VitriLife® Technology Platform

Industrial Scale Production & Mucosal Delivery of Thermostable Vaccines and Other Biopharmaceuticals

Victor Bronshtein, Ph.D.

victorb@vitrilife.com
858.245.9323

Vaccines Summit, Boston
May 2023

Markets We Serve

Cold chain requirements due to the thermal instability of freeze-dried (F-D) vaccines and many other biologicals limit their stockpile potential, distribution, delivery, and greatly increase costs. Most current vaccines are formulated for parenteral delivery, requiring trained medical personnel, sterile water, needles and syringes. There is an urgent need for thermostable vaccines that can be self-administered.

VitriLife® technology platform addresses a need for better ambient temperature (AT) stabilization and delivery of vaccines and other fragile biologicals with higher yields, at higher storage temperatures, and lower cost of production.

Biopharmaceuticals Including Vaccines

Animal Health & Nutrition

***VitriLife®* Markets**

Agricultural Biologicals

Human Microbiome

Three Pillars of *VitriLife*® Technology Platform

AT Stabilization

biologicals in preservation solution (liquid)

Preservation by Vaporization (PBV)

Glassy foam containing thermostable biologicals

Inactivation (Optional)

Glassy foam containing thermostable biologicals

UV or electron beam (EB) inactivation of AT stabilized biologicals

Inactivated potent biologicals

Delivery

Glassy foam containing inactivated thermostable biologicals

OR

Glassy foam containing thermostable biologicals

Reconstitution with water for injection (optional)

Micronization into powder for vaccination using anhydrous delivery devices

Key Benefits of *VitriLife*® Technologies

Stabilization

- Cornerstone of UST's *VitriLife*® platform is its proprietary Preservation by Vaporization (PBV) industrial scale vacuum drying technology, which preserves biologicals by boiling from a partially frozen (slush) state. PBV enables substantially higher AT stabilization of vaccines, microbiome and other heat-labile biotherapeutics than can be achieved using conventional lyophilization.
- PBV is several times quicker and cheaper than freeze-drying, can be executed using standard lyophilizers, and is suitable for GMP under FDA/EMA approval.
- Biologicals stabilized using PBV technology remain stable at high ambient temperatures, eliminating a need for a cold chain during storage and distribution.
- Shorter drying time vs. freeze drying (minutes to hours vs. hours to days), removes bottlenecks associated with lyophilization manufacturing.
- Lower losses in vaccine activity or potency vs. lyophilization.
- PBV enables novel and more efficient vaccine inactivation and delivery technologies.

Inactivation

- PBV stabilized products can be treated with UV light or electron-beam (EB) irradiation in a dry state at AT, allowing for controllable, targeted damage, primarily to nucleic acids.
- UV or EB inactivation of microorganisms after PBV has significant advantages vs. heat or chemical inactivation, which damage membranes and biomolecules.
- These inactivation technologies also enable accelerated and cost-effective development and production of vaccines utilizing wild-type pathogens, which can address urgent vaccination needs against emerging diseases.

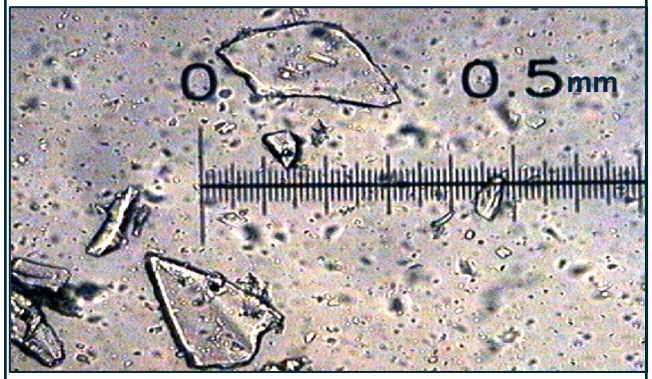
Delivery

- Thermostable VitriLife® vaccines and other biologicals can be micronized with no or minimum damage for subsequent incorporation in needle-free delivery devices (including DPIs, disintegrable tablets or capsules, dissolvable polymeric rods, films, microneedle patches, etc.). These devices enable mucosal (respiratory, oral, intravaginal etc.) and transdermal delivery without reconstitution and minimize the need for trained medical personnel for administration.

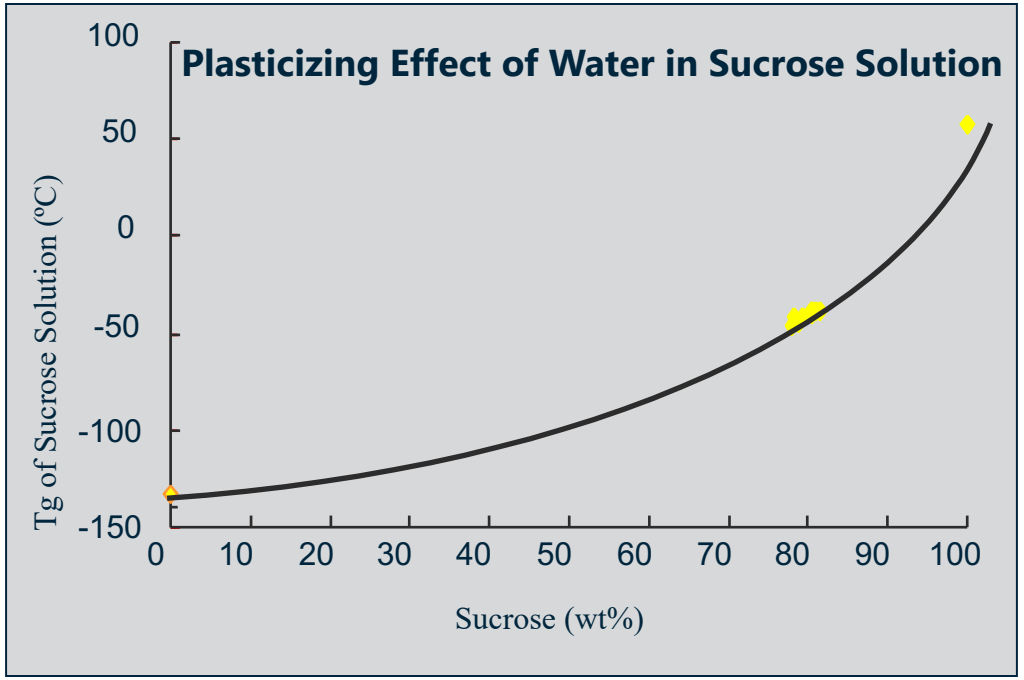
VitriLife® Stabilization Overview

Ambient Temperature (AT) Stability Can be Achieved by Immobilization of biologicals in a Carbohydrate Glass

Insect Preserved in Amber Glass

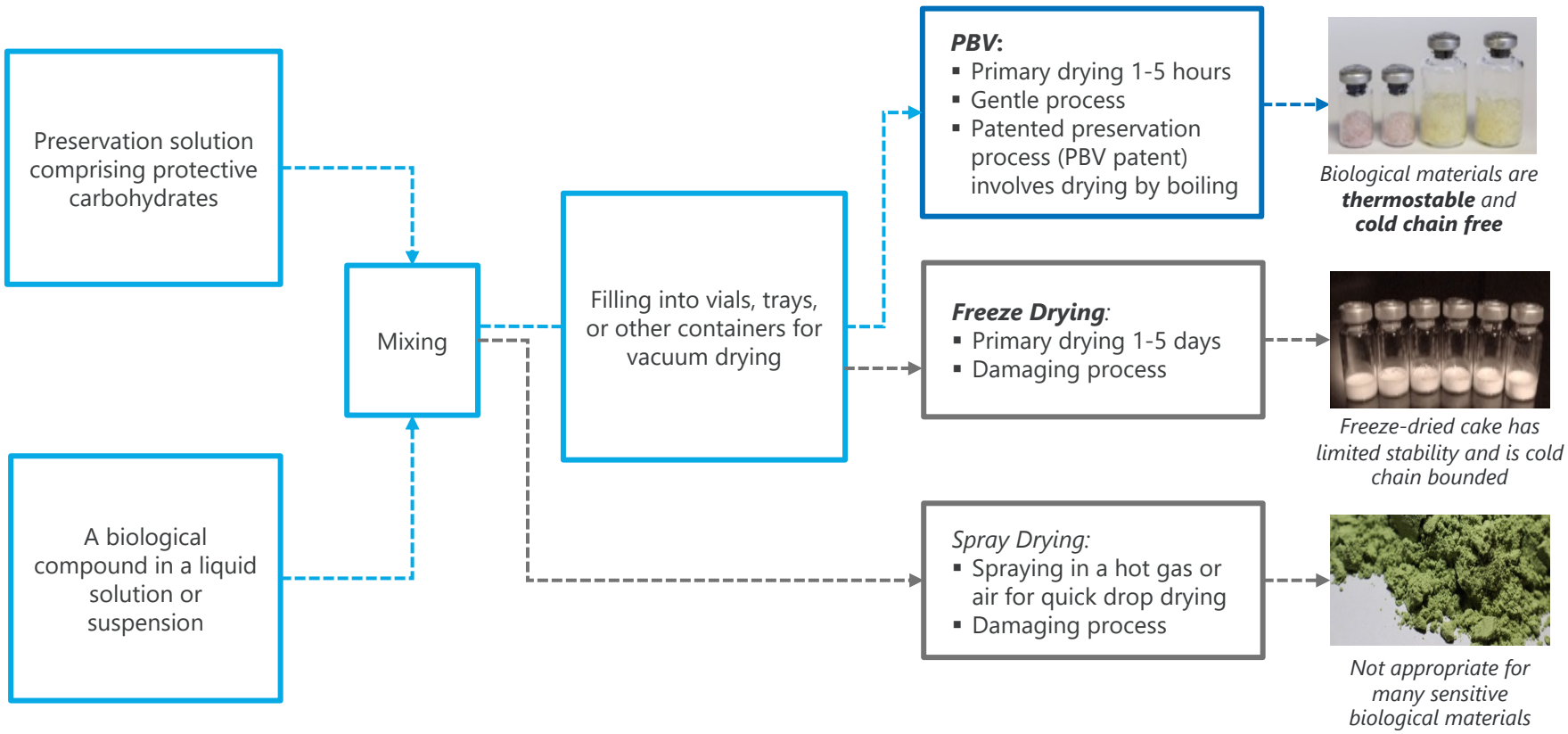


L. acidophilus Preserved in Milled Sugar Glass



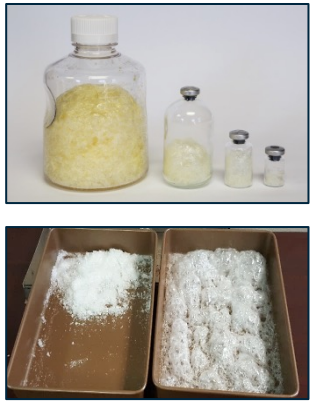
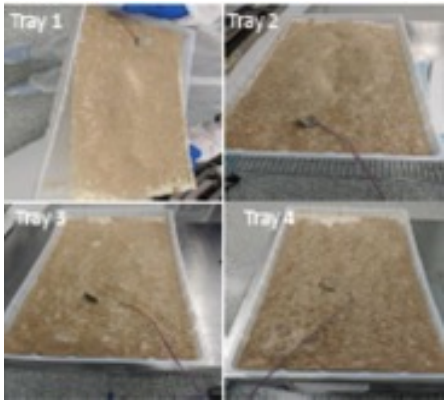
Water decreases glass transition temperature (T_g) and should be removed to achieve glass state at ambient temperatures.

PBV vs. Conventional Freeze-Drying and Spray Drying



VitriLife (PBV) Stabilization is Scalable for Industrial Applications

The images below depict the scale-up of *VitriLife*® stabilized dairy cow rumen microbes from a small lab to mass production at one of the largest lyophilization manufacturing facilities.

