AEGIS
BIODEFENSE INC.

Rapid Development, Manufacturing and Deployment of a COVID-19 Vaccine

July, 2020

John D. Lewis, CEO
(10)(2e)@aegis.bio
+1 (760) 704-9105

Dr. Hong Jiang, COO
(10)(2e)@aegis.bio
+ 650 666 5287

Executive Summary

Our lead vaccine candidate creates an immune response which is as powerful as **Convalescent Human Serum**

- At a dilution rate of 75x they both reduce infection rate by 75% (slide 12)

Safety- Our vaccine uses a delivery system designed to eradicate the danger of disease enhancement.

- We do not use a viral vector or an electric charge or an electroporation device
- Our Maximum Tolerated Dose is more than 50x greater than the doses used for these highly efficacious results

- Data charts demonstrating equivalent neutralizing antibody titer to convalescent COVID-19 patients on slides 11&12. This has been achieved with ultra low doses. We will assess up to 10x this dose in clinical trials and expect to see corresponding increases in antibodies.

All current leading vaccine candidates seem to target the Spike protein which makes them all vulnerable to the same weakness- a mutation in the Spike which could render all of them ineffective. Due to our superior payload carrying capacity we can and do target the N protein as well as S and develop strong T cell responses from that. This multiple targeting enables us to provide mutation insurance, as well as diversification of risk in the portfolio of APAs.

Agenda

- Background
- Aegis COVID-19 DNA Vaccine
- Fusogenix DNA Vaccine Platform
- Fusogenix FAST Fusion Protein
- Fusogenix Advantages for Genetic Medicine Delivery
- Designing a pan-coronavirus DNA vaccine
- Rapid Vaccine Development
- Potent SARS-CoV-2 directed T-cell response
- Protective anti-SARS-CoV-2 neutralizing antibody response
- Vaccine Competitive Landscape
- Accelerated Development Timeline and Pipeline
- Scalable Manufacturing
- Modular Fusogenix Manufacturing Core
- Fusogenix Vaccine Supply Chain Vaccine – Integrated Model
- Fusogenix Vaccine Supply Chain Vaccine - Regional Model
- Partnering
- Cost Components
- EU based production capacity
- Engagement at an Early Stage with EU Regulators
- Risk sharing, Global solidarity and Liability
- Company and Team Overview
- Fusogenix Gene Delivery Technology Primer

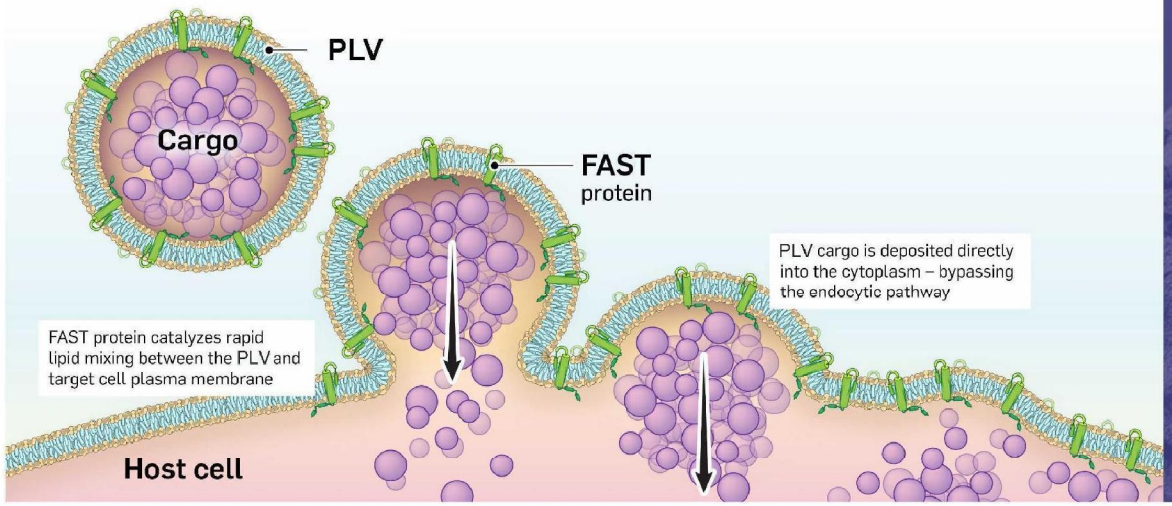
Background

- **Aegis Biodefense,** the international arm of Entos pharmaceuticals, is developing a DNA based vaccine and therapeutic against Coronaviruses for worldwide deployment.
- **Entos Pharmaceuticals**, a leading biotech company in Canada, has developed **Fusogenix**, its next generation delivery system for genetic medicine
  - 13 years of research and development on Fusogenix
- We are setting up **Aegis Europe** to produce our COVID-19 vaccines and to build our genetic medicine capacity in the EU

Aegis COVID-19 DNA Vaccine

- DNA plasmids of S and N proteins delivered via our **Fusogenix Gene Delivery platform**
- Generates a potent and protective antibody in mice study
- Induces balanced T-cell based response in mice study
- Protects against COVID-19 as well as other coronaviruses
- Administered as an injectable in liquid suspension, with storage at 4C and for 1 year
- Oral Formulation of our vaccine has shown early efficacy and currently is in development
- DNA plasmids are very stable to store and scalable to produce

Fusogenix DNA Vaccine Platform



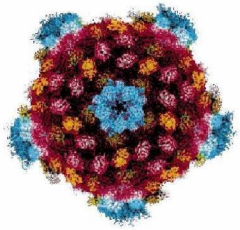
Optimized for intracellular delivery and high expression of plasmid DNA

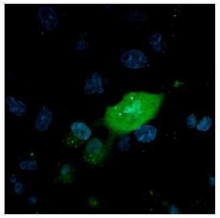
Significantly more efficient than viral or non-viral formulations

