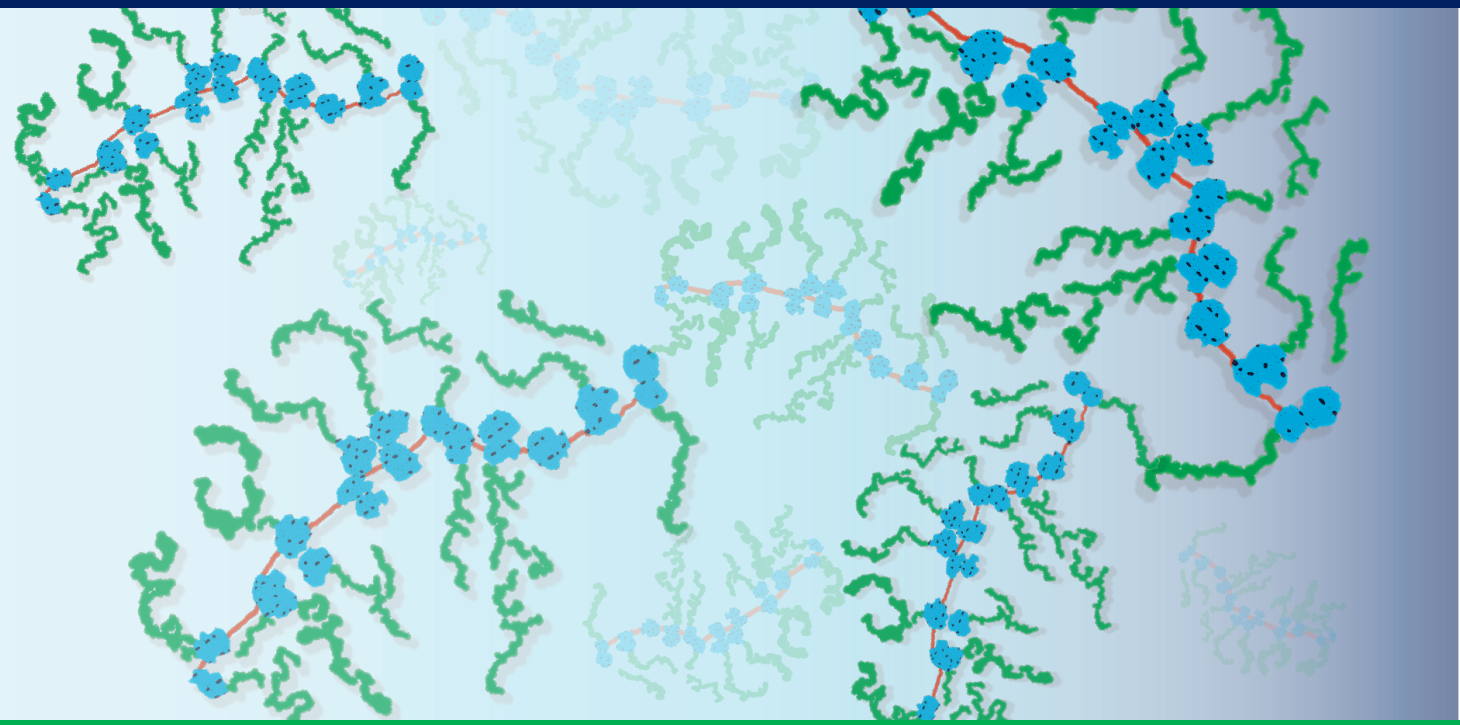

Thank You