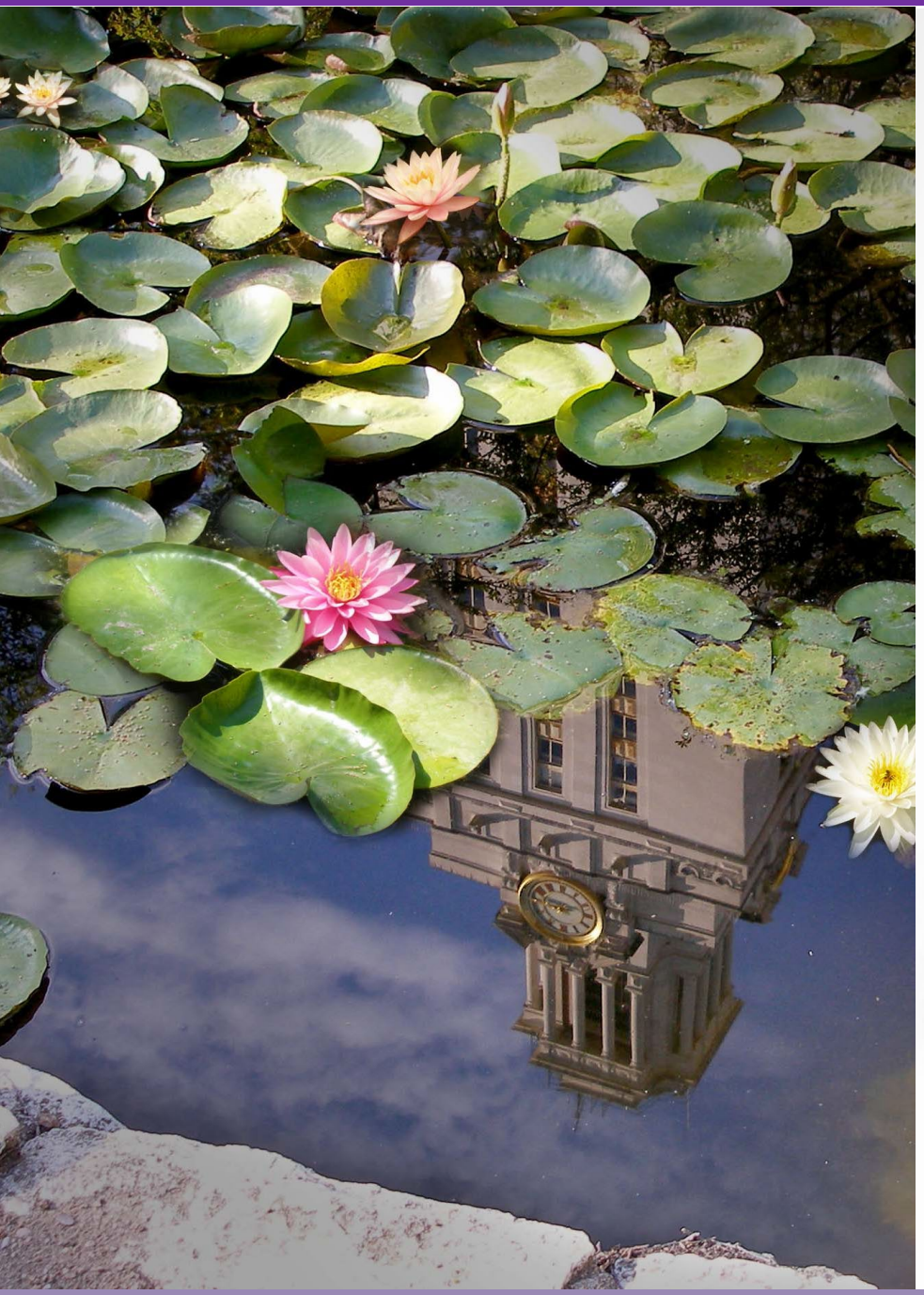
JURATA
THIN FILM

Revolutionizing Biologics Storage and Distribution



Jurata Thin Film, Inc.

- Founded in April 2019 by Sheila Mikhail, Dr. Jude Samulski, and Dr. Maria Croyle
- Holds the exclusive license for thin film technology developed at the University of Texas at Austin by Prof. Maria Croyle, PhD & Stephen Schafer
- Extensive publication history demonstrating thin film performance and potential
- Technology won the Johnson & Johnson QuickFire Challenge for potential to disrupt pharmaceutical supply chain and BLUE KNIGHT QuickFire Challenge
- Have BSL1 & BSL2 space in JLABS@TMC (Houston, TX)

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Our Team

Sheila Mikhail, JD, MBA, Founder and CEO

- 20+ yrs biopharmaceutical leadership experience
- CEO and Co-Founder of Bamboo Therapeutics, sold to Pfizer in 2016 ($827 million)
- CEO and Co-Founder of AskBio, sold to Bayer in 2020 (up to $4 billion)

Irnela Bajrovic, Ph.D., CSO

- Advanced thin film technology for almost a decade while a student at UT
- Industry formulation expert gained from a leading biotechnology company
- Inventor on multiple formulations patents

Maria Croyle, R.Ph., Ph.D., Scientific Founder

- 25+ yrs formulation development of biological products
- First to Report Durable Protection from an Ebola Vaccine
- 20+ yrs consultant pharmaceutical and biotech industry (GSK, Biogen, Sigma-Aldrich Life Sci)

R. Jude Samulski, Ph.D., Co-Founder

- Former Director UNC Gene Therapy Center
- Holds over 200 patents related to AAV technology
- Bamboo, Asklepios Biopharmaceutical

Megan Livingston, M.Sc., Sen. Dir. Business Development

- 10+ yrs material science, drug delivery experience
- GMP scale up of cell and gene therapy products
- Expertise in new product development and marketing

Christopher M. Pavlos, Ph.D., Dir. Research & Development

- Ph.D. in Organic Chemistry from Johns Hopkins University
- 15+ yrs materials science, commercial process development
- Expertise in polymer science, organic chemistry, and drug delivery

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Covid-19 has illuminated the shortcomings of pharmaceutical manufacturing and supply chain…

… Jurata's thin film technology aims to prepare us for future pandemics by enabling regional manufacturing and removing cold chain requirements

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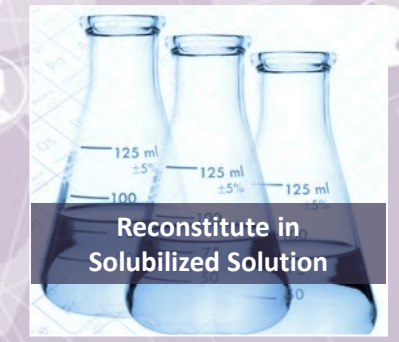
Jurata Thin Film Technology Overview