Laboratory Scale	R&D Scale	Production Scale	Enhanced Production Scale
			
0.5cm fill height ***Batch size: 0.3kg***	*0.5cm to 1.8cm fill height* ***Batch size: 0.6kg to 3.8kg***	*1.8cm fill height* ***Max batch size: 41.8kg*** *(110 trays x 3.8kg)*	*1.8cm fill height* ***Max batch size: 205.2kg*** *(540 trays x 3.8kg)*

PBV is a Commercially Validated Superior Drying Technology for Industrial Applications at Scale

PBV is a Reproducible and Scalable Process (1)

No Evidence of Significant Variability Across Multiple Trays and within a Single Tray

Bulk and unit dose formats:

- ✓ Vials
- ✓ Trays
- ✓ Bottles
- ✓ Containers
- ✓ Bags
- ✓ Other

Reproducibility Testing
Vials taken from 4 locations on full drying tray:

Glass Transition Temp (Tg)

Group #	Group Average (Tg)
1	48.18 ± 3.17 °C
2	47.08 ± 2.07 °C
3	49.48 ± 3.07 °C
4	48.65 ± 1.99 °C

Water Activity (aw)

Group #	Group Average (a_w)
1	0.1287 ± 0.0060
2	0.1290 ± 0.0012
3	0.1319 ± 0.0017
4	0.1305 ± 0.0032

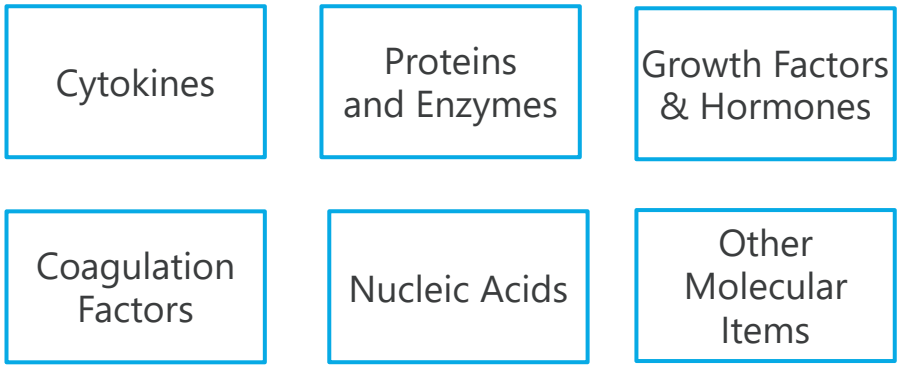
PBV is a Reproducible and Scalable Process (2)

Three vials were evaluated from four corners and from the center of each tray after two independent PBV drying runs. No evidence of significant vial-to-vial variability in Listeria Monocytogenes LAV survival, T_g, A_w, nor foam physical appearance were found.

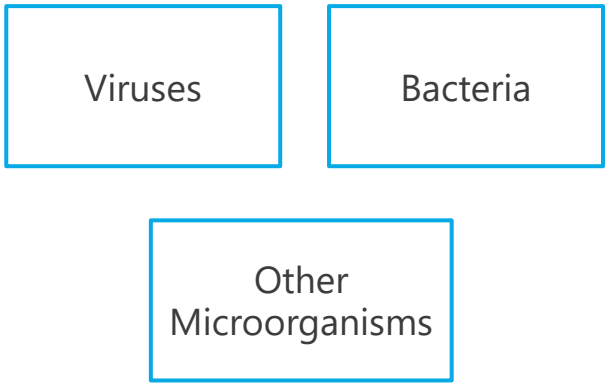
PBV Run #1 Tray #	Location on a tray	Viability after PBV (E9 CFU/mL)	Water activity (A_w) Mean of 3	T_g (ºC) Mean of 3
Before Drying	N/A	1.96± 0.28	N/A	N/A
1	Corner 1	1.94 ± 0.08	0.127	25.1
1	Corner 2	2.09 ± 0.05	0.142	25.3
1	Corner 3	2.25 ± 0.01	0.137	24.8
1	Corner 4	1.92 ± 0.16	0.118	25.5
1	Middle	2.38 ± 0.11	0.112	25.9
2	Corner 1	1.82 ± 0.09	0.135	24.5
2	Corner 2	1.70 ± 0.09	0.136	25.6
2	Corner 3	1.90 ± 0.30	0.122	25.9
2	Corner 4	1.69 ± 0.09	0.139	25.4
2	Middle	2.03 ± 0.06	0.126	26.1

PBV Run #2 Tray #	Location on a tray	Viability after PBV (E9 CFU/mL)	Water activity (Aw) Mean of 3	T_g (ºC) Mean of 3
Before Drying	N/A	2.75± 0.01	N/A	N/A
1	Corner 1	1.77 ± 0.14	0.127	24.4
1	Corner 2	1.94 ± 0.24	0.127	24.8
1	Corner 3	1.70 ± 0.08	0.127	25.2
1	Corner 4	1.74 ± 0.05	0.129	25.8
1	Middle	1.65 ± 0.08	0.124	24.0
2	Corner 1	1.65 ± 0.05	0.118	25.2
2	Corner 2	1.42 ± 0.11	0.117	25.2
2	Corner 3	1.54 ± 0.28	0.127	24.9
2	Corner 4	1.42 ± 0.12	0.129	24.2
2	Middle	2.52 ± 0.14	0.123	23.2

PBV Preserves Viability of Microorganisms and Activity of Biomolecules at High and Low Ambient Temperatures (AT)



- Expected stability from -30°C to + 40°C or higher temperatures for years
- Insignificant loss of activity or function after drying and subsequent storage



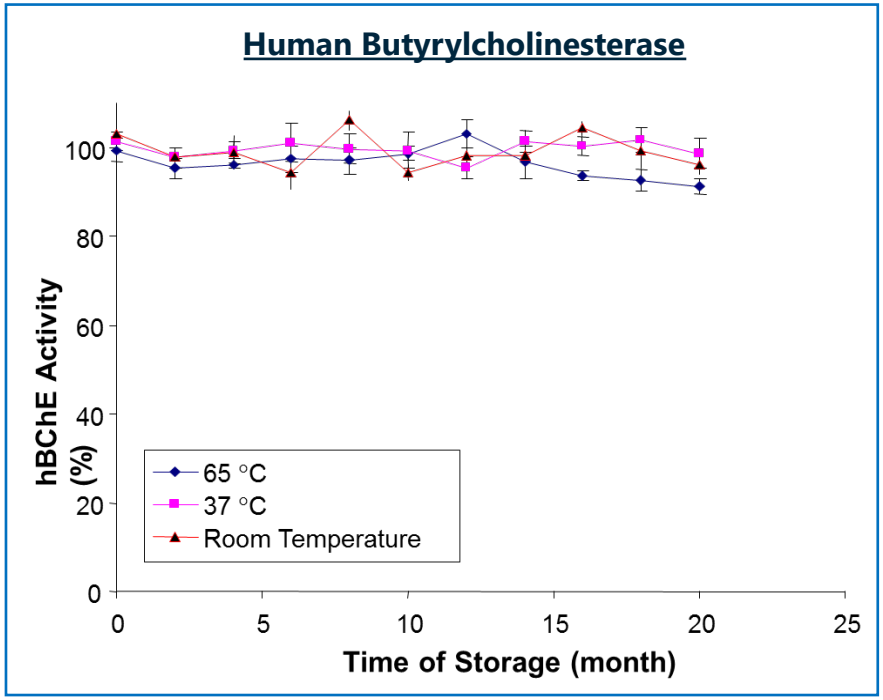
- Stable from -30°C to +25°C for years
- Stable from +25°C to +37°C (or higher) for many months
- <0.5 logs reduced activity after drying and subsequent storage
- <0.5 logs reduced activity after micronization
- Stable as dry powder in low humidity environment and/or anhydrous delivery vehicles (polymeric films, oils, etc.)

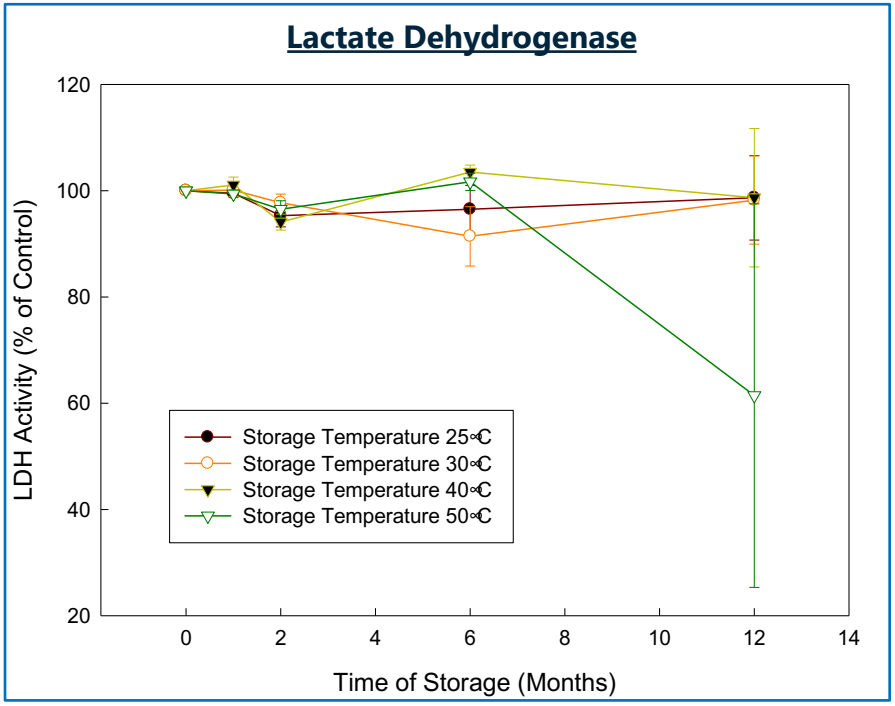
Stability of VitriLife® Proteins / Molecular Items

No Activity Loss after Drying and Subsequent Storage

Class	Material	Temperature	Storage Time	Activity Loss
Coagulation Factor	Factor VIII	40°C	90 days	No loss
Coagulation Factor	Factor VII	37°C	40 days	No loss
Coagulation Factor	Factor XIII	37°C	40 days	No loss
Industrial Enzyme	Ice Nucleating Protein	50°C	99 days	No loss
		37°C	140 days	No loss
Enzyme	Thrombine (blood)	37°C	40 days	No loss
Enzyme (serine proteases)	Urokinase Human Protein	40°C	30 days	No loss
Enzyme	Luciferase	37°C	180 days	No loss
Enzyme	β-galactosidase	37°C	176 days	No loss
Enzyme	Lactate Dehydrogenase	40°C	360 days	No loss
		50°C	180 days	No loss
Enzyme	Isocitrate Dehydrogenase	50°C	70 days	No loss
Antibiotic	Amphotericin	40°C	30 days	No loss

Superior Stability of *VitriLife*® Enzymes at High Ambient Temperatures (AT)

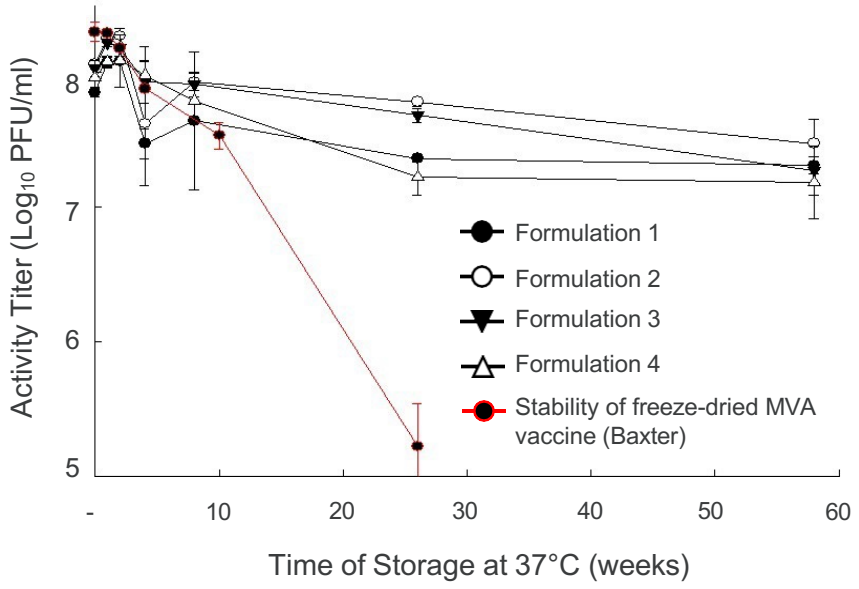




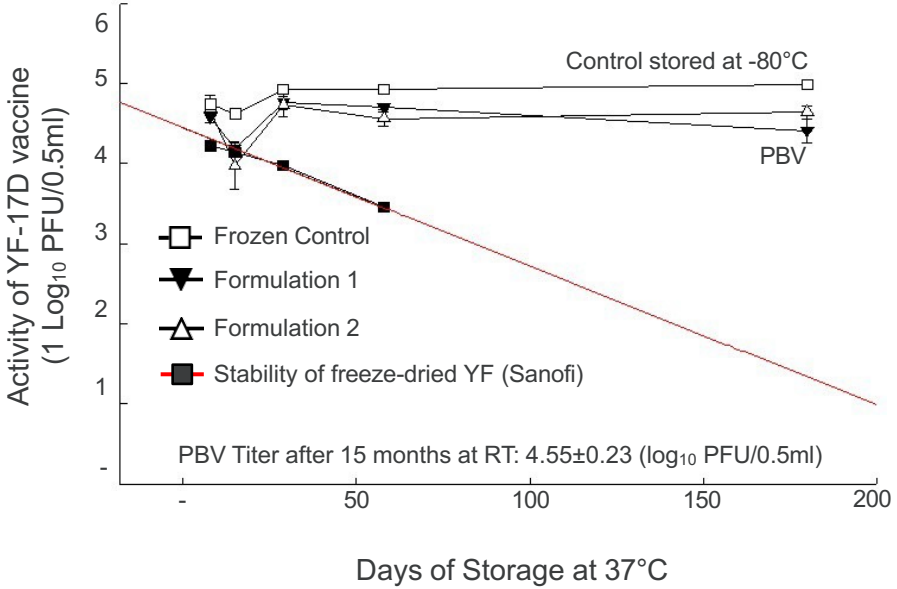
Head-to-Head Stability Comparison of PBV vs. FD LAVs