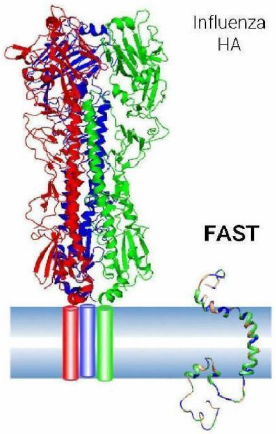
Scalable and inexpensive microfluidic manufacturing

Fusogenix FAST Fusion Protein

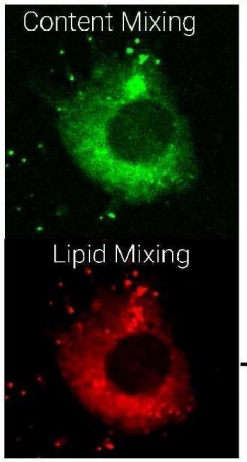
Fusogenic orthoreovirus



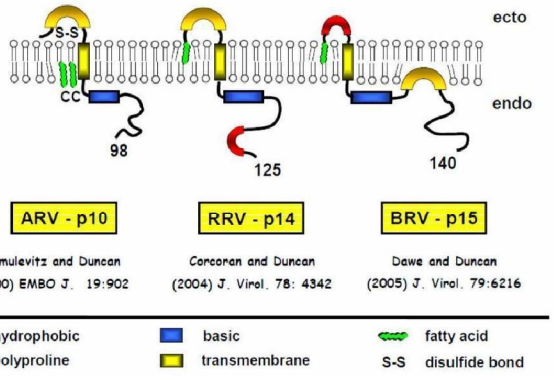




FAST fusion proteins via neutral proteo-lipid vehicles to deliver nucleic acids inside cells safely and efficiently



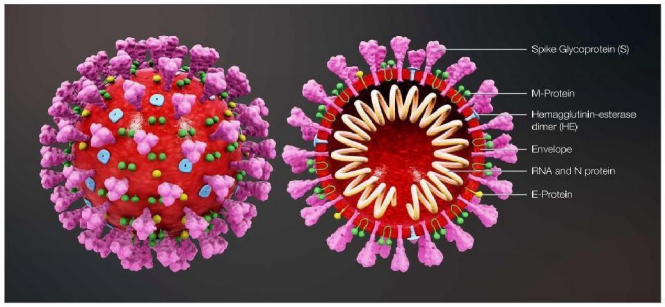
Top et al., EMBO J (2005)

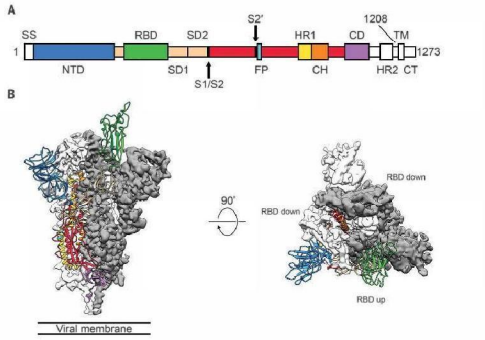


Fusogenix Advantages for Genetic Medicine Delivery

- Effective and nontoxic delivery mechanism to transport the medicine and deposit the medicine inside the human cells
- Fusogenix is a hybrid between LNPs and viral vectors, with tiny viral fusion proteins on its LNP surface to facilitate seamless entry inside human cells
- It does not require electric charges and avoids the cell damage that it can cause.
- Fusogenix is a scalable genetic medicine delivery platform for RNA or DNA –based vaccines and therapeutics on the same equipment
- Fusogenix can be produced on microfluidic manufacturing equipment which is highly scalable and deployable in the EU
- Fusogenix can also deliver genetic medicines intravenously to treat COVID-19 prophylactically and therapeutically

Designing a pan-coronavirus DNA vaccine





DNA Vaccine

Antigen Expression

Spike Protein	N Protein
Spike Ectodomain (secreted)	S/E/M Epitopes (String of Beads)

Humoral Immunity	Cellular Immunity
B cell epitopes + T helper Epitopes	MHC I Epitopes + T helper Epitopes

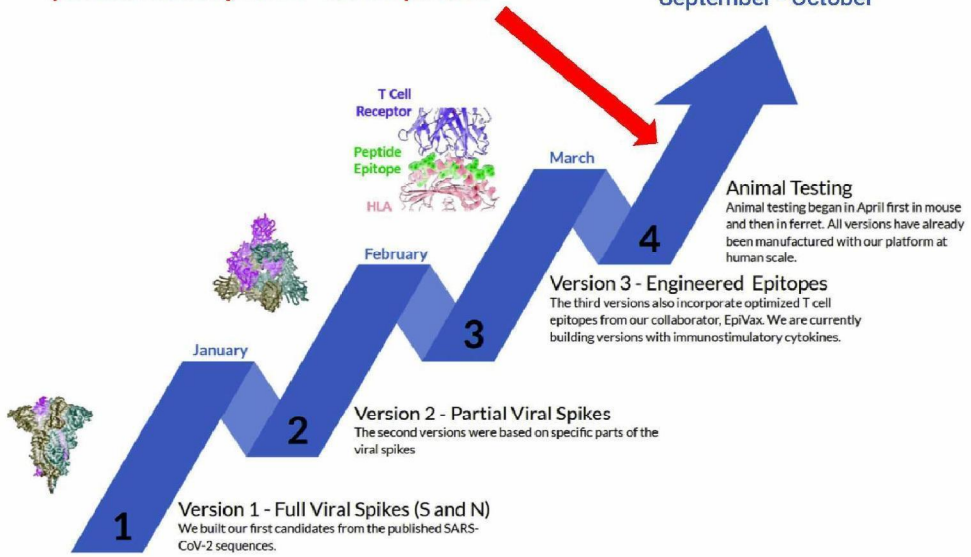
Durable SARS-COV2 Immunity

Rapid Vaccine Development

Optimized vaccine candidates induce potent antibody and T cell responses

Phase I Human Trial
August - September

Phase II Clinical Trial
September - October



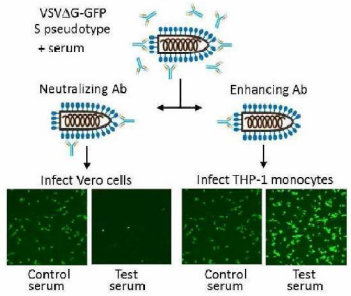
Version 1 - Full Viral Spikes (S and N)
We built our first candidates from the published SARS-CoV-2 sequences.