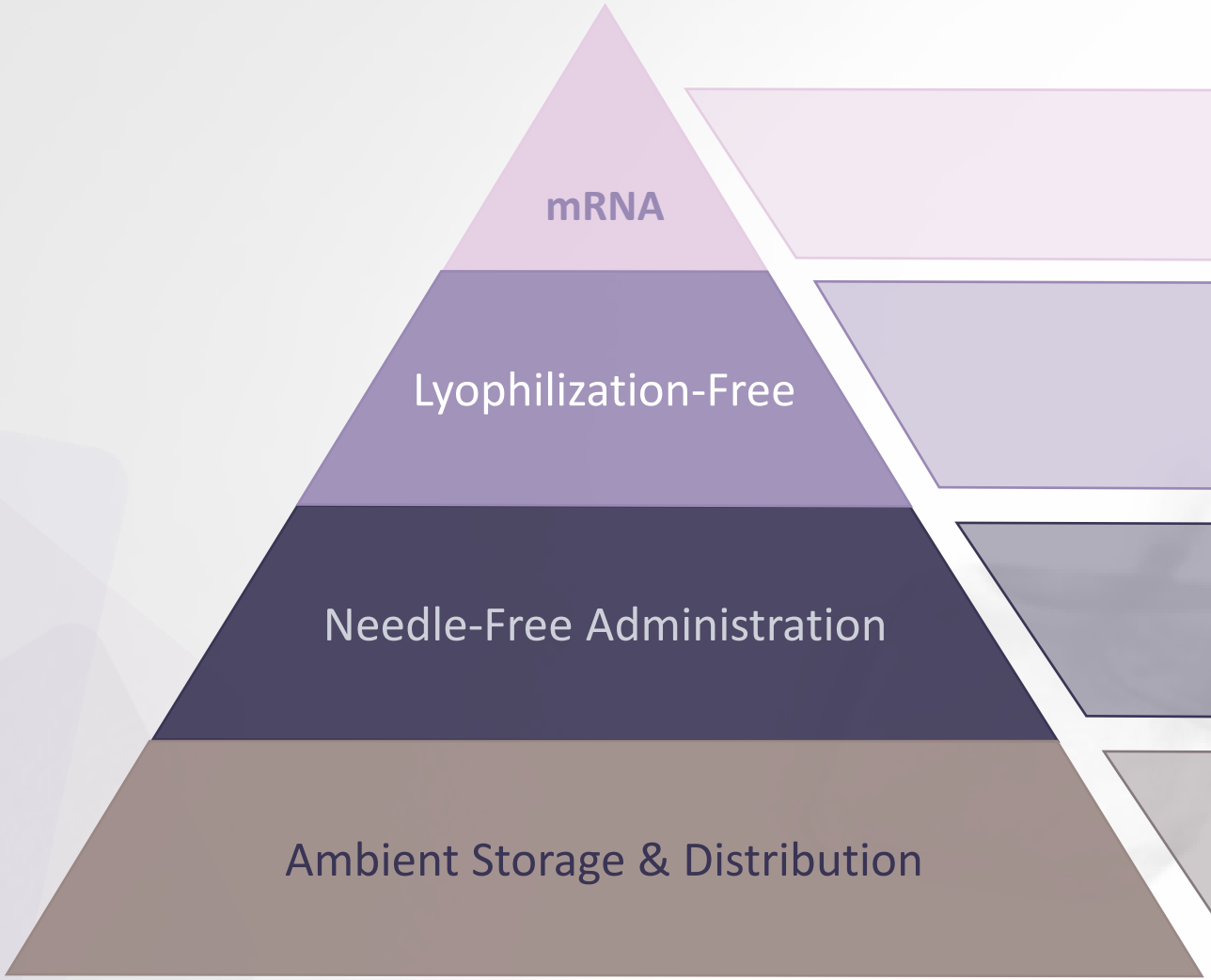
Thin film technology revolutionizes distribution

- No limitation on volume or global access
- Does not require special shipping or storage
- Maintains therapeutic potency
- Withstands extreme temperature exposure

Billions of Doses Around the World



Technology Value Added



SAVINGS & GAINS

Stabilize diverse vaccine platforms, including mRNA → **save energy** and **$$**

No need for lyophilization in vaccine manufacturing → **save energy** and **$$, increase manufacturing** efficiency

Administer vaccines without needles → **save $$, increase patient** compliance, **decrease burden** on healthcare workers

No need for cold packs and dry ice → **save energy** and **$$, decrease burden** on healthcare workers

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Thin Film Manufacturing Process

Purify API

Removes salt and other excipients from API bulk

Mix Thin Film Base & API

Stir thin film base and bulk API at appropriate concentration

Dispense Into Molds

Dispense solution into thin film molds

Dry Under Airflow

Expose to pure airflow at room temperature for ~3 hours until thin films are dry

Package & Ship

Add lid to blister packaging and heat seal

Add to secondary containment, add label, & ship

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Fill/Finish Process Comparison

	Freeze Drying	Thin Film
Cycle Time	85-hour cycle 4-hour cleaning **Total: 89 hours**	3-hour cycle 1-hour cleaning **Total: 4 hours**
Cycle Capacity	100,000 doses	10,000 doses
Infrastructure to Manufacture 40M Doses	**6 lines**, operating **24 hrs** per day	**4 lines**, operating **16 hrs** per day
Energy Costs	**$$$** (> 6.5X more than thin film)	**$**

Jurata's technology saves **millions of $$$ in CapX** and **hundreds of thousands each year in OpX** costs