Commercial FD Vaccines Reconstituted with UST's Preservation Solutions and Stabilized Using PBV

MVA (Smallpox) Vaccine from Baxter



Yellow Fever Vaccine from Sanofi

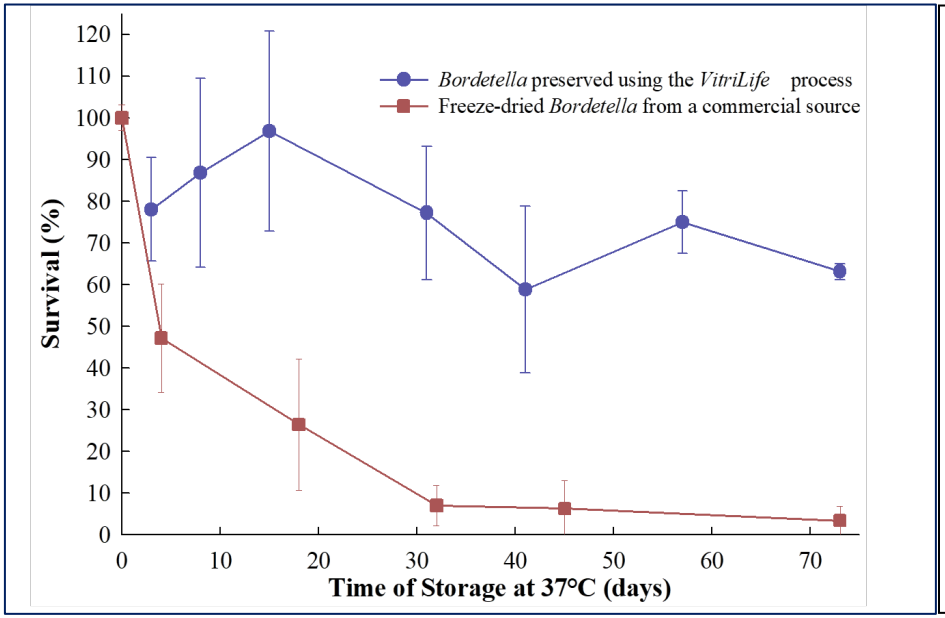


*Additional stability comparison data available for Measles and Bordetella

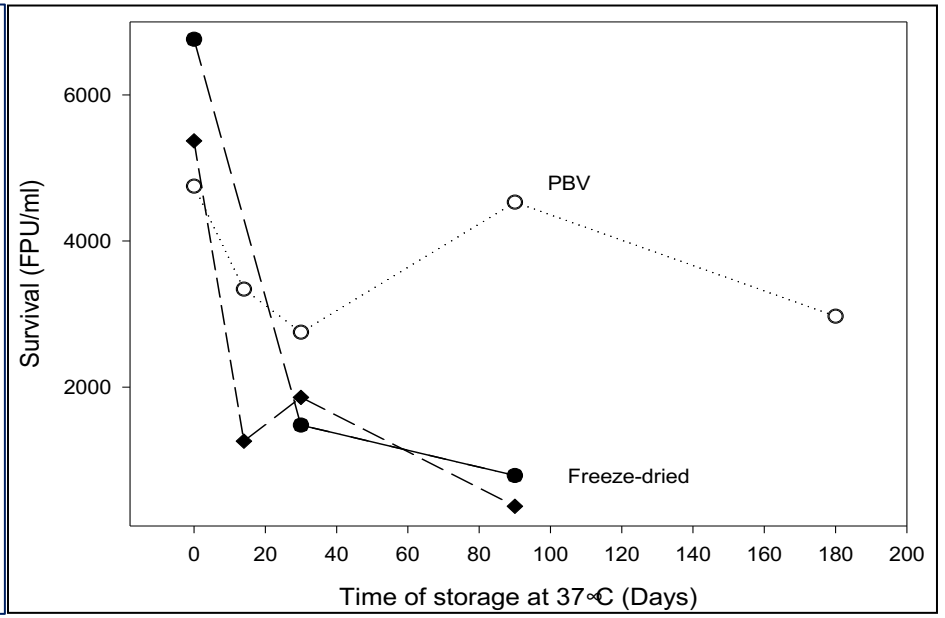
At 37°C, Freeze-Dried LAVs' Activity is Reduced >1,000x when Stored for Six Months, While PBV LAVs Remain Stable

Head-to-Head Stability Comparison of PBV vs. FD LAVs

Bordetella Vaccine



Measles Vaccine from Berna Biotech



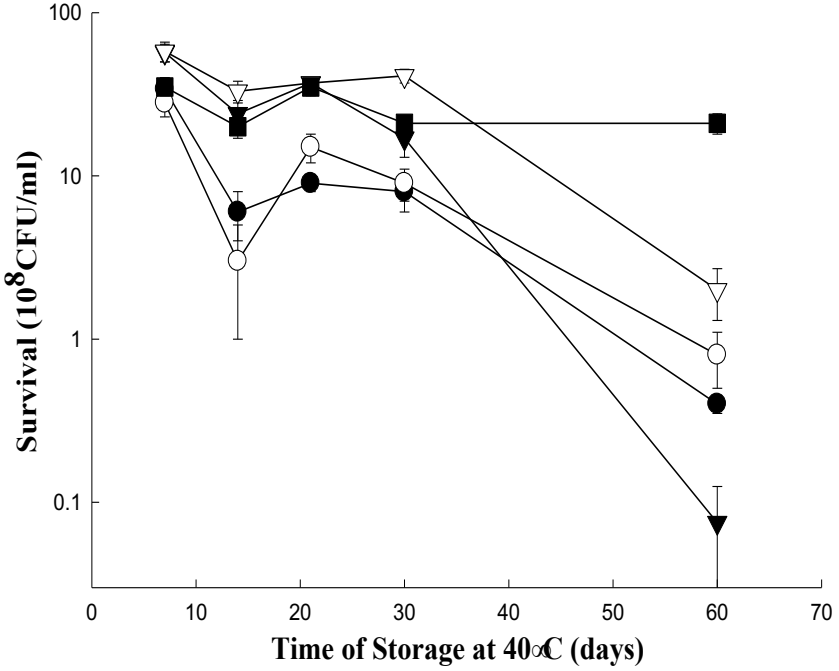
Stability of *VitriLife*® Live Attenuated Vaccines (LAVs)

Freeze-Drying Loses >1 Log and Requires Refrigerated Storage; *VitriLife*® Loses <0.5 Logs and is Cold-Chain Free

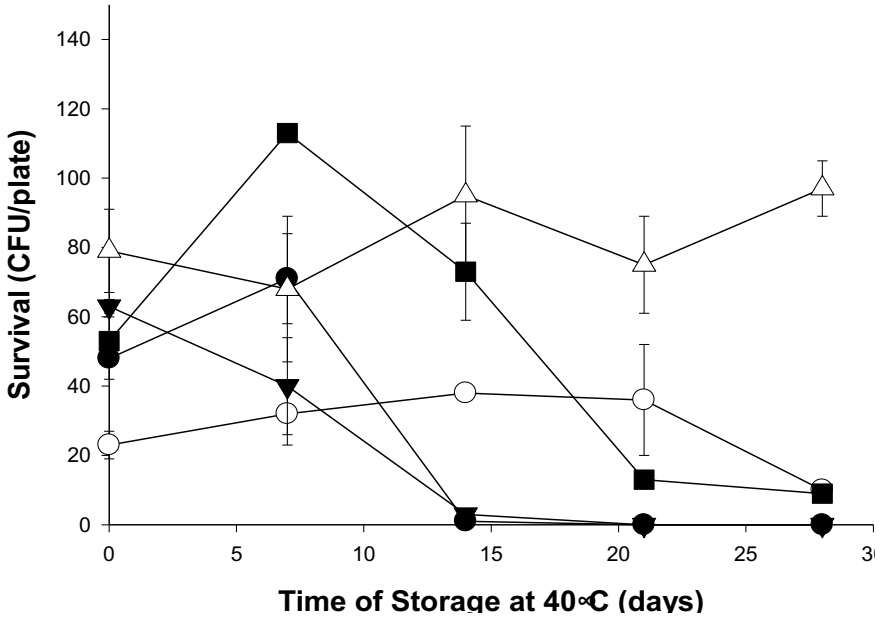
Activity / Viability of VitriLife® Vaccines after Drying and Subsequent Storage				
Live Attenuated Vaccines	**37°C**		**25°C**	
	Storage Time	Activity Loss	Storage Time	Activity Loss
Rubella	6 months	0.5 log	1 year	0.5 log
Influenza	3 months	0.1 log	1 year	0 log
Rotavirus	2 years	0.5 log	2 years	0 log
Polio Sabin strain	1.5 months	0.4 log	1.5 months	0 log
Modified Vaccinia Ankara (MVA)	1 year	0.6 log	3 years	0.3 log
Yellow Fever	8 months	0.2 log	1 year	0 log
Rabies	2 months	0.6 log	2 years	0.4 log
Measles (from SII)	4 months	0.3 log	1 year	0.7 log
Measles (from CDC)	2 years	0.7 log		
Listeria Monocytogenes	12 months	0.2 log		
Vegetative Anthrax	10 months	0.1 log		

Stability of PBV-preserved probiotic bacteria at 40°C depends on composition of preservation solutions (PS)

Stability of L. *reuteri after PBV with different PS*



Stability of L. *rhamnosus after PBV with different PS*



Stability of *VitriLife*® Gram-Positive Probiotic Bacteria

We found that the membranes of many Lactobacilli and other gram-positive bacteria tend to be desiccation tolerant, and success of their preservation depends on the successful loading of the intracellular space with carbohydrates to protect intracellular proteins, enzymes, nucleic acids and other biologically active molecules during drying.

UST has the expertise and know-how to formulate and optimize preservation solutions and cell loading protocols.

	L. crispatus	L. rhamnosus	L. jensenii	L. monocytogenes
Viability	($x10^9$ CFU/mL)			
Before drying	9.5 ± 2.8	13.9 ± 1.7	11.8 ± 1.2	32.6 ± 1
After Drying	7.0 ± 1.2	9.3 ± 1.5	11.0 ± 1.5	17.7 ± 0.7
3 months at 37°C	5.2 ± 0.9	7.8 ± 0.6	11.6 ± 2.0	
6 months at 37°C	5.2 ± 1.2	4.9 ± 0.7	3.1 ± 0.7	
1 year at 37°C	3.3 ± 0.5	7.6 ± 0.7	4.2 ± 0.3	11.7 ± 1.6
1 year at 25°C	5.5 ± 1.9	11.3 ± 1.0	8.6 ± 1.5	
2 years at 25°C	6.0 ± 0.7	8.9 ± 0.3	7.4 ± 0.9	
3 years at 25°C		5.1 ± 0.8	7.9 ± 1.0	

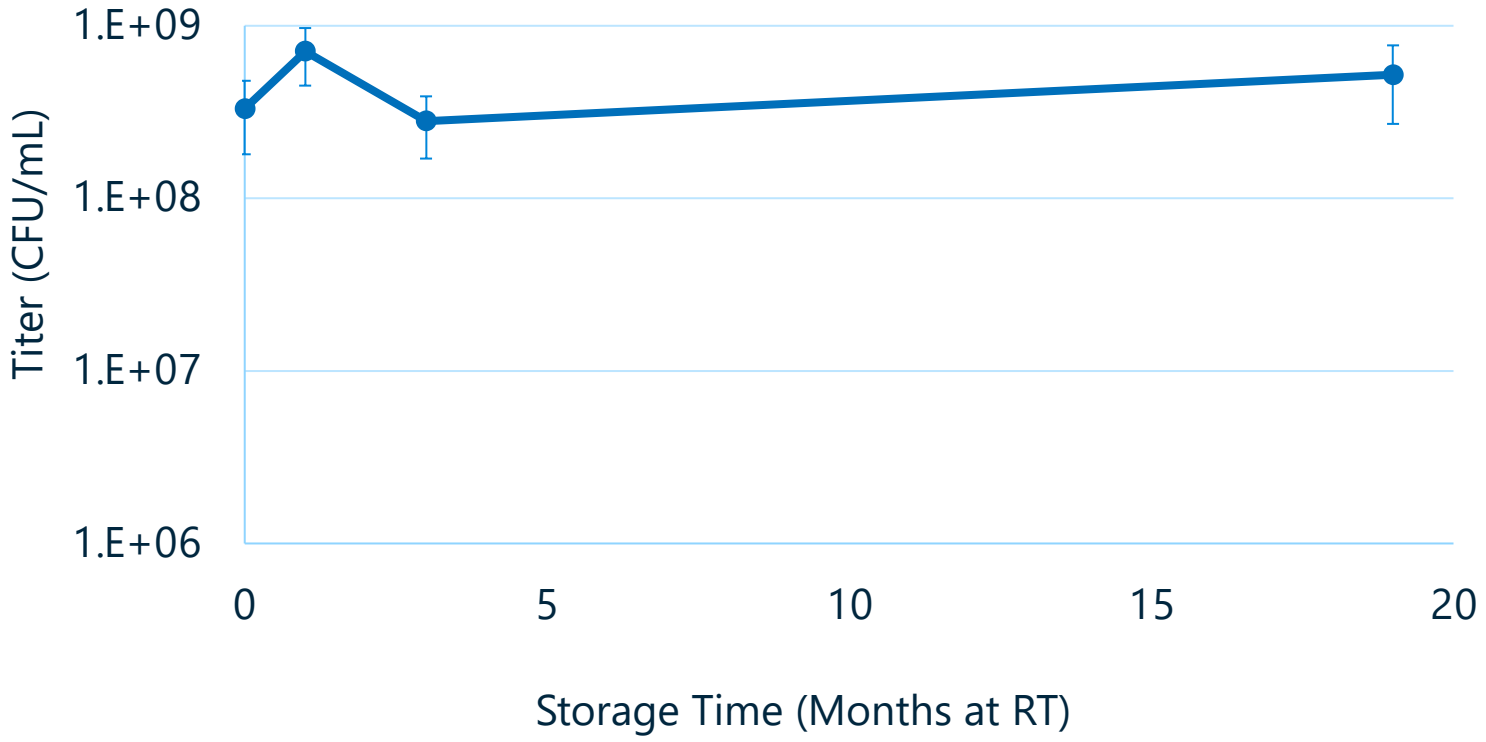
Stability of *VitriLife*® Gram-Negative Probiotic Bacteria

It is difficult to stabilize gram-negative bacteria and other microorganisms with more fragile membranes. In addition to loading these cells with protective carbohydrates, fortification of the extracellular membranes may be required to achieve thermostable products.