Version 2 - Partial Viral Spikes
The second versions were based on specific parts of the viral spikes

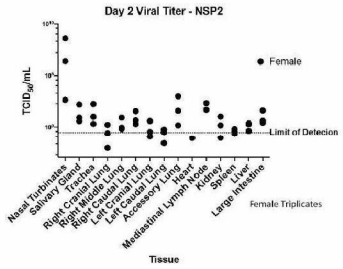
Version 3 - Engineered Epitopes
The third versions also incorporate optimized T cell epitopes from our collaborator, EpiVax. We are currently building versions with immunostimulatory cytokines.

Animal Testing
Animal testing began in April first in mouse and then in ferret. All versions have already been manufactured with our platform at human scale.

Assays for neutralizing and enhancing Abs using VSV-deltaG-GFP backbone pseudotyped with SARS-CoV-2 S protein (Dalhousie) and SARS-CoV-2 challenge (VIDO-Intervac)



Ferret challenge model. Female ferrets were inoculated with SARS-CoV-2 10^6 $TCID_{50}$ intranasally. Two days post inoculation, vRNA load was determined by qRT-PCR assessing the NSP1 gene.

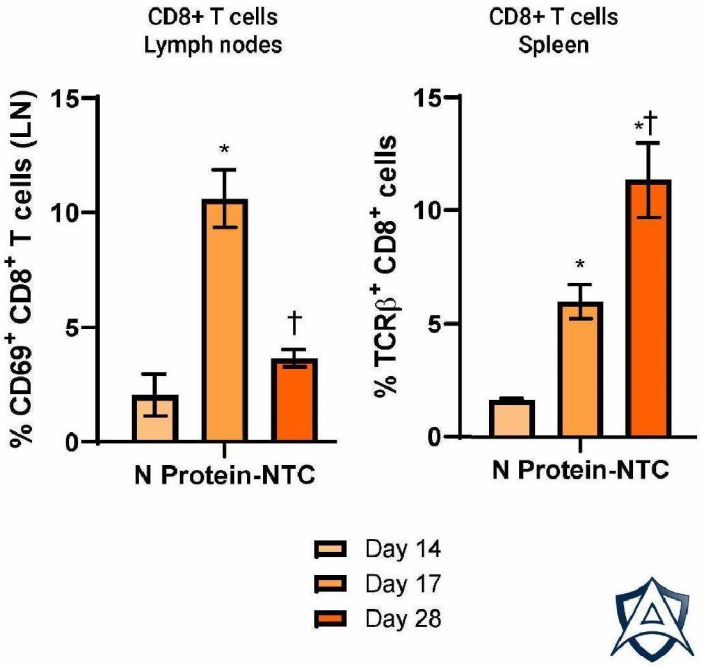


N Vaccine: Potent pan-coronavirus T-cell response

2 doses of 25 µg
MTD is 1-2 mg

Aegis Fusogenix PLV Vaccine

- Fusogenix PLV carrying a plasmid encoding full length COVID-19 N protein
- Mice were injected intramuscularly with a 25 µg dose of PLV encoding FL-N on a backbone with optional RIG-I/CpG on Day 1 and 14.
- At 14, 17 and 21 days, T cells from lymph nodes and spleen were assessed by flow cytometry to identify CD8+ population.
- Significant increase in CD8+ cells in lymph nodes and liver following vaccination with N protein DNA vaccine
- Our lead pan-coronavirus candidate is a potent generator of T cells that destroy cells infected with SARS-CoV-2.