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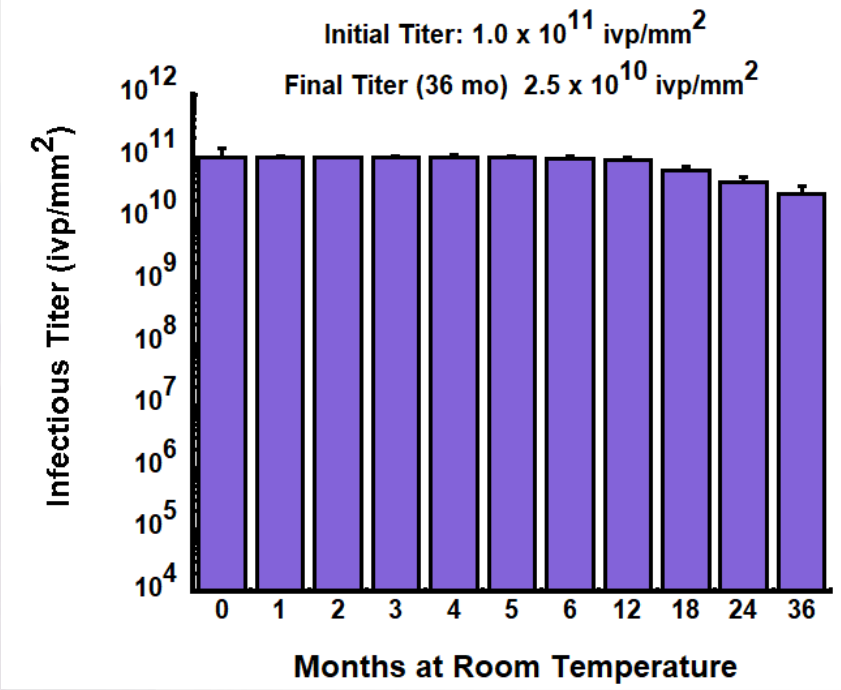
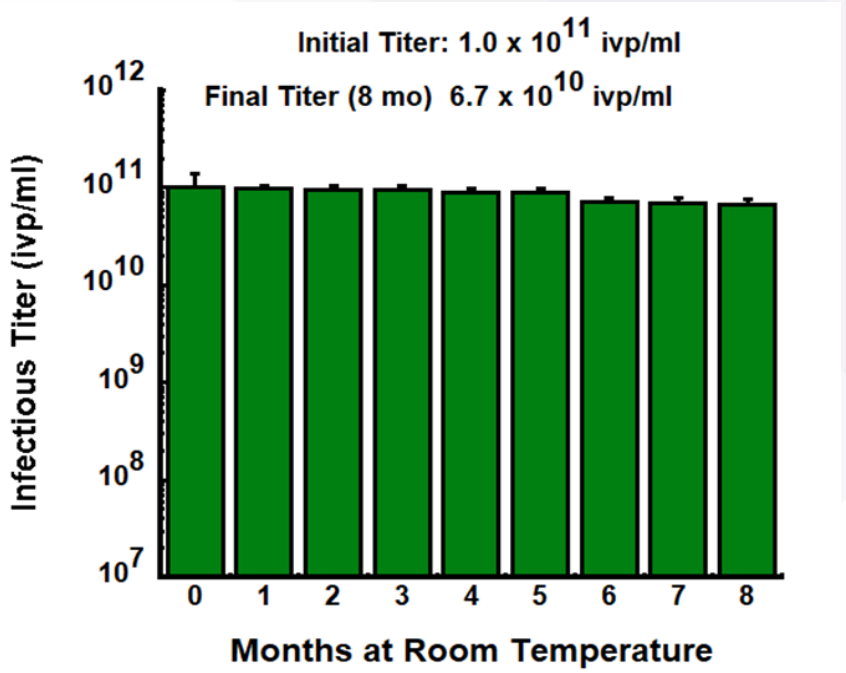
Lasting Vaccine Stability at Room Temperature Before & After Reconstitution

Live recombinant vaccine viable after 36 months at 25°C



Bajrovic, I et. al Science Advances 2020 Mar 4;6(10):eaau4819

Live recombinant vaccine viable at 25°C 8 months after reconstitution



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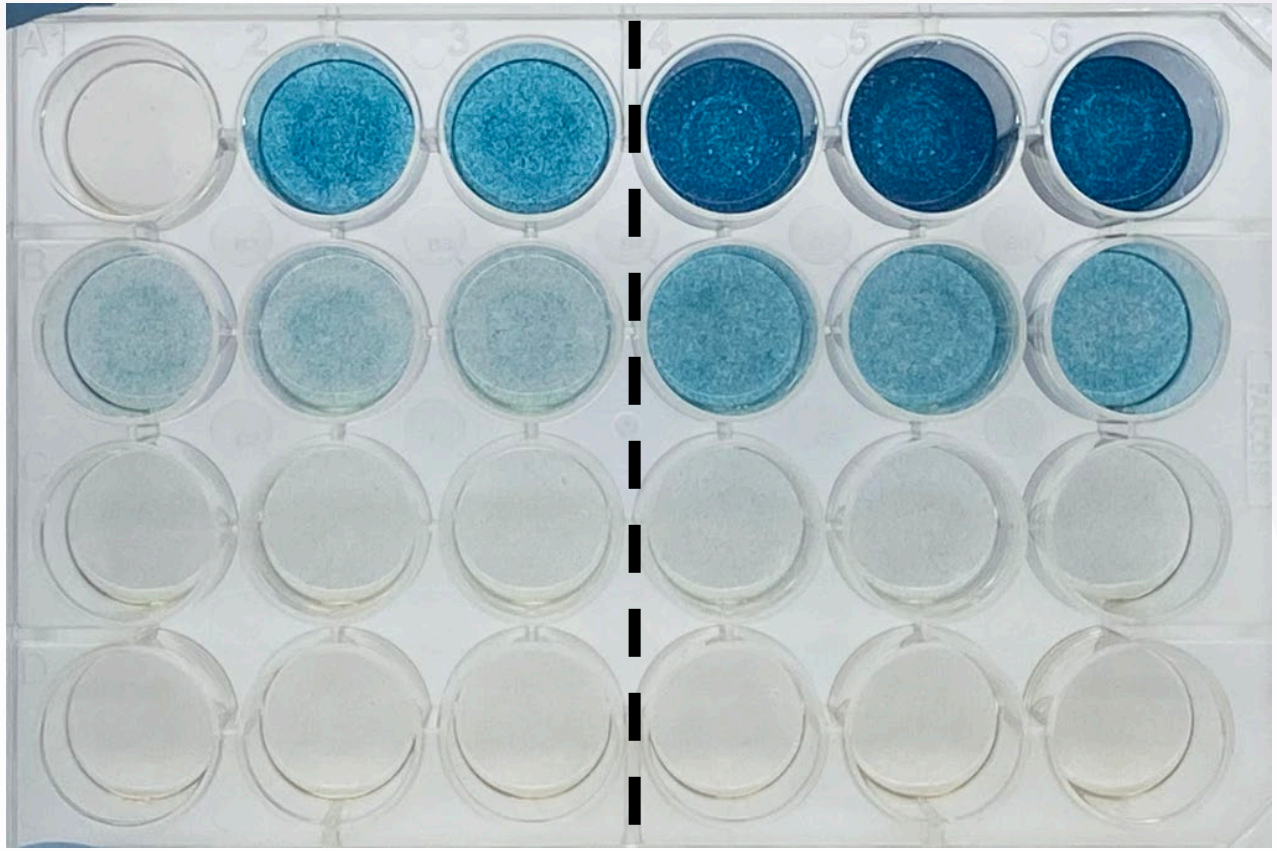
Thin Film Supports API Uptake by Oral Epithelium