In many cases, the fortification can be achieved using polymeric protectants that reversibly cross-link and/or preferentially absorb to the membrane surface. We identified several polymers that can be used to fortify these membranes and help produce thermostable gram-negative bacteria.

Viability	E. coli M17 (x106 CFU/mL)	K. variicola (x108 CFU/mL)
Before Drying	465 ± 39	140 ± 50
After Drying	460 ± 90	99 ± 8
1-month at RT	303 ± 65	
1-month at 37°C	204 ± 50	61 ± 9
3 months at RT	287 ± 32	
3 months at 37°C	162 ± 30	49 ± 5

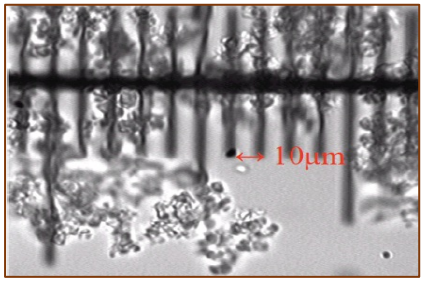
Long-term Stability of Probiotic E. coli M17 at Room Temperature (RT)

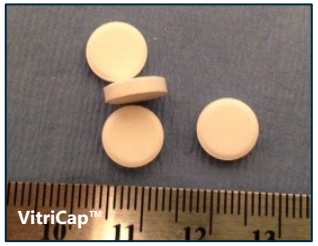


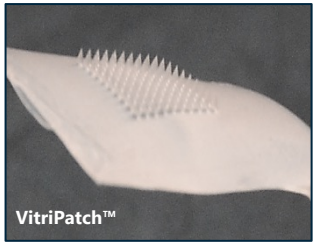
VitriLife® Delivery Overview

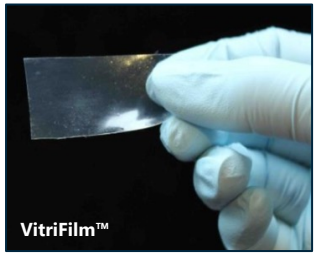
Needle-Free Delivery without Reconstitution

Foam → **Powder** → **Delivery**









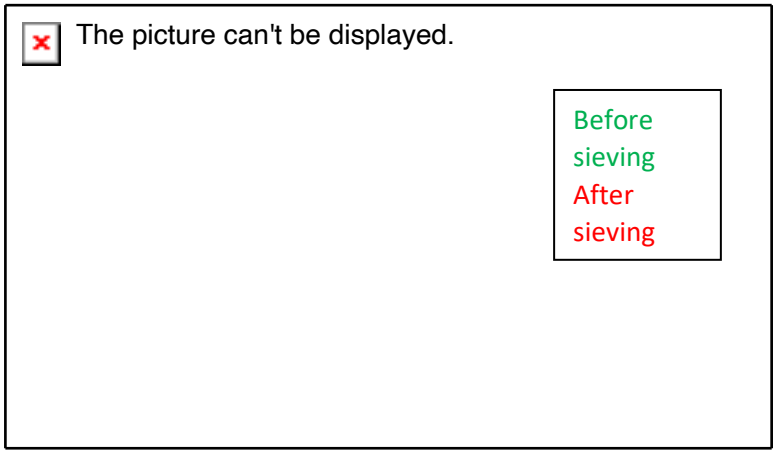
Routes:

- Oral (intestinal, sublingual, buccal)
- Respiratory/intranasal
- Transdermal
- Vaginal
- Rectal

Devices:

- DPIs
- Capsules/tablets
- Oil suspensions
- Dissolvable films
- Microneedle patches
- Ointment/creams
- Suppositories

Stability of Micronized *VitriLife*® H3N2 LAIV



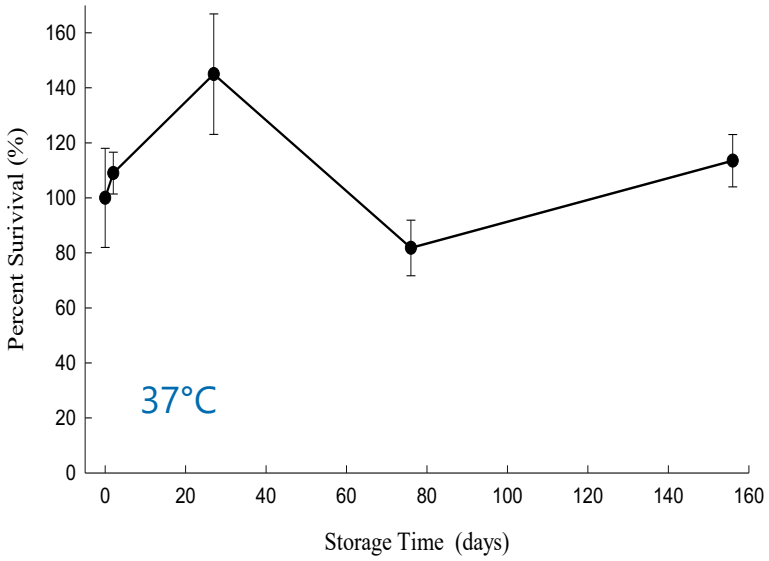
Vaccine was micronized and sieved between 21-63 microns for optimal respiratory delivery. There was minimal activity loss after micronization and good subsequent stability at ATs.

Initial Yield and Stability of LAIV in final Micronized Powder Format

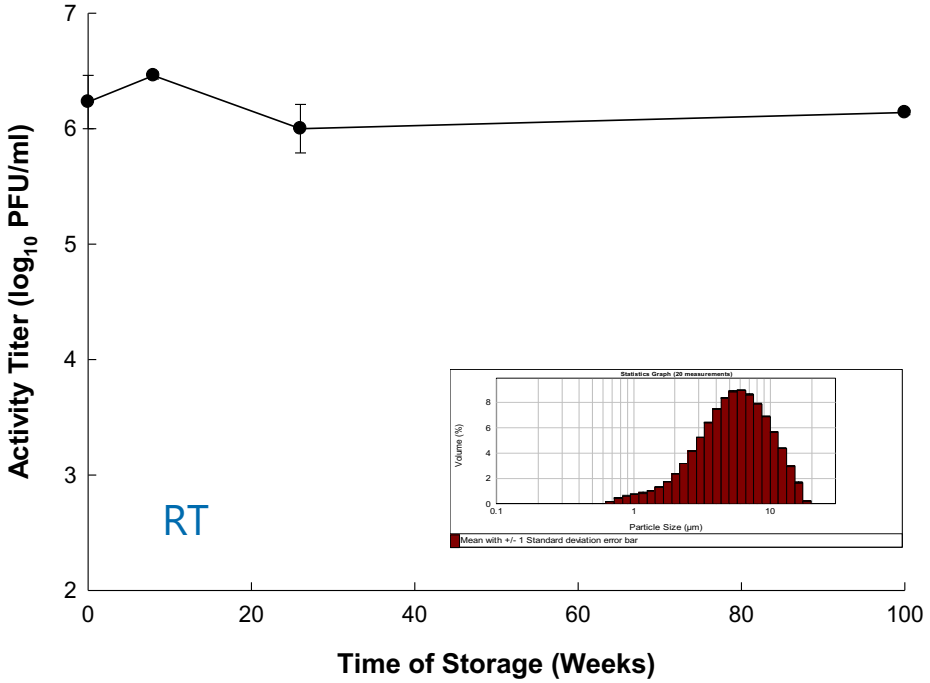
Timepoint	Formulation	Overall Log loss	Average ($TCID_{50}$/mL)	Average ($TCID_{50}$/mg)	Deviation ($TCID_{50}$/mg)
Initial Yield	Frozen control	N/A	1.34E+07	1.12E+05	5.02E+04
	Flu-7 Powder	-0.46	4.69E+06	3.90E+04	8.25E+03
1 Month Stability	Frozen control	N/A	1.05E+07	8.77E+04	3.79E+04
	RT powder	-0.46	3.62E+06	3.02E+04	2.19E+03
	37°C powder	-0.44	3.83E+06	3.19E+04	1.56E+04
3 Month Stability	Frozen control	N/A	1.21E+07	2.53E+04	0.83E+04
	RT powder	-0.55	3.44E+06	7.16E+03	3.31E+03
	37°C powder	-0.83	1.77E+06	3.70E+03	0.42E+03
6 Month Stability	Frozen control	N/A	4.40E+07	9.16E+04	2.22E+04
	RT powder	-0.56	1.21E+07	2.53E+04	0.41E+04
	37°C powder	-1.02	4.18E+06	8.72E+03	4.48E+03
12 Month Stability	Frozen control	N/A	2.51E+07	5.23E+04	0.00E+04
	RT powder	-0.81	3.87E+06	8.06E+03	0.81E+03
	37°C powder	-0.95	2.80E+06	5.83E+03	0.10E+03