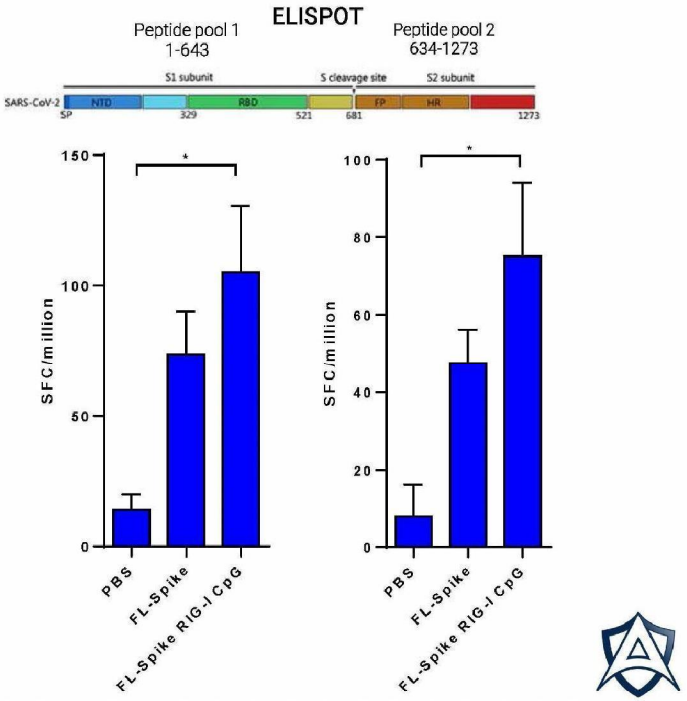


S vaccine: Potent T-cell response

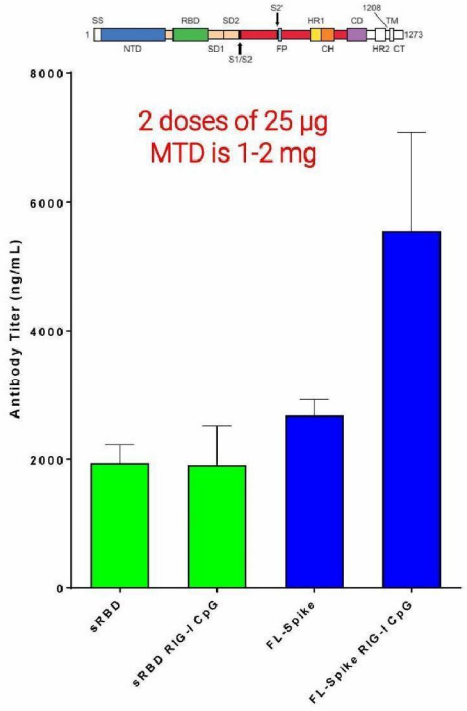
Aegis Fusogenix PLV Vaccine

- Fusogenix PLV carrying a plasmid encoding optimized COVID-19 Spike protein fragments
- Mice were injected intramuscularly with a 25 µg dose of PLV encoding sRBD or FL-Spike on a backbone with optional RIG-I/CpG or saline on Day 1 and 14.
- At 21 days, splenic T cells were stimulated with no peptide (control) or Spike peptides, and interferon gamma-expressing cells were enumerated using ELISPOT assays.
- Significant increase in IFNγ-expressing spot forming cells (SFC - expressed per million splenocytes)
- Our lead candidate is a potent generator of T cells that destroy cells infected with SARS-CoV-2.

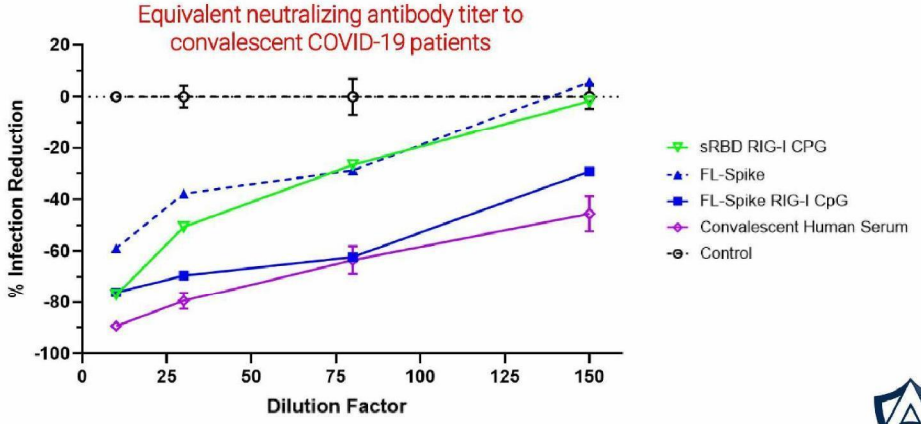
2 doses of 25 µg
MTD is 1-2 mg



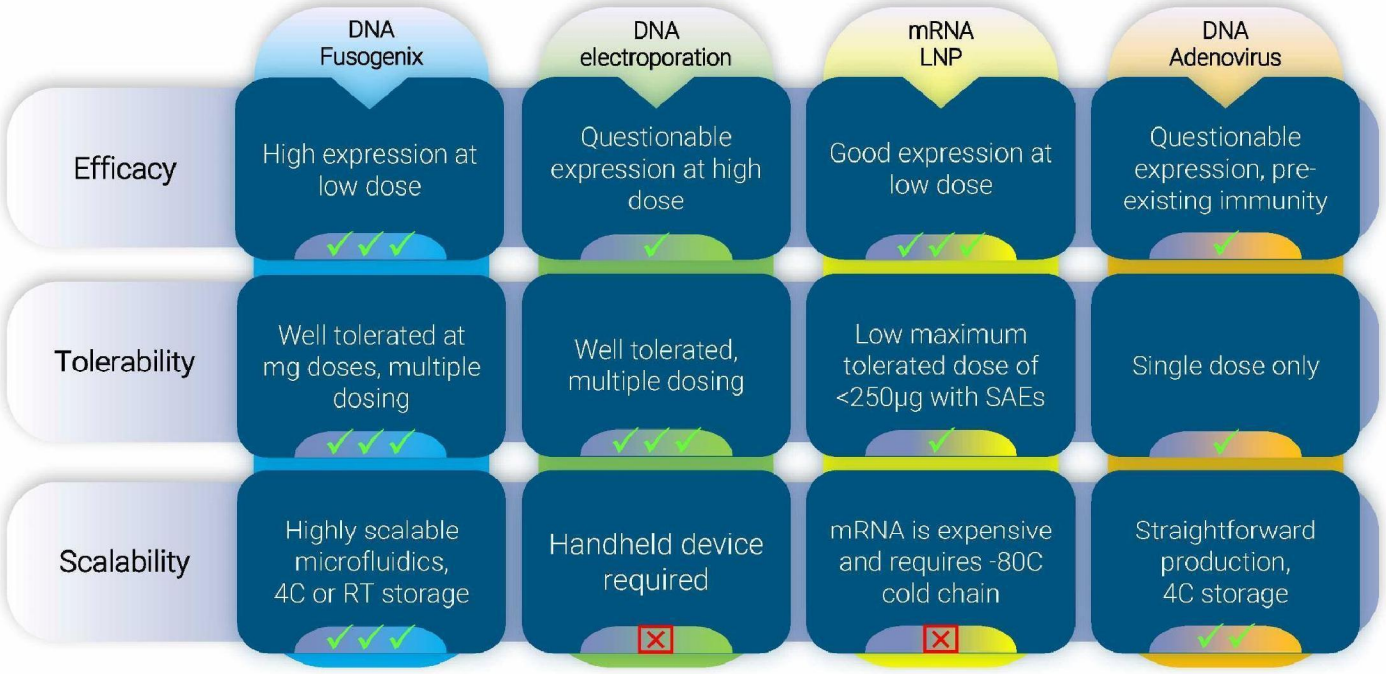
S vaccine: Protective neutralizing antibody response