Our thin film formulation improves cellular uptake of adenovirus by buccal epithelial cells

Stock Ad diluted in inf. media

Ad + Film diluted in inf. media



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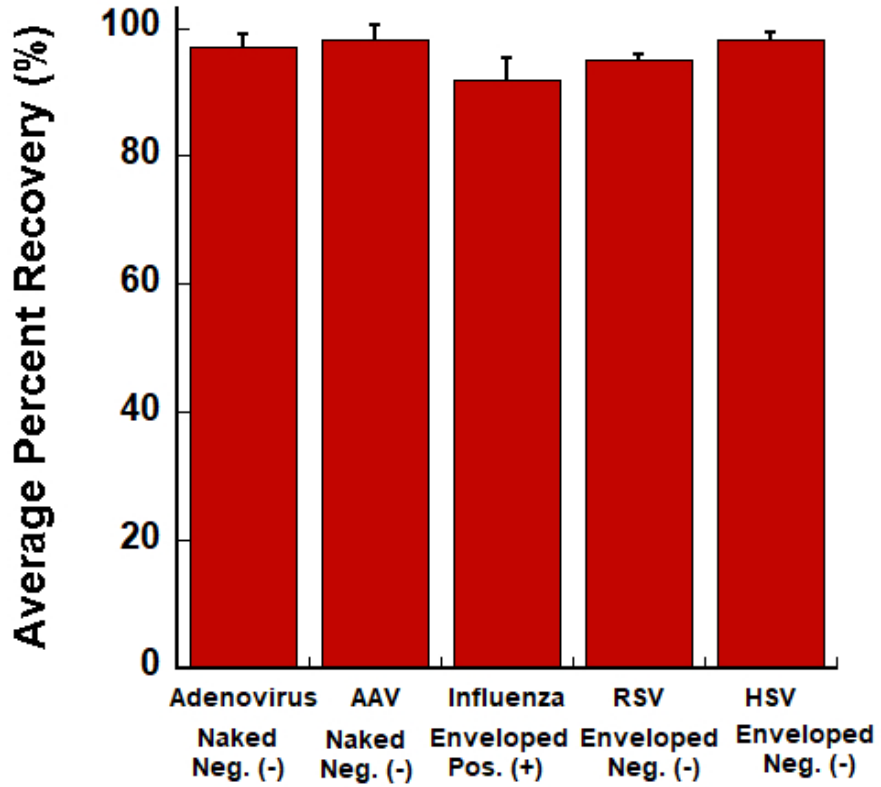
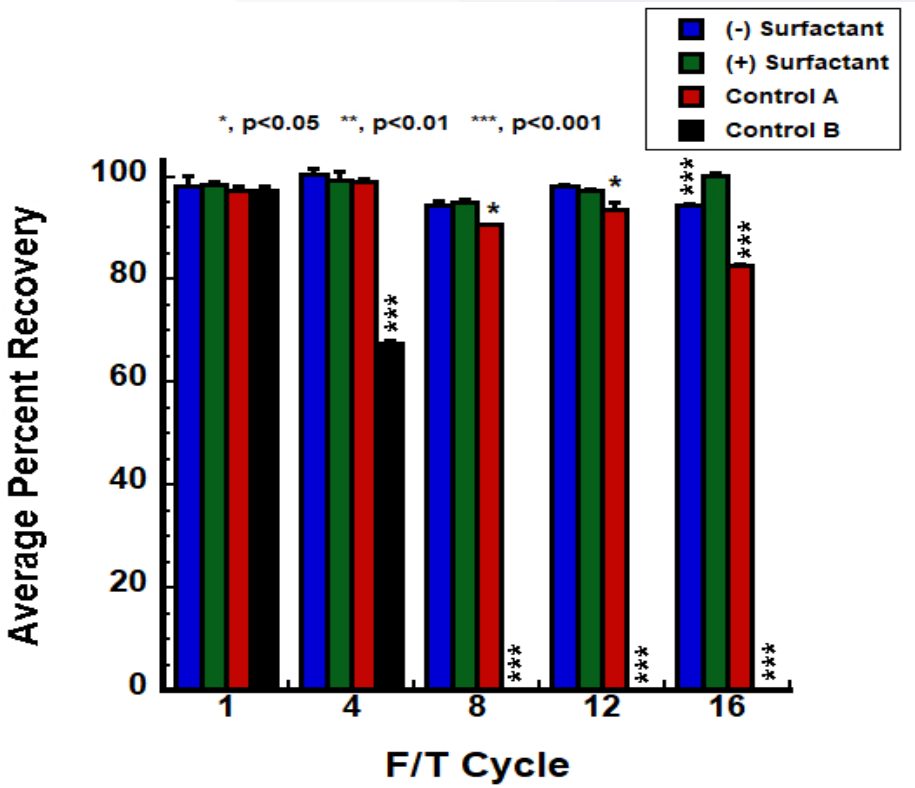
Novel Film Technology Effectively Stabilizes a Variety of Live Viruses Through Multiple Freeze/Thaw Cycles