Stability of Micronized *VitriLife*® Powders in Oils

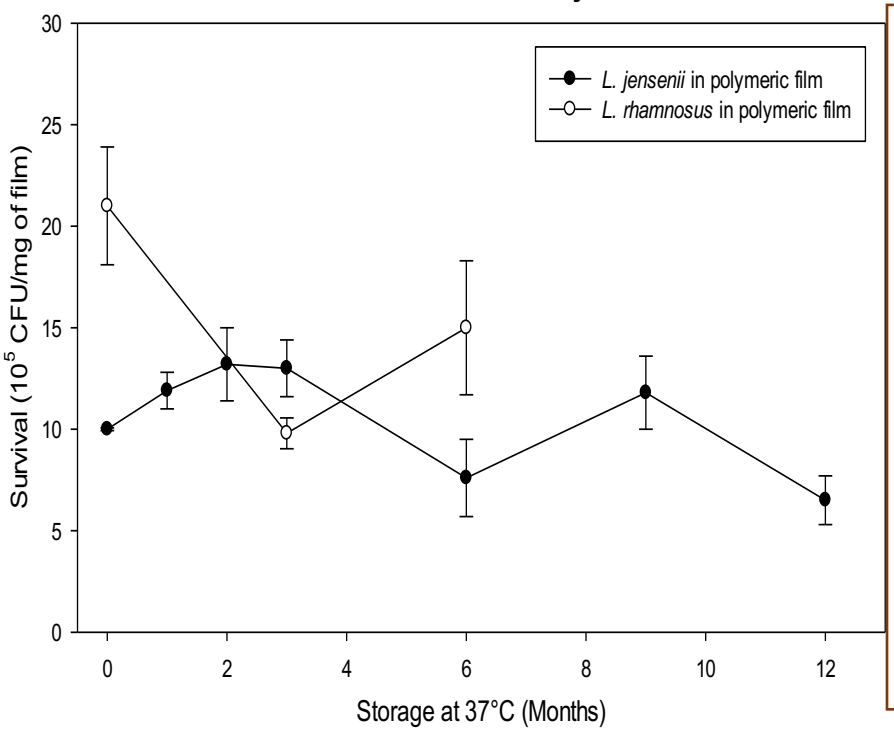
L. Acidophilus in Cottonseed Oil

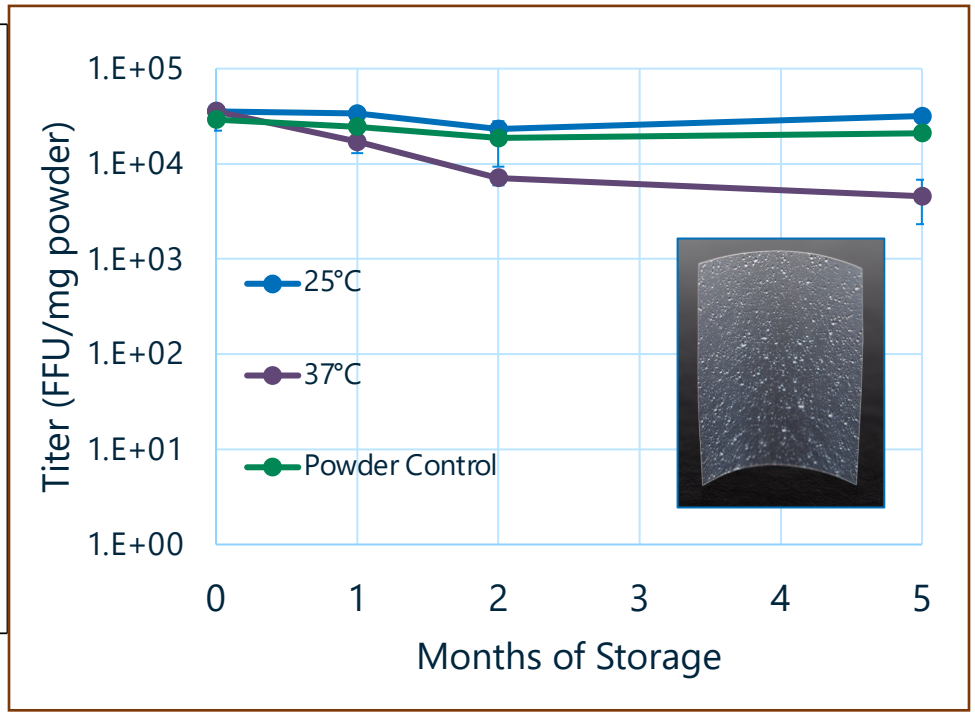


MVA Vaccine in Mineral Oil



Stability of *VitriLife*® Powders in HPC Dissolvable Films





VitriLife® Inactivation Overview

VitriLife® Inactivation (or Sterilization)

Advantages of VitriLife®

- ✓ Allows for controllable, targeted damage to replication components
- ✓ Retains membrane structural integrity
- ✓ Live viral vaccines retain high antigenicity after inactivation

Drawbacks of Conventional Inactivation Approaches

Thermal Inactivation:

- × Pervasive damage to cellular components
- × Reduced epithelial adhesion

Chemical Inactivation:

- × Non-specific cross linking leading to the epitope damage
- × Longer treatment times and higher cost
- × Additional processing required to remove residual chemicals

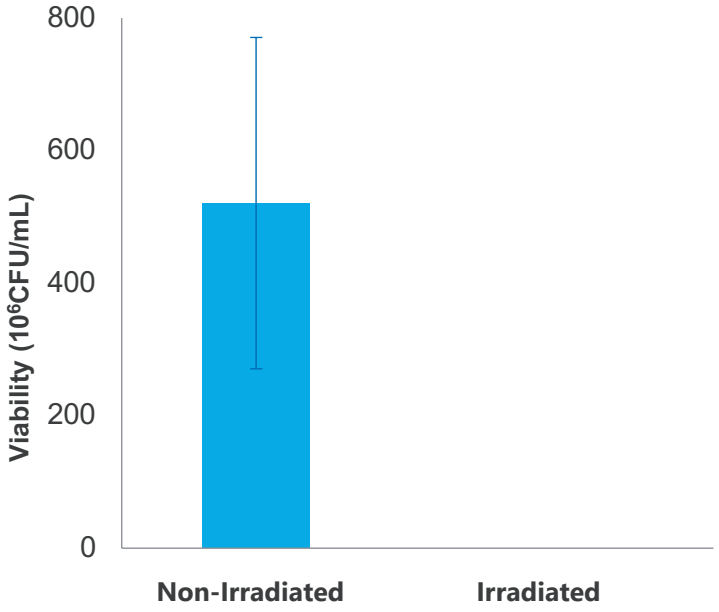
Inactivation by Irradiation in Liquid State:

- × Damage of epitopes by free radicals

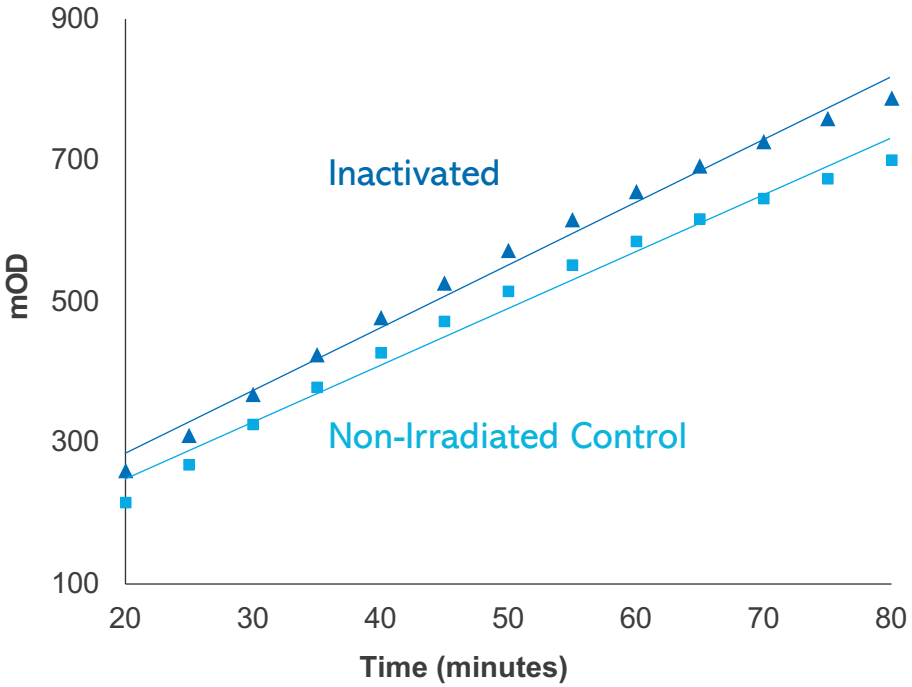
Production steps of thermostable of UV or electron beam (EB) inactivated vaccines:

Electron Beam (EB) Inactivated *VitriLife*® Bacteria Remained Metabolically Active

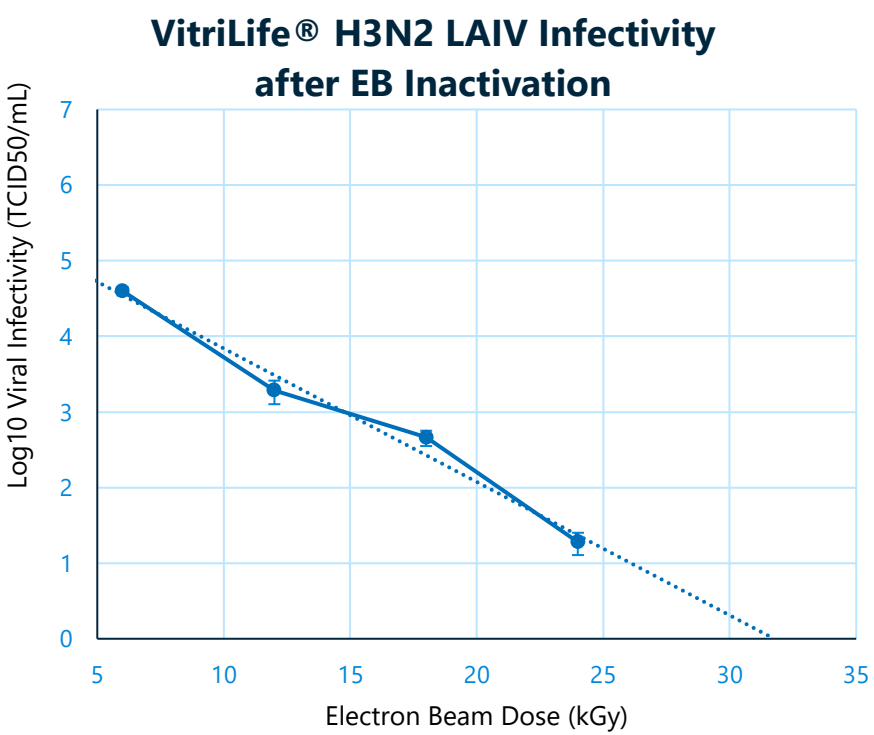
12 kGy Dose of EB Irradiation Completely Kills PBV Stabilized E.coli M17



Reducing Metabolic Activity of Both Irradiated and Non-Irradiated *VitriLife*® E.coli M17 Remained Equal to 100%



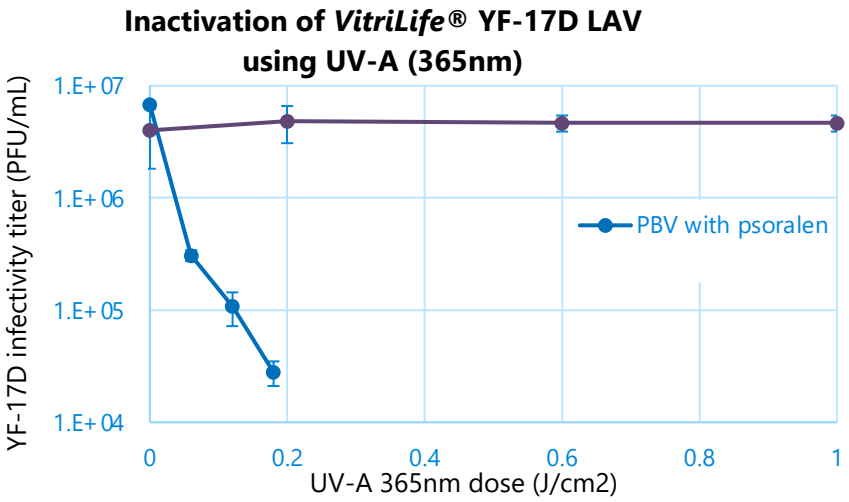
EB Inactivation of *VitriLife*® Viruses is a Gentle Process That Does Not Damage Viral Epitopes

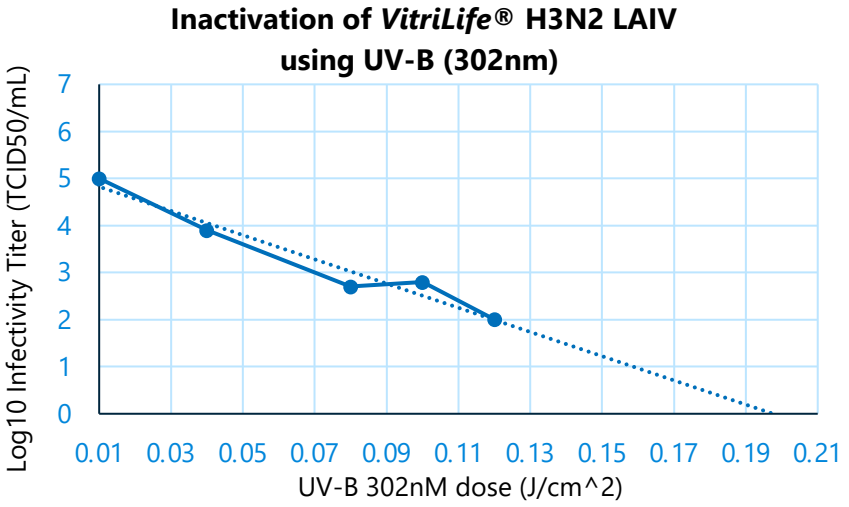


Effect of EB Dose on Infectivity and Antigenicity (HI) of *VitriLife*® H3N2 LAIV

EB dose	Log Titer Loss	Titer ($TCID_{50}$/mL)	HI Titer
Control	N/A	6.31E7	320
(0kGy)	0.35	2.80 ± 0.36 E7	320
6kGy	3.20	3.97 ± 1.37 E4	320
12kGy	4.51	1.93 ± 0.44 E3	320
18kGy	5.14	4.59 ± 1.5 E2	320
24kGy	>7	BLD*	320
48kGy	NA	BLD*	285

UV Inactivation of *VitriLife*® Viruses is a Gentle Process That Does Not Damage Viral Epitopes