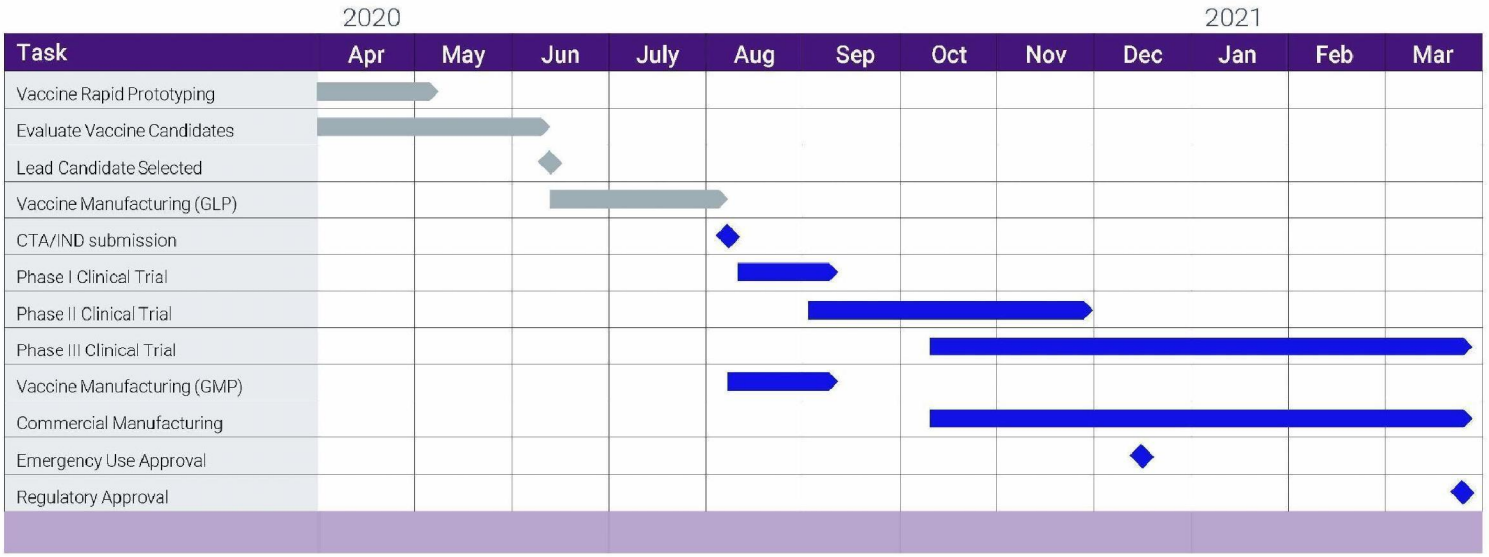
- Fusogenix PLV carrying a plasmid encoding optimized COVID-19 Spike protein fragments
- Mice were injected intramuscularly with a 25 µg dose of PLV encoding sRBD or FL-Spike on a backbone with optional RIG-I/CpG or saline on Day 1 and 14.



Vaccine Competitive Landscape



Accelerated Development Timeline



Pipeline

Therapeutic Area	Product	Candidate	R&D	Preclinical	IND	Phase 1	Phase 2/3
COVID-19 and Pan-coronavirus Vaccines	VAC-001	Spike and Capsid (N) Proteins					
	VAC-002	Optimized Spike					
	VAC-003	Optimized Spike + "string of beads"					
	VAC-004	Secreted Optimized S + "string of beads"					
COVID-19 Therapeutics (neutralizing antibodies)	VIP-005	Sorrento Therapeutics/SmartPharm					
	VIP-006	Kobinger Lab					
Influenza	AB-007	Undisclosed					
	AB-008	Undisclosed					

Scalable Manufacturing

- We use a scalable microfluidic manufacturing platform to manufacture research & clinical grade DNA vaccines.
- Manufacturing technology licensed from Precision Nanosystems (Vancouver, BC).