Bajrovic, I et. al Science Advances 2020 Mar 4;6(10):eaau4819

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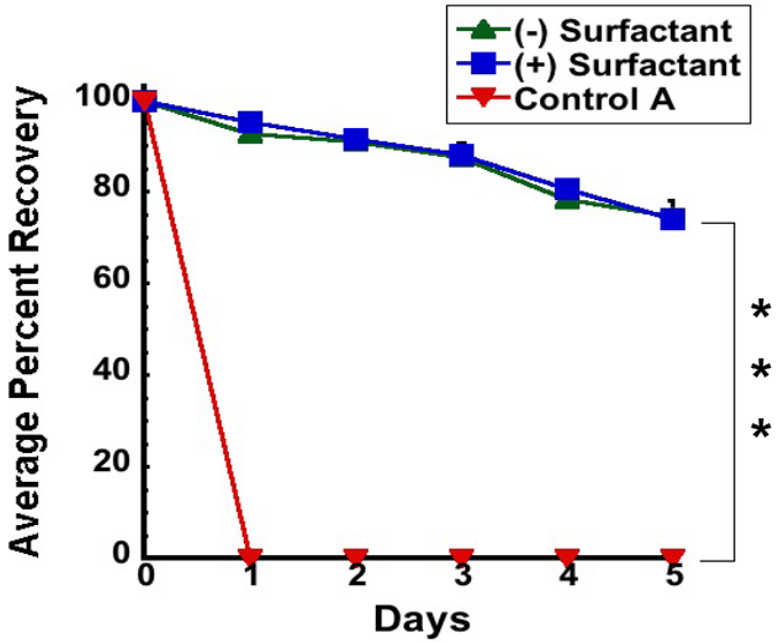
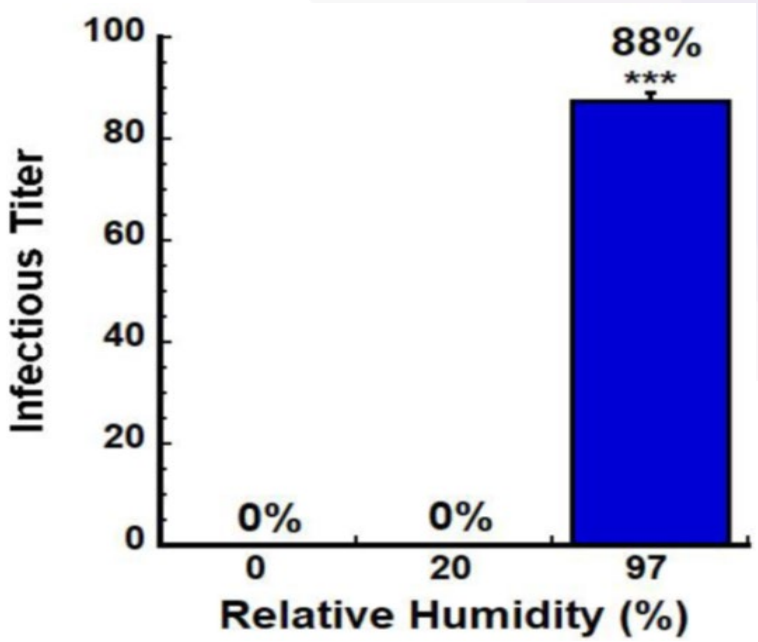
Live Virus Remains Stable in our Thin Films, Even at Elevated Temperature

40°C (no RH control)



High RH improved virus recovery after 5 days at 40°C



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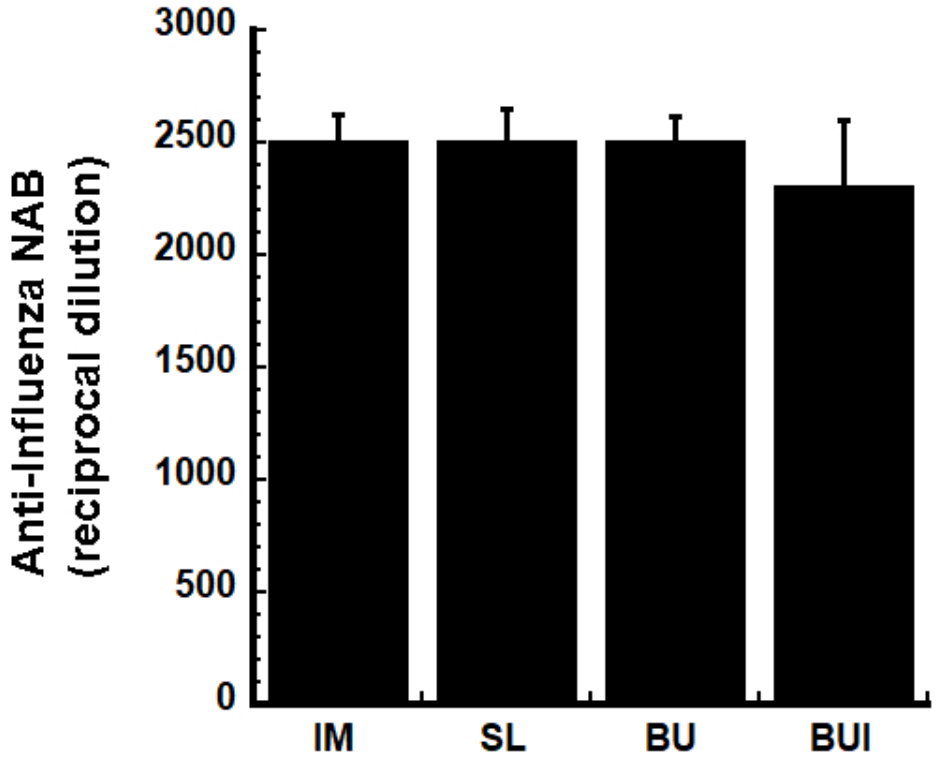
Thin Film Can Be Used for Needle-Free Vaccination



Influenza vaccine delivered via sublingual (SL) or buccal (BU) route generates equivalent immunogenicity to those administered via intramuscular (IM) injection

Immunogenicity generated even after thin films were exposed to 60°C heat for 4 days then administered via BU route (BUI)