H3N2 vaccine antigenicity remains undamaged after UV-B inactivation

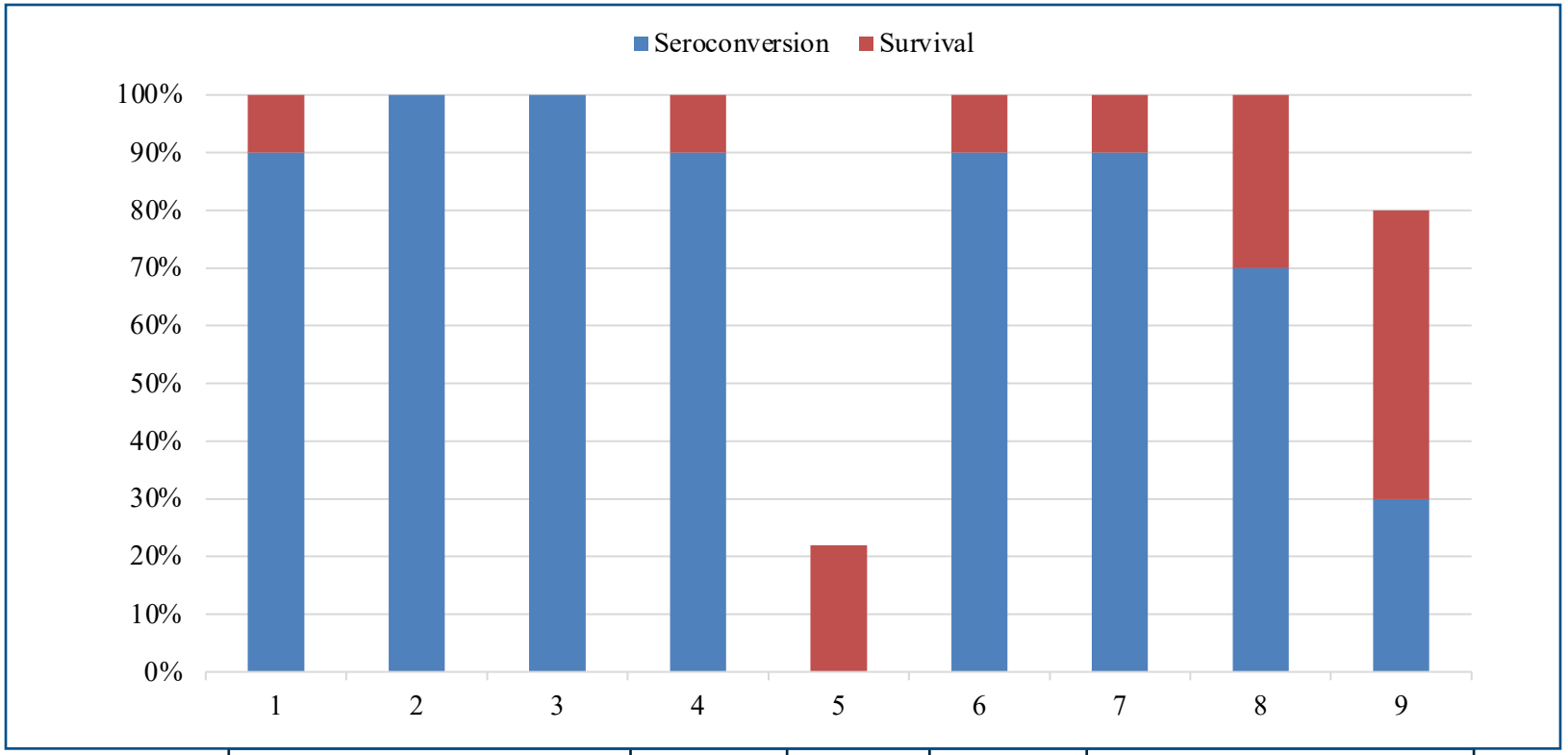
H3N2 samples	HI titer #1	HI titer #2	HI titer #3	HI titer (geometric mean)
Frozen control	320	320	640	403.17
PBV foam control	320	320	320	320.00
UV 0.04 J/cm^2	320	320	320	320.00
UV 0.08 J/cm^2	320	320	320	320.00
UV 0.10 J/cm^2	320	320	320	320.00
UV 0.12 J/cm^2	320	320	320	320.00
UV 0.16 J/cm^2	320	320	320	320.00
UV 0.9 J/cm^2	320	320	320	320.00
UV 1.8 J/cm^2	320	320	320	320.00

Evaluation of Immunogenicity and Potency of VitriLife® Vaccines Using Animal Models

Animal study results were disclosed in the following publications:

- Smith TG, et al. Rabies vaccine preserved by vaporization is thermostable and immunogenic. Vaccine. 2015 May;33(19):2203-2206.
- Smith TG, et al. Assessment of the immunogenicity of rabies vaccine preserved by vaporization and delivered to the duodenal mucosa of gray foxes (Urocyon cinereoargenteus). American Journal of Veterinary Research. 2017;78(6):752-756.
- Hensley C, et al. Thermostable, Dissolvable Buccal Film Rotavirus Vaccine Is Highly Effective in Neonatal Gnotobiotic Pig Challenge Model. Vaccines. 2021;9(5):437.
- Luczo JM, et al. Intranasal powder live attenuated influenza vaccine is thermostable, immunogenic, and protective against homologous challenge in ferrets. NPJ Vaccines. 2021;6(1).
- Kurup D, et al. Inactivated Rabies Virus-Based Ebola Vaccine Preserved by Vaporization is Heat-Stable and Immunogenic Against Ebola and Protects Against Rabies Challenge. The Journal of Infectious Diseases. 2019;220(9):1521-1528.

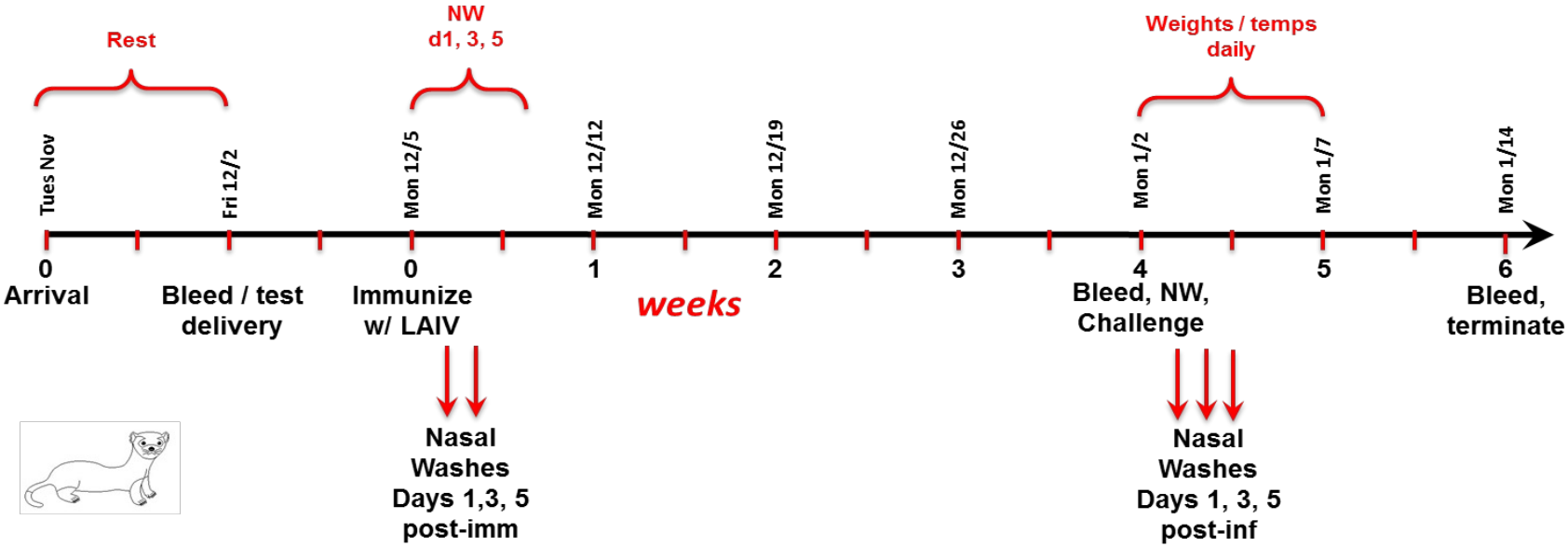
EB Inactivated *VitriLife*® ERA 333 Effectively Protects Mice after IM challenge with Street Rabies Virus



	PBV ERAg333			ERAg333	Placebo	Commercial	Inactivated PBV ERAg333		
Dilution	10^{-1}	10^{-2}	10^{-3}	10^{-2}	None	None	None	10^{-1}	10^{-2}
Dose (log_{10}ffu)	**6.8**	**5.7**	**4.4**	**7.9**	**300**	**620**	**350**	**34**	**2.3**

*Commercial = RabAvert, Novartis

Immunogenicity and Efficacy of Respiratory *VitriLife*® H3N2 LAIV in a Ferret Model



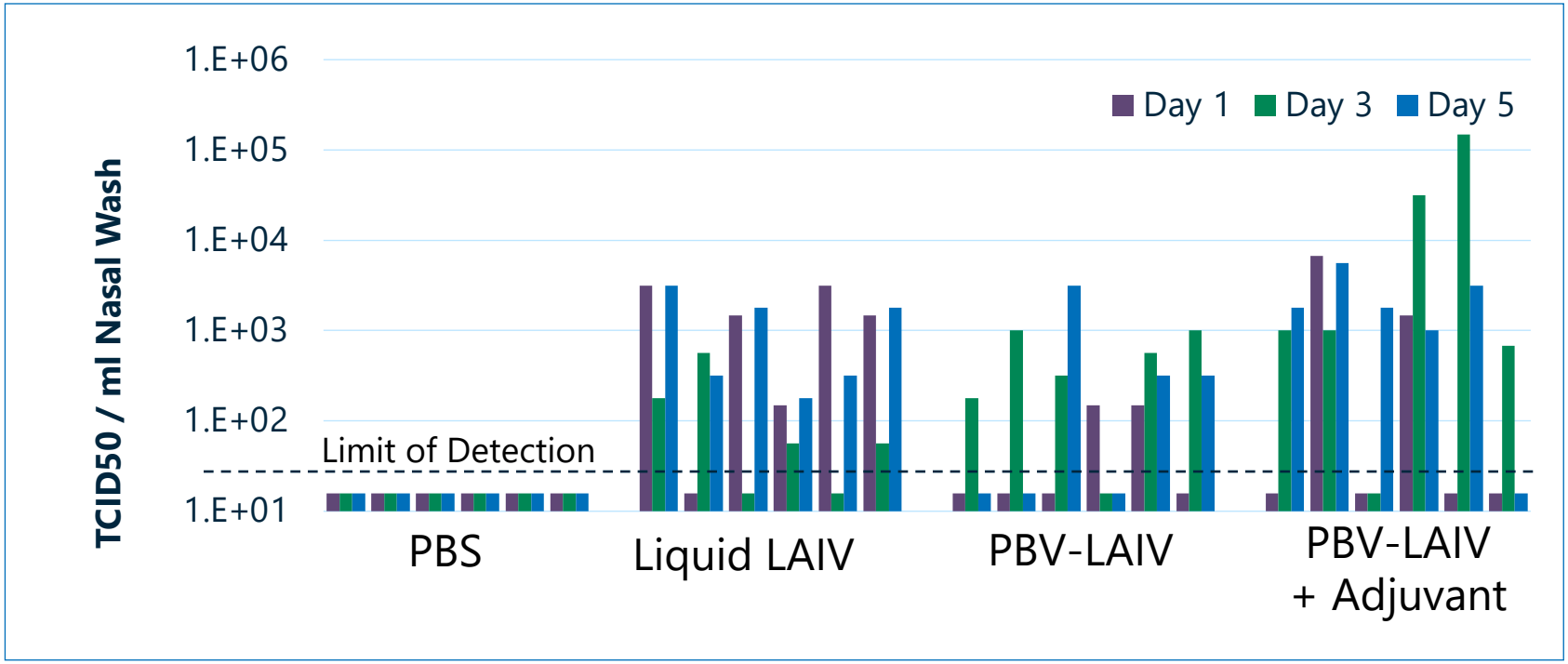
Immunization groups

Vehicle/PBS	n = 6
LAIV (-80C liquid stock, 10^7 EID_{50})	n = 6
Stabilize LAIV powder (10^7 EID_{50})	n = 6
Stabilize LAIV powder + Adj (10^7 EID_{50})	n = 6

Influenza strains

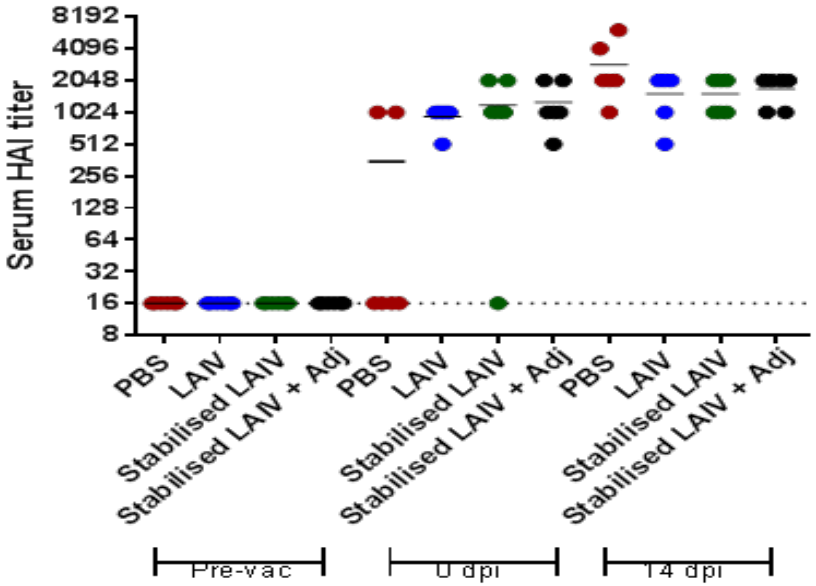
Vaccine strain: A/17/Texas/2012/30 (H3N2) LAIV (BioDiem)
Stabilization by Universal Stabilization Technologies (UST)
Challenge strain: wildtype A/Texas/50/2012 or similar