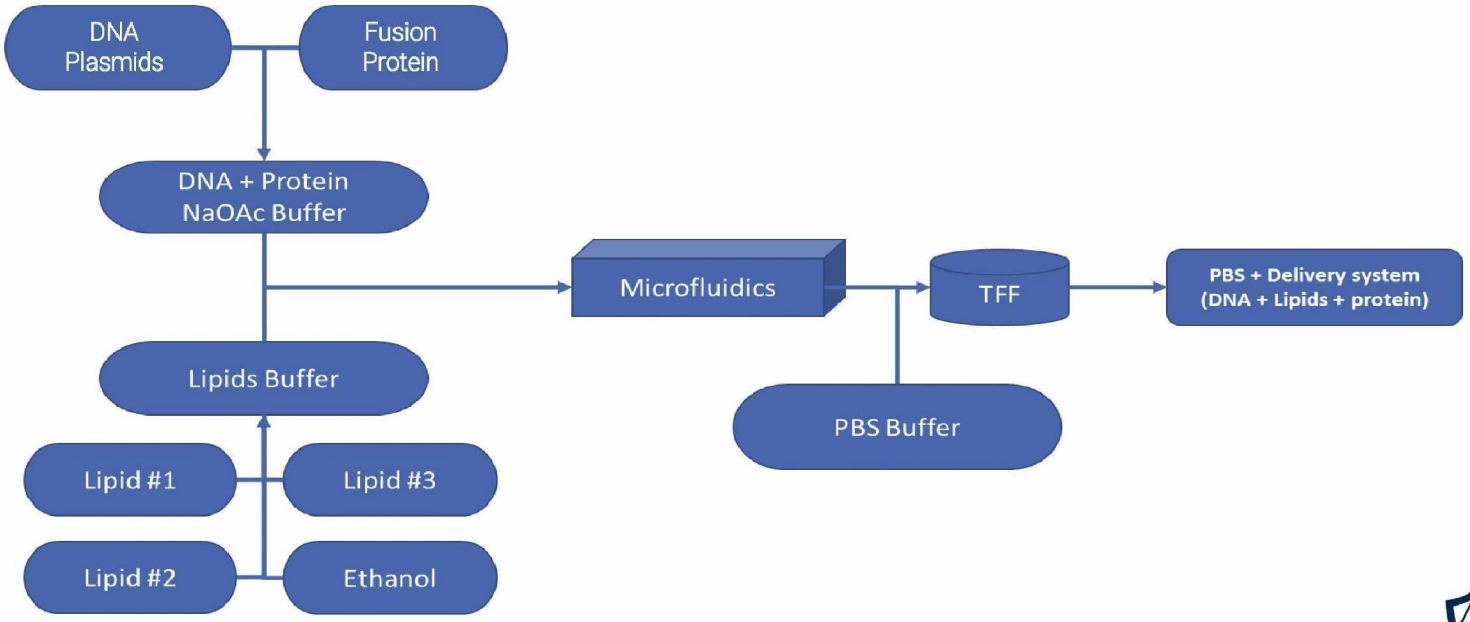
PRECISION NANOSYSTEMS

Spark	NanoAssemblr	Blaze	cGMP 8x Scale-up
25 – 250 µL	1 to 20 mL	10 mL to 1 L	up to 25 L

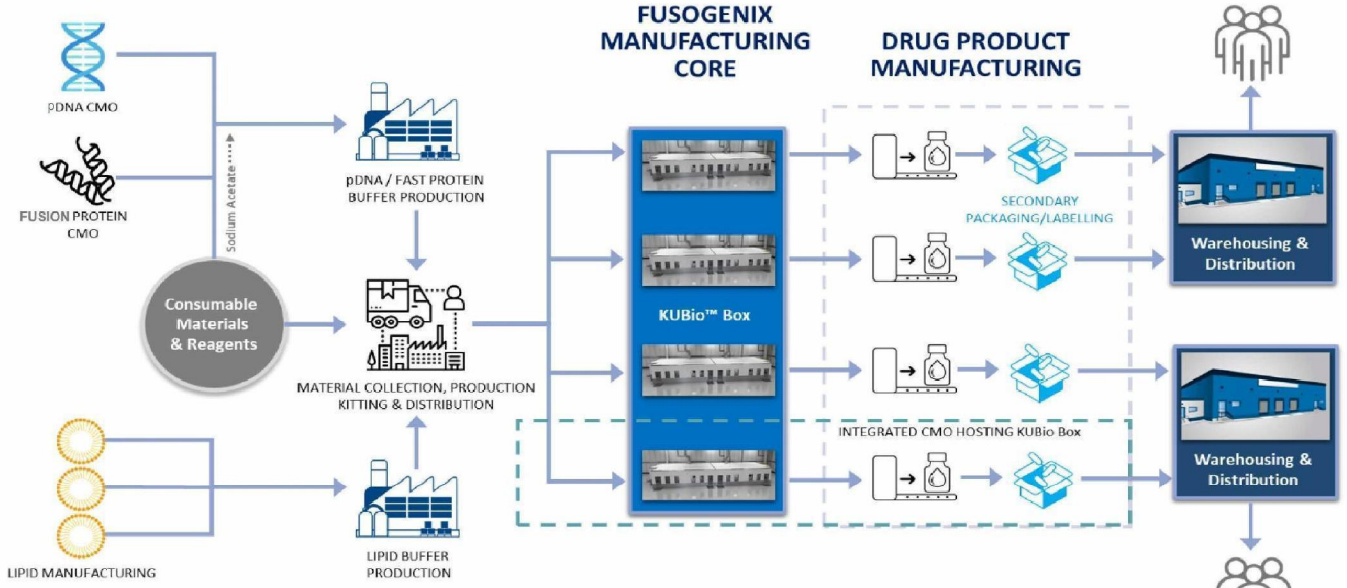
Canada:

Up and running GMP manufacturing site at the Advanced Cell Therapy Manufacturing Facility