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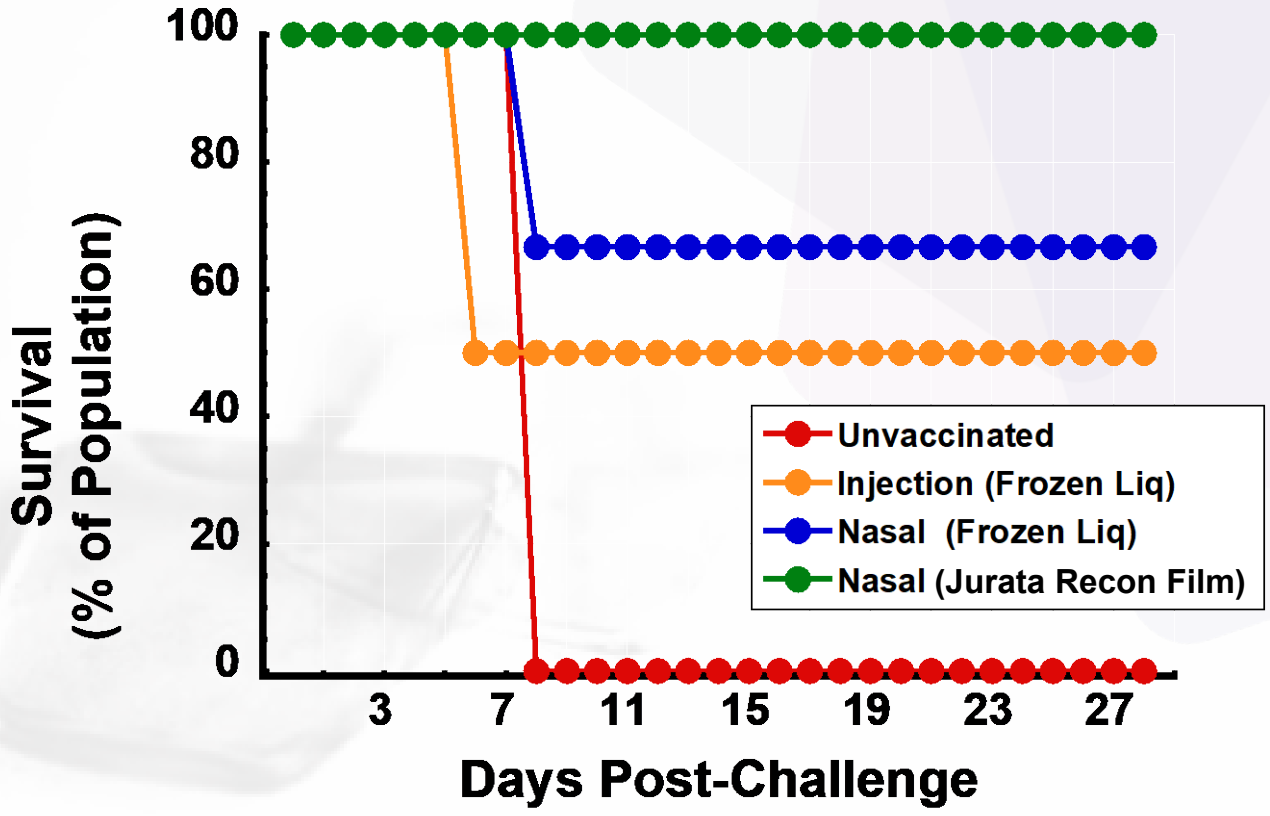
Thin Film-Stabilized Vaccine Confers Life-Saving Protection Against Ebola

A 50% dose of vaccine stabilized in Jurata's thin film technology, then reconstituted and administered as nasal spray provided 100% survival to non-human primates injected with lethal dose of Ebola

Equivalent dosage of frozen vaccine only conferred 50% survival when administered IM and ~65% survival when administered as a nasal spray



Choi, J.H.et al. *Mol. Pharm.*, 2015.12(8): 2712-2731

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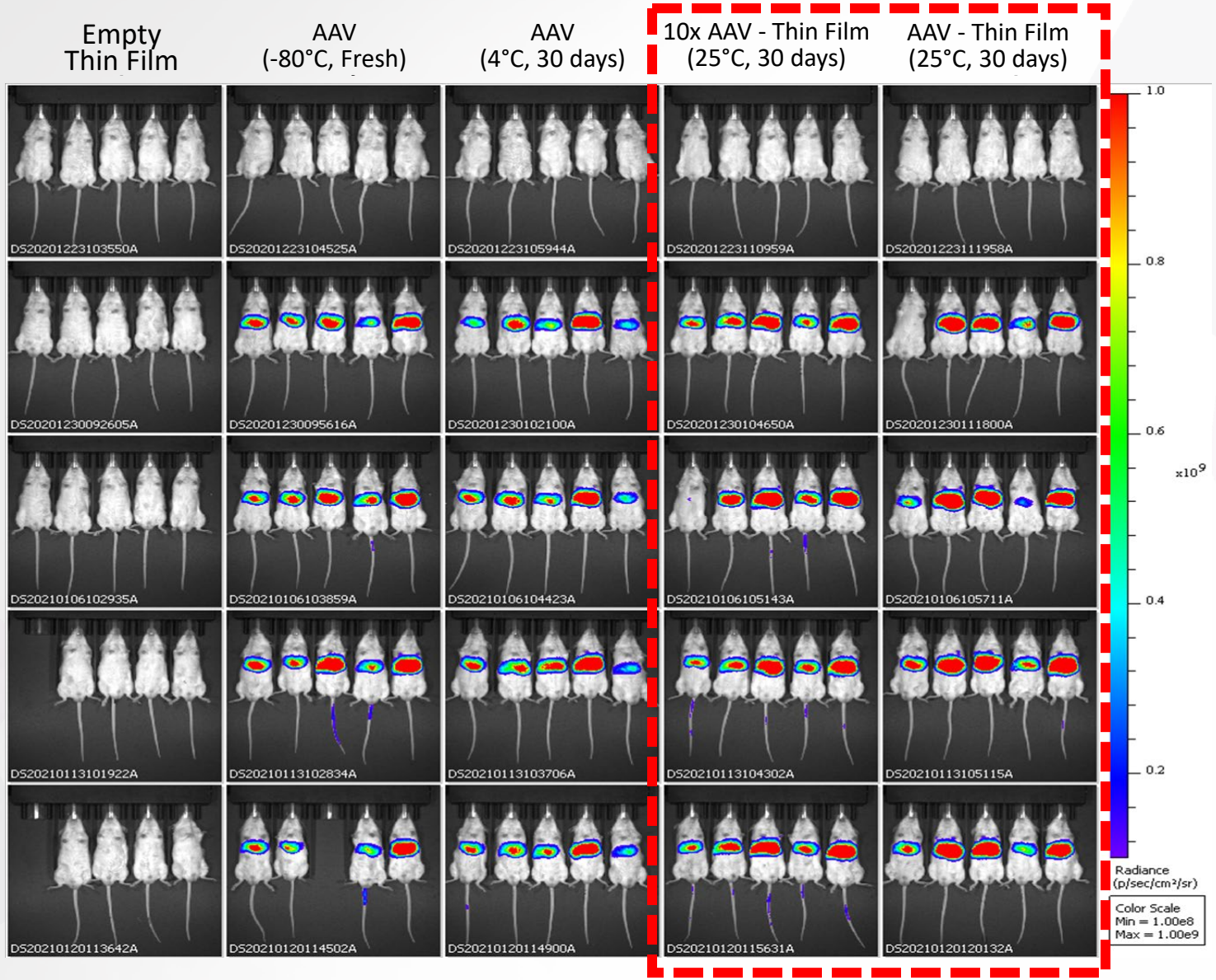
Thin Film-Stabilized Gene Therapy Delivered by Injection



10X concentrated and 1X AAV-loaded thin films stored at room temperature for 30 days showed comparable gene therapy delivery to fresh AAV stored at -80°C