Post-Immunization Nasal Wash H3N2 LAIV Titers

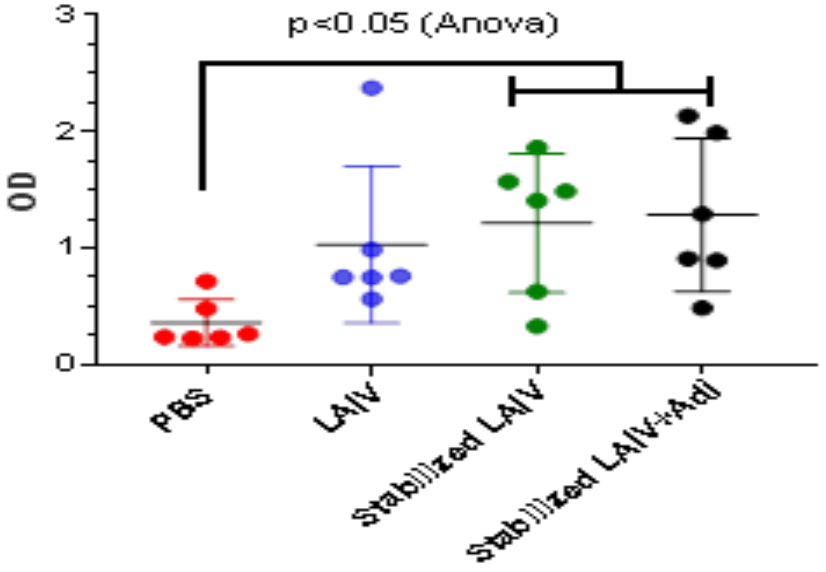


Post-Immunization Nasal Wash Antibodies

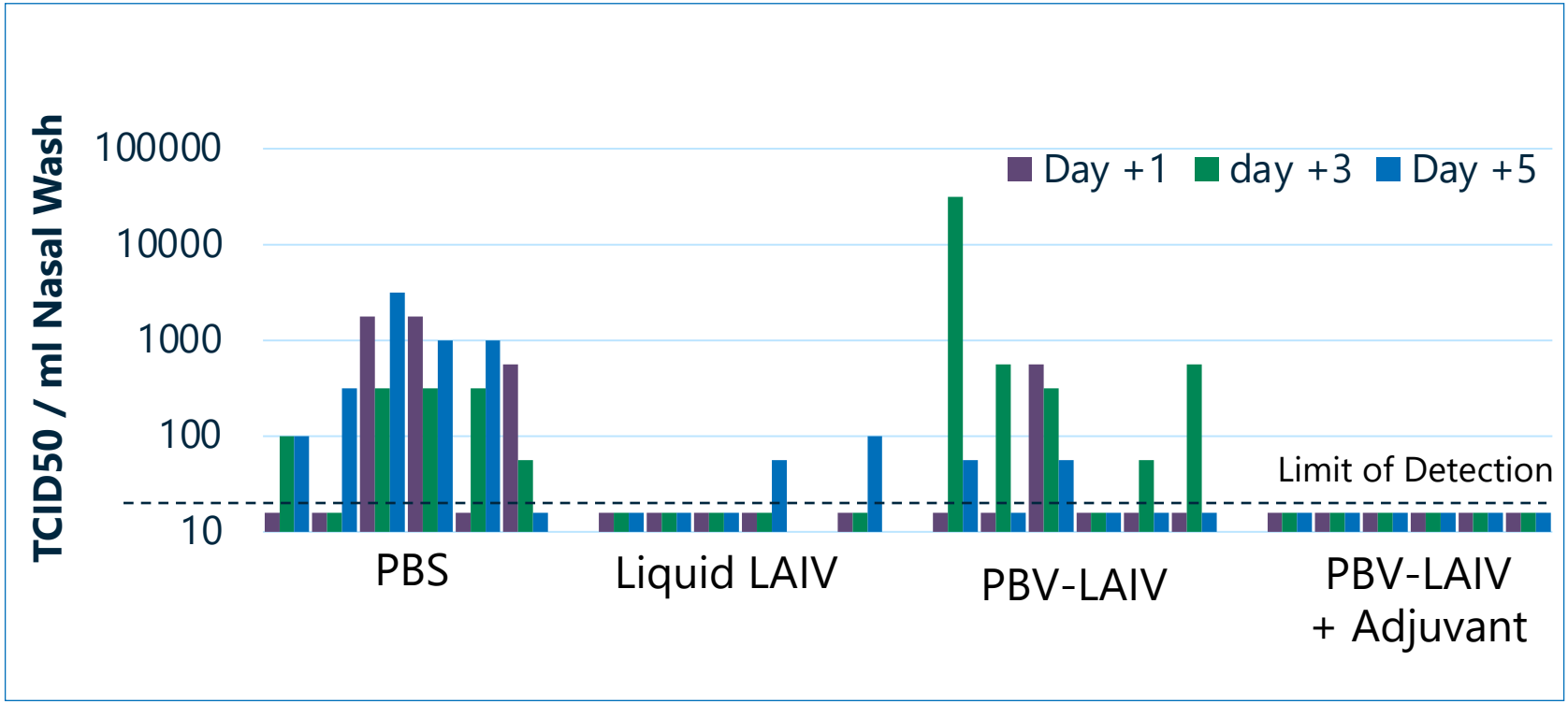
Nasal Wash ELISA Titers



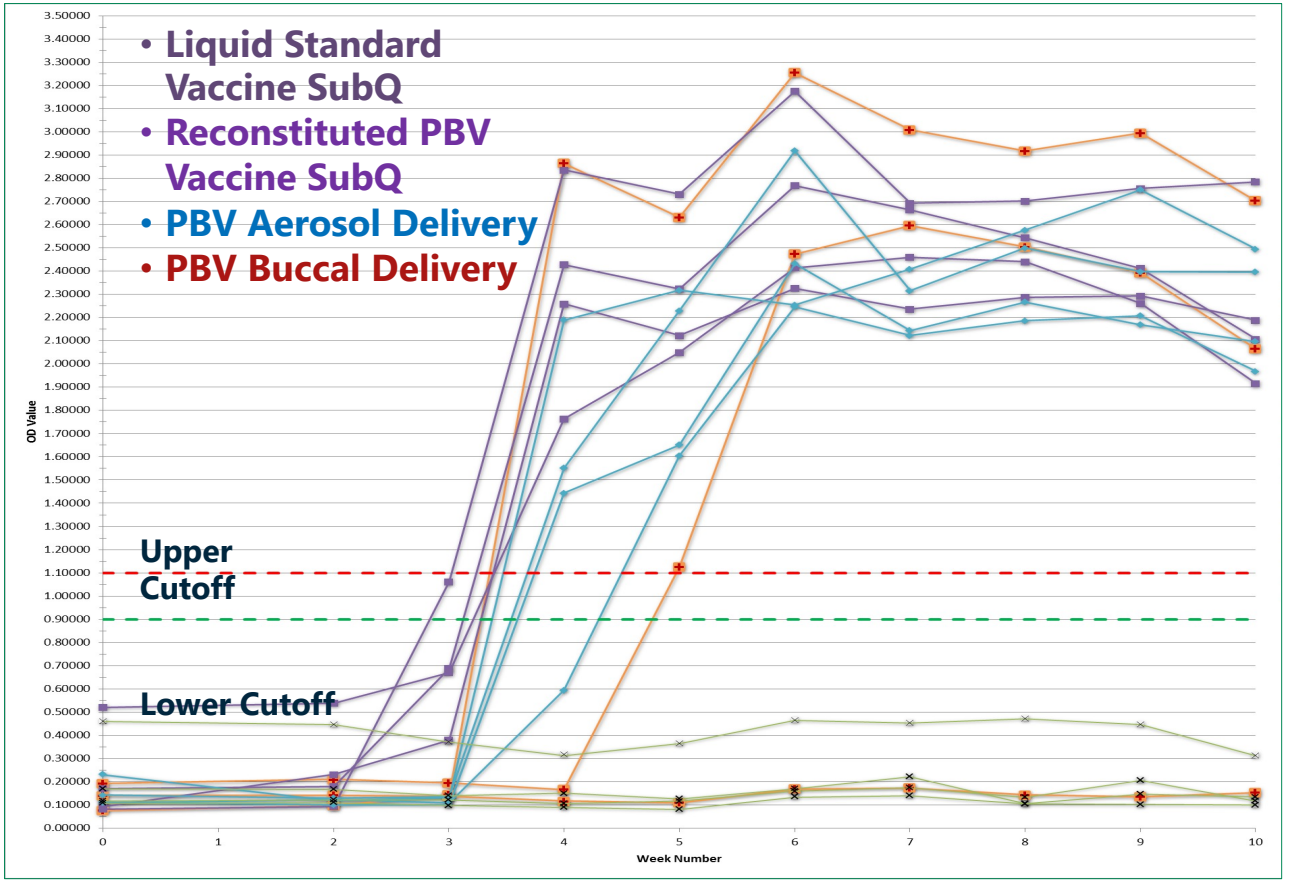
Ferret Ig Response in Nasal Washes Day 1 Post-Challenge (1:4 dilution)



Post-A/TX/50/12 Challenge Nasal Wash Viral Titers

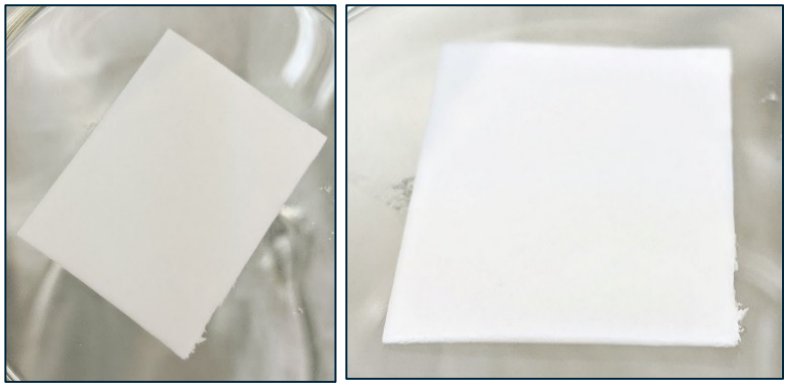


VitriLife® Measles and Rubella Vaccines Delivered Intranasally in Dry Powder Format were Immunogenic in Non-human Primates



- Intranasal delivery of unadjuvanted aerosolized PBV stabilized dry powders provided high IgG antibody titers after a single dose for rubella vaccine and after a prime + boost regimen for measles vaccine.
- Subcutaneously injected reconstituted PBV measles and rubella vaccines performed as well as the standard liquid vaccines.