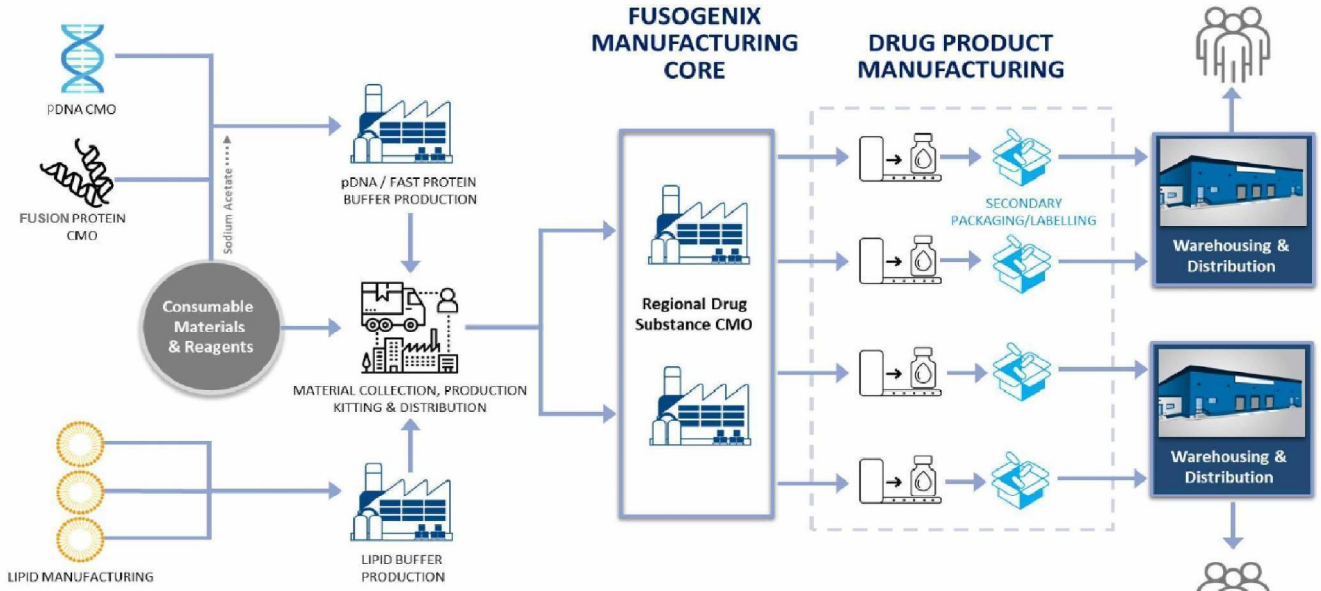
Modular Fusogenix Manufacturing Core



Fusogenix Vaccine Supply Chain (Integrated Model)



Fusogenix Vaccine Supply Chain (Regional Model)



Partnering

- Manufacturing Equipment
  - Formerly GE Healthcare and Life Sciences division, now named **Cytiva**. **KUBio** box, over 90% of top selling biologicals worldwide are manufactured using their equipment.
  - Precision Nanosystems Inc.
- Raw Materials
  - ThermoFisher Scientific
  - Merck Millipore
  - Lonza AG
  - FujiFilm Diosynth Technologies
- CMOs
  - Celonic
  - Northway Biotech
  - FujiFilm Diosynth
- Payload Design
  - Sorrento Therapeutics
  - Nature Technology Inc

Potential Sterile Fill-Finish Partners

CMO	Location	Fill-line Feed Tank Capacity	High-speed Line	Available Capacity	Secondary Packaging, Labelling & Serialization capabilities	KUBio Box Hosting Interest
Patheon	Ferrantino, IT	>1200-L	150,000 / shift	Yes	Yes	Yes
Cenexi*	France	1500-L	Yes	45 Mi / Yr	Yes	Yes
Cenexi*	Belgium	1500-L	Yes	10 Mi / Yr	Yes	Yes
IDT Biologika	Germany	>1200-L	>200,000/shift	Yes	Yes	Yes
(10)(2e) Fabre	France	>500-L	Yes	Yes	Yes	Yes
Rovi Pharma Industrial Services	Spain	>400-L	Yes	TBD	Yes	Yes
Vianex	Greece	500-L Expanding 2021	Summer 2021	Yes	Yes	TBD

* Confirmed available capacity as of 6-July 2020.

Cost Components

- GMP Facility rent and operation
- Equipment purchase and installation
- Trials costs
- EU regulatory and marketing authorisation costs
- Raw materials
- Facility management
- Process management
- Quality Control
- Management
- Logistics Cost
- Warehousing (materials, DS, DP) / Central Distribution and kitting services
- Process Validation Costs
- Extraordinary expenses to accelerate time-to-market

EU based production capacity

- GE Healthcare Life Sciences/Cytiva has offices throughout the EU and has facilities in
  - Sweden
  - Germany
  - Austria

  In order to meet our high production ramp rates we also expect to site production or fill and finish in the following countries:

- Belgium, Germany, Denmark, Netherlands, France, Italy, Spain, Lithuania and Greece
- We request contacts in EU member countries to explore siting our facilities
- We will also have production facilities in Canada with funding from the Canadian government

Engagement at an Early Stage with EU Regulators

- Efficacy data of oral formulation will be available in mid August, 2020
- Phase I/II clinical trial will start in August, 2020
- Hamster challenge data will be available by mid-August, 2020
- Immunogenicity data from non-human primates will be available by mid-August, 2020
- Safety and early efficacy data will be submitted to EMA from adaptive Phase I/II trial by the end of September, 2020
  - Up to 72 human subjects in phase 1 (dose and age cohorts)
  - 500-800 human subjects in phase 2
- Phase II interim data will be submitted to EMA in November, 2020
- Phase III trial will begin mid October, 2020
- Phase III interim data will be submitted to EMA in December, 2020 for the potential emergency use approval thereafter

Risk sharing

- Option A – If we have a successful vaccine, the funding provided will be considered as a down-payment on the vaccines that will actually be purchased by the Member States

- Option B – No vaccine, but potential flexibilities for our manufacturing capacity include:
  - Deliver alternative vaccines with higher efficacy (COVID-19, COVID-X, Influenza, Measles, Pneumonia etc...)
  - Deliver genetic medicine-based therapeutics such as neutralizing antibodies for COVID-19, COVID-X, Influenza, HIV, Herpes...
  - Production of therapies for age-related diseases (Oisin Biotechnologies) and cancer (OncoSenX Inc)
  - Aegis will build capacity in the EU for a wide range of genetic medicines. More than 15 partners utilize the Fusogenix PLV platform, and 3 are in clinical trials in 2021

Global Solidarity

- We intend to offer this vaccine to EU partner countries
- we are establishing a foundation and working with other foundations to help us with our commitment to providing vaccination across the entire world at affordable prices.