Doan, T. et al. Nat Comm Med 2022 (in press)

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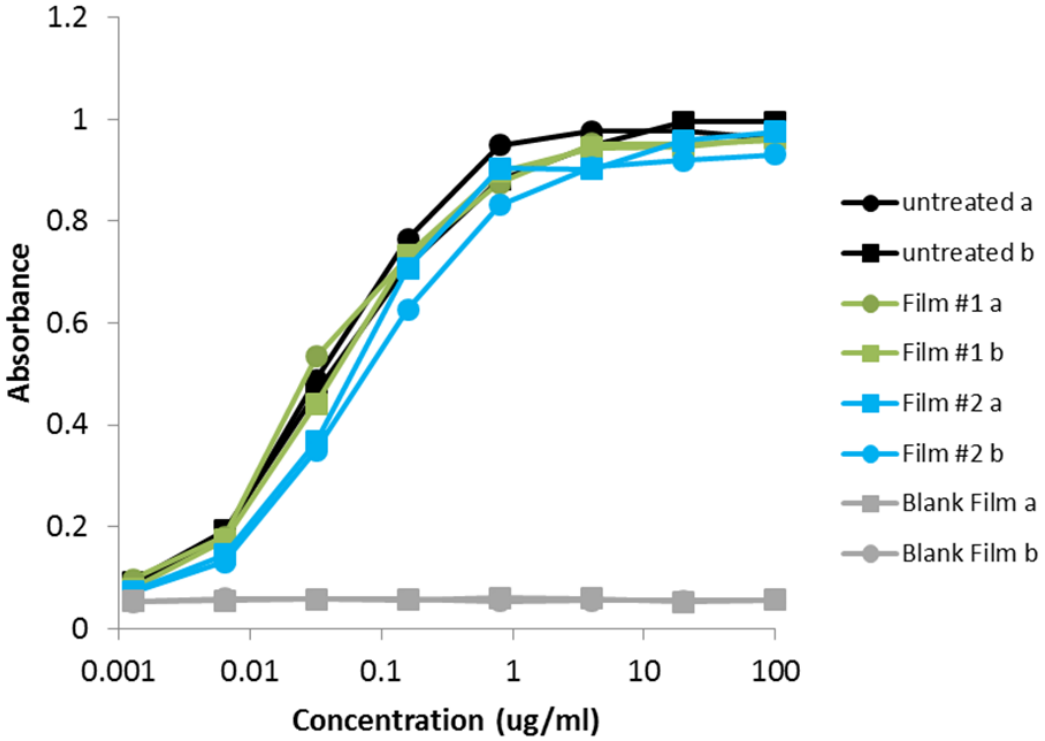
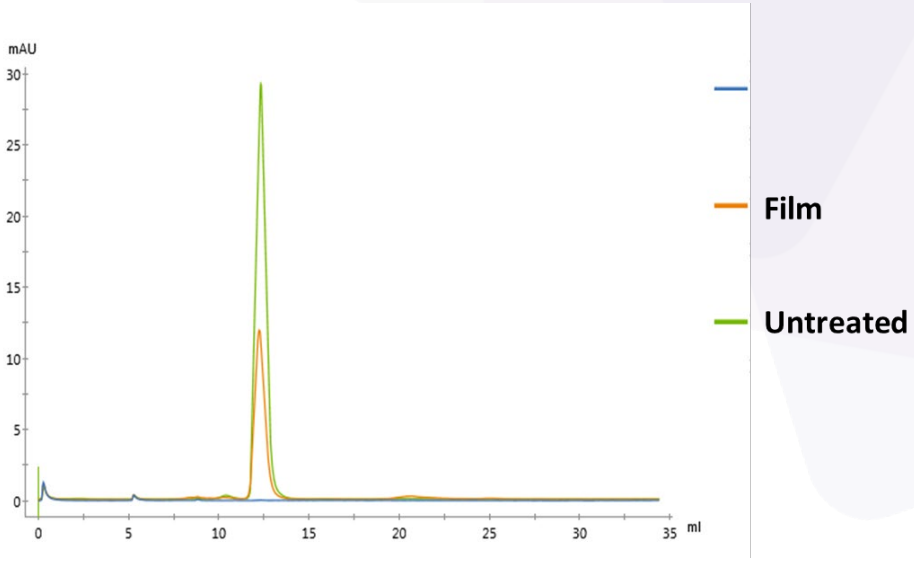
Film Technology Preserves Ability of Humanized Anti-Pertussis Toxin Antibody to Bind to Pertussis Toxin and Prevents Aggregation in Solution





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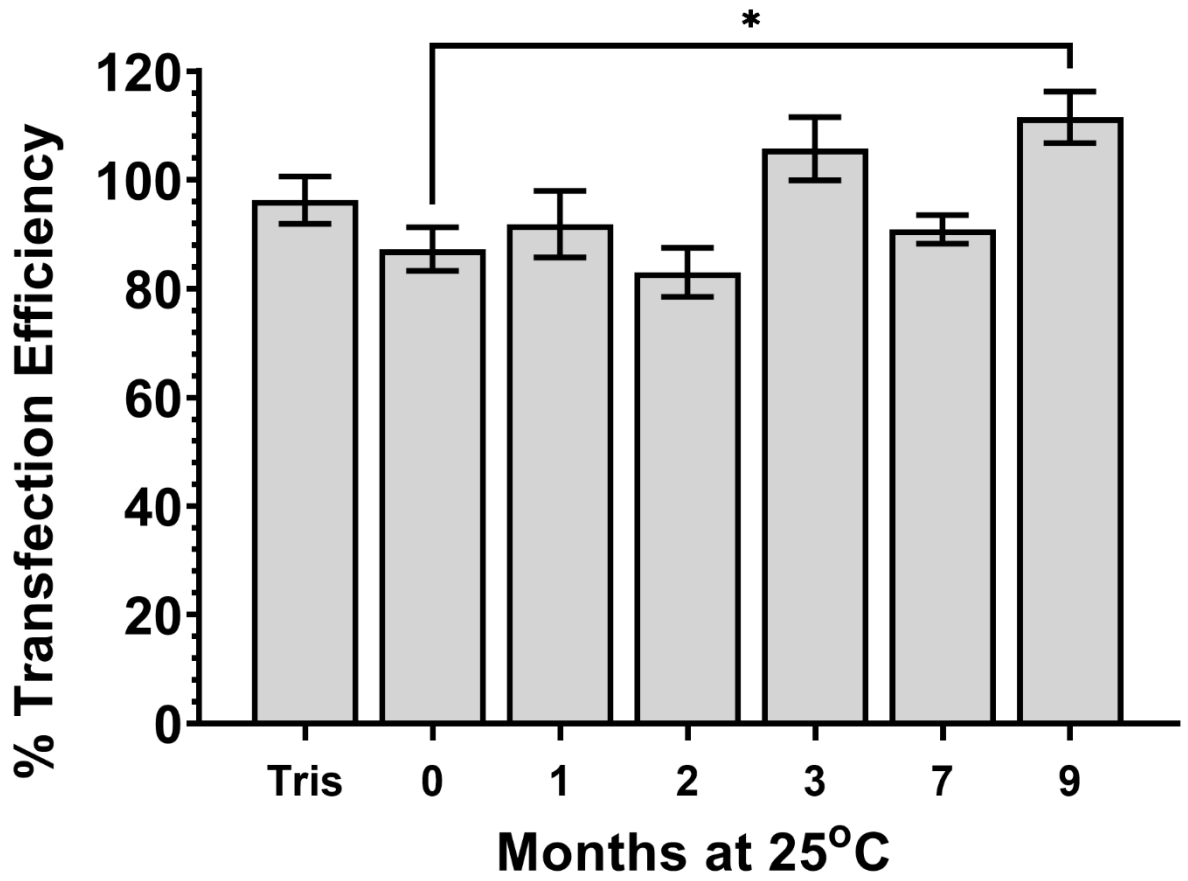
Stability of Naked Plasmids at 25°C Confirms Versatility of Thin Film Platform