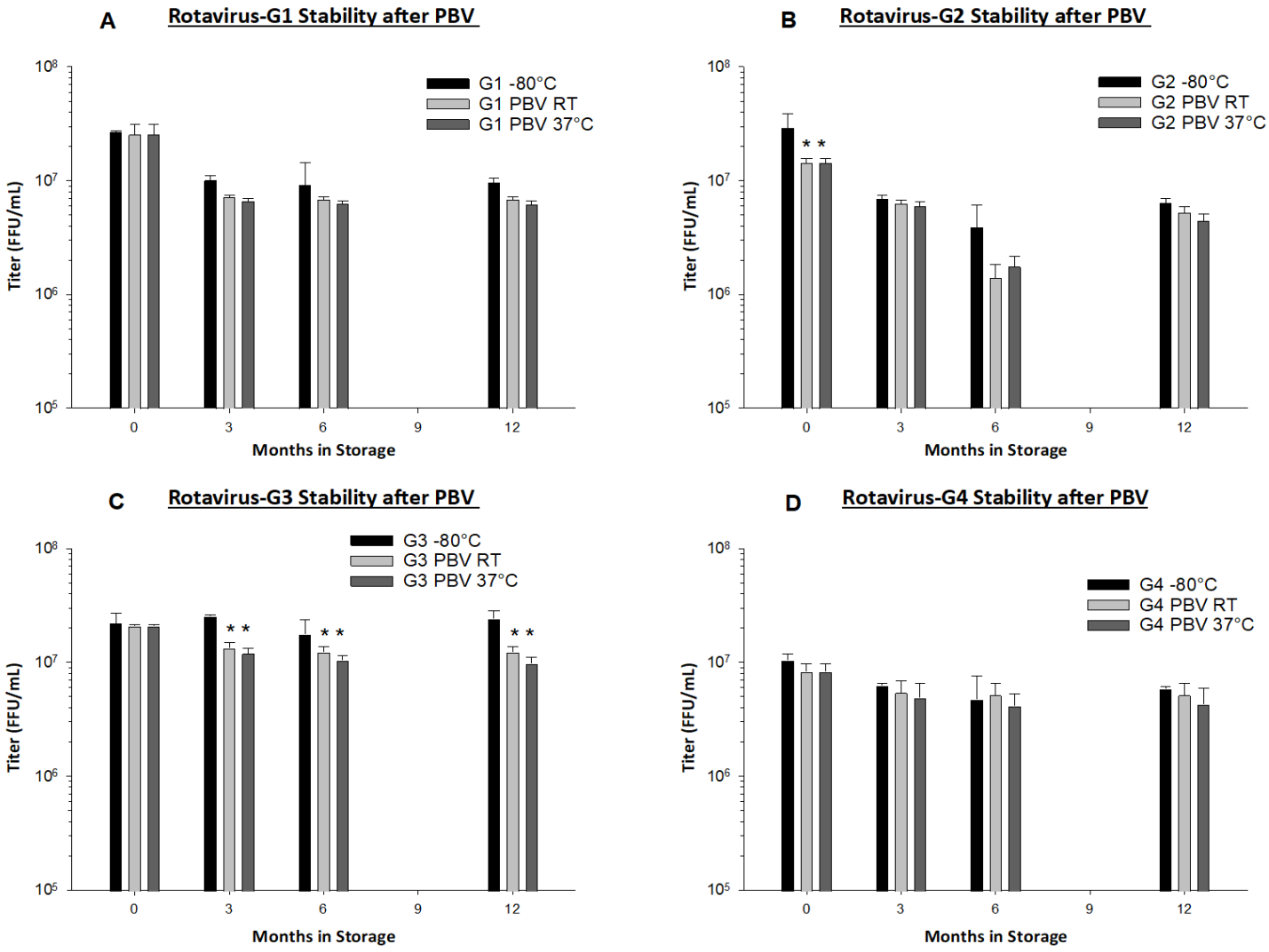
Dissolvable Buccal Films Comprising Micronized *VitriLife*® RRV-TV Rotavirus Vaccine and Antacid $CaCO_3$ powder



Tetravalent rhesus-human reassortant rotavirus vaccine (RRV-TV) includes G1, G2, G3 and G4 mono-reassortant strains.

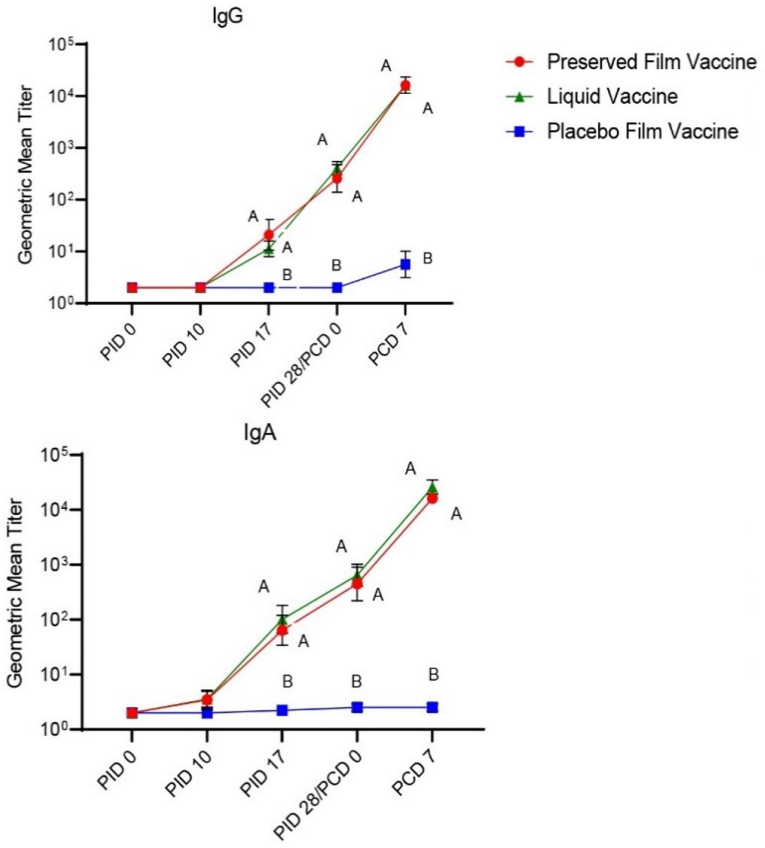
- Initial 14-day toxicity study in rats was performed by Charles River Laboratories. Study results showed no clinical observations of toxicity, effects on body weight or food consumption, changes in hematology or clinical chemistry parameters, or effects on organ weight, and no macroscopic or microscopic findings at any dose level.
- Initial oral mucosal irritation/sensitivity study in hamsters was performed by NAMSA. The right cheek pouch of 10 hamsters was implanted with full human dose film; the left cheek pouch of all animals was implanted with polymethylmethacrylate (PMMA) disks serving as control article. The results showed no macroscopic or microscopic reactions of the RRV-TV film to hamster cheek tissue.

Long-term Stability of PBV Live Rotavirus Vaccines G1 (A), G2 (B), G3 (C) and G4 (D) at Different Storage Temperatures

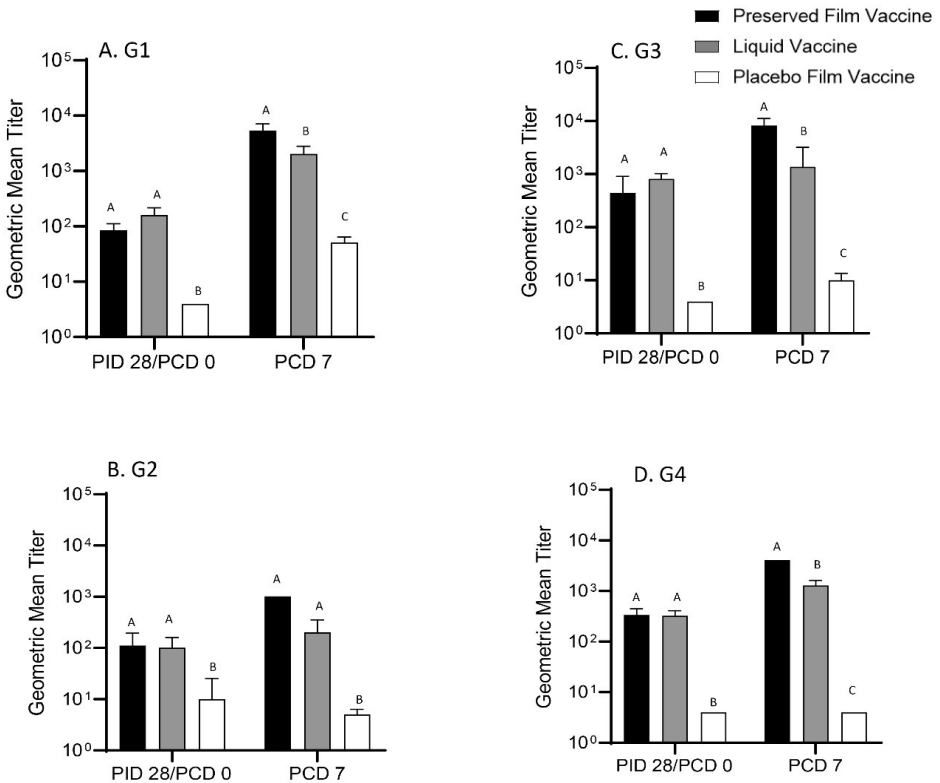


Dissolvable Buccal Film Rotavirus Vaccine Is Highly Effective in Neonatal Gnotobiotic Pig Challenge Model

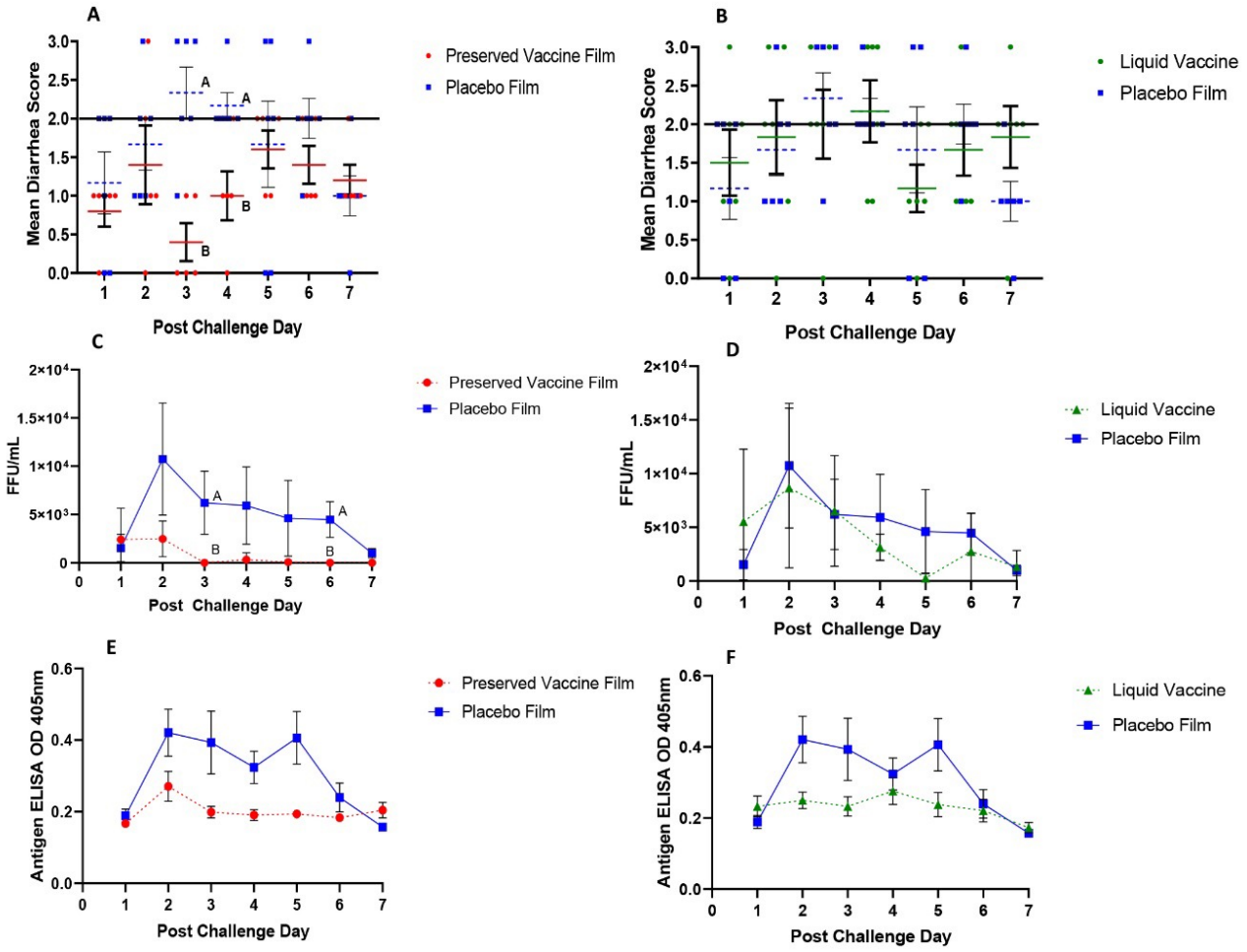
Strong serum IgG and IgA antibody responses were induced by preserved film RRV-TV vaccine.



Significantly higher titers of G1, G3, and G4 rotavirus serum virus neutralization (VN) antibody responses were induced by the preserved film vaccine compared to liquid vaccine at post-challenge day (PCD) 7.



VitriLife® Buccal Film RRV-TV Conferred Strong Protection Against Both Diarrhea and Virus Shedding Upon Challenge with VirHRV



Preserved film-vaccinated pigs showed significantly reduced duration of virus shedding (2.2, 5.7, and 6.8 days, respectively), mean peak titers (~4-fold lower) and area under the curve (AUC) (~6- to 8-fold lower) of virus shedding compared to both placebo and liquid vaccine groups.

Collaborations

NIH and CDC

- Awarded 17 grants and contracts.
- Grants supported studies around AT stabilization of LAVs and microbiome bacteria, mucosal delivery of vaccines and microbiome products.

Military

- Awarded 4 grants.
- Grants supported studies around AT stabilization and delivery of blood components, development of hemostatic and wound healing bandages.

Academic Institutions & Hospitals

- Collaborated with researchers and professors from 10+ academic institutions.

UST is Seeking Validation and Implementation of The *VitriLife*® Technology Platform Through:

- Corporate Partnerships
- Strategic Alliances
- Commercial Client Services