Risk Sharing

- We request liability waiver or insurance coverage provided by member states.
- Aegis-Entos Europe will establish a fund for EU patient follow up post vaccination

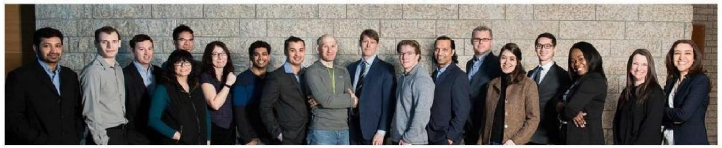
Company Overview

John Lewis
Founder
Chief Executive Officer

Matthew Scholz
Founder
Chief Technical Officer

Hong Jiang
Founder
Chief Operating Officer

Roy Duncan
Founder
Board Member



Locations:
Offices: San Francisco, San Diego
R&D Facilities: Edmonton, San Diego

Manufacturing:
Edmonton, AB

Team

Arun Raturi
Chief Scientific Officer

Gregory Reid
Regulatory/Quality

Colin Coros
Business Development

Jailal Ablack
Preclinical Development

Catalina Vasquez
Clinical Development

Perrin Beatty
Communications

PhD Scientists:
- Prakash Bhandari
- Ping Wee
- Manoj Parmar
- Maryam Hejazi

MSc Scientists:
- Liliya Grin
- Jennifer Gyoba
- Hector Vega

PhD Candidate:
- Douglas Brown

Intellectual Property:
- Gowling WLG, (10)(2e) Bown
- WSGR

Accounting/Tax:
- Grant Thornton, Ian Griffiths

Corporate/Legal:
- Dentons, Heather Barnhouse

Contracts/Licensing/Legal:
- Norton Rose Fulbright, Vanessa Grant

Financial/Investment:
- Deloitte, Jason Ding

AEGIS
BIODEFENSE INC.

Fusogenix Gene Delivery Technology Primer

Dr. Hong Jiang, Founder and COO
hong.jiang@aegis.bio

Applications of Fusogenix

- Vaccine Delivery
  - Corona family of viruses (SARS, MERS, COVID-19, COVID-X)
  - Influenza family of viruses (e.g., H1N1)
  - Measles
  - Meningitis
  - Malaria
  - ....
- Therapeutic Delivery
  - Corona family of viruses (SARS, MERS, COVID-19, COVID-X)
  - Influenza family of viruses (e.g., H1N1)
  - ....

Aegis can lyophilize its vaccines and enable the development of a pill vaccine

Fusogenix is likely to be safe in humans

Company	Technology	Type	MTD	Clinical Development
Various	Lipotrust, DOTAP, others	CL	0.45 mg/kg	Phase I (various – all terminated due to toxicity)
Calanad/Arrowhead	RONDEL lipopolymer	CL	0.81 mg/kg	Phase II (CALAA-01)
EGEN	PEG-PEI-Chlolestrol Lipopolymer	CL	0.65 mg/kg	Phase II (EGEN-001, failed due to toxicity)
Marina Biotech, ProNAi	Smarticles (amphoteric liposomes)	CCL	3.2 mg/kg	Phase II (PNT2258)
Marina Biotech	DiLA^2	CCL	1 mg/kg	Phase I
Arbutus (Tekmira), Alnylam	SNALP	CCL	0.9 mg/kg	7 programs in Phase I and II
MD Anderson (Anil Sood)	DOPC liposomes	NL	>10 mg/kg	Phase I (siRNA-DOPC-EphA2)
AEGIS BIODEFENSE INC.	Fusogenix PLVs	NL	>10 mg/kg	Estimated from rat/NHP tox studies

Fusogenix Technology Good Safety and Biodistribution Profile

Extensive tox profiling done in mice (internal), rats (CRO), dogs (CRO) and primates (CRO)

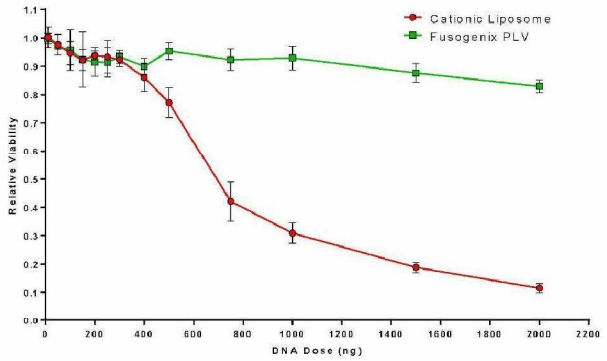
TOXICOLOGY STUDIES	
Anti-FAST / PLV antibody & neutralization assays	• No antibody response against Fusogenix in immune-competent mice, even at high doses • Neutralization requires very high Ab concentration • "Vaccination" against FAST/PLV doesn't reduce vaccine efficacy Repeat dosing is effective and well tolerated
CARPA Assays	• Fusogenix PLV has been optimized to have low reactivity
Non-Human Primate and Canine Studies	• 17 and 28 day studies completed - no toxicity seen in animals receiving PLV at 6, 10 and 20 mg/kg single and multiple doses • No detectable ADA, CARPA, histological changes

Fusogenix is non-toxic compared to competitors platforms

(in vitro)

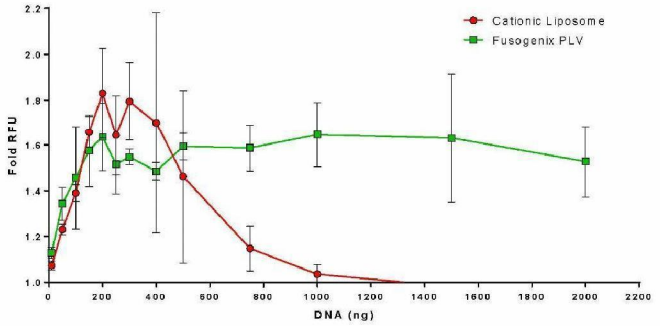
Toxicity

Fusogenix PLV vs. Cationic LNP