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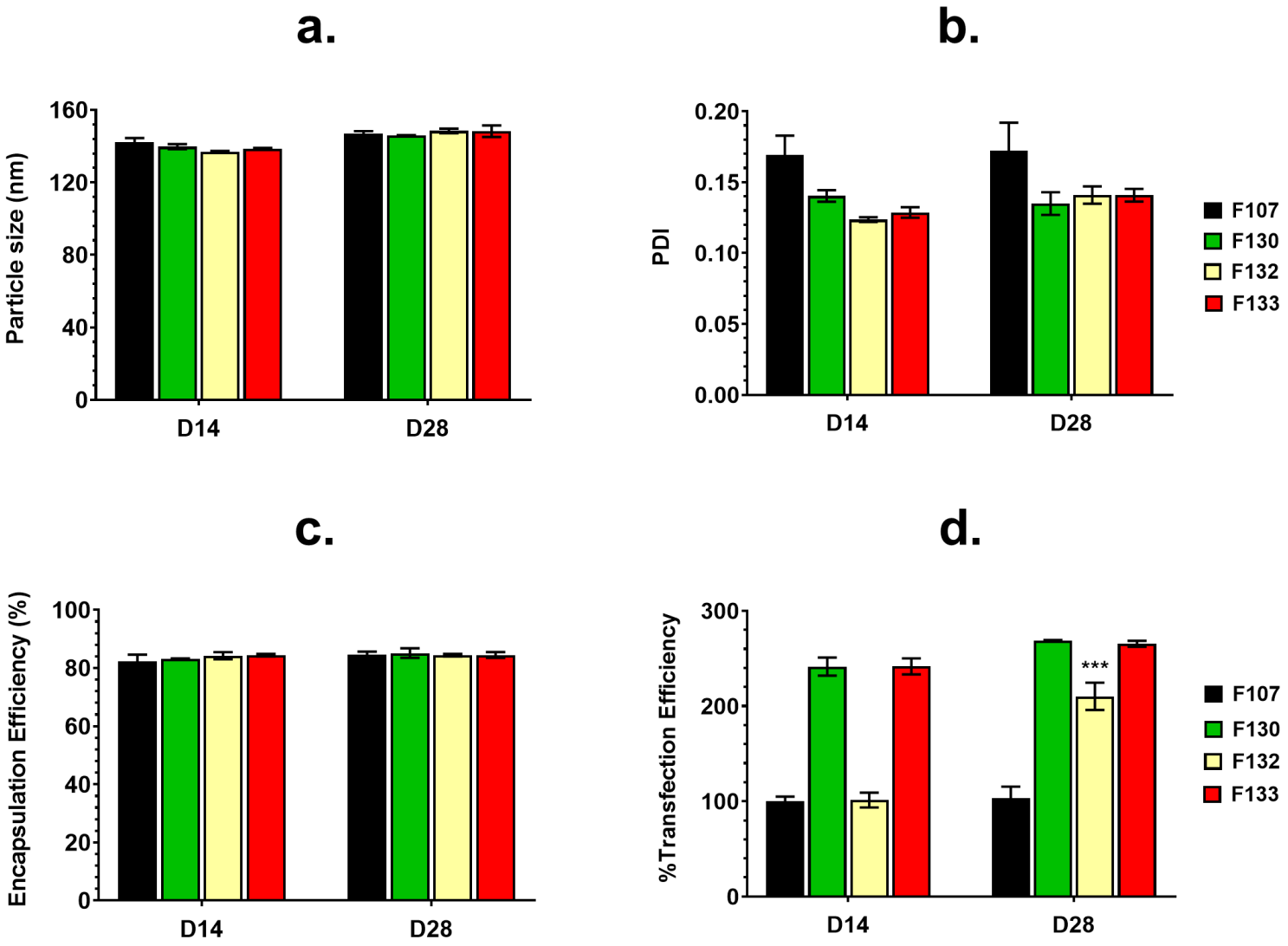
Thin Film Platform Adapted to Stabilize mRNA Therapeutics



Four different thin film formulations have been developed showing **no degradation of mRNA LNPs stored at 4°C for 1 month**

These studies are ongoing and we are happy to share longer term stability data when available

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Regulatory Pathway

Our thin film formulation is considered an excipient by regulators

Work to Be Done

New Excipient Toxicity Studies

- New excipient testing must be run on the novel surfactant
- Toxicity will be evaluated for each administration route
- Toxicity studies only need to be done once

File Type IV DMF

Submit a Type IV Drug Master File (DMF) with surfactant toxicity studies and thin film negative control data (i.e., thin film alone)

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A new era in biologic storage and distribution

- Removes major supply chain and logistics challenges associated with moving pharmaceutical substance
- Removes need for lyophilization, dramatically increasing manufacturing efficiency
- Removes dependency on highly specialized infrastructure and reduces drug product costs
- Scalable production process, with less than two years needed for pilot manufacturing and regulatory submission

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Let’s bring life to the world.

Join us to break the cold chain.

Thank you.

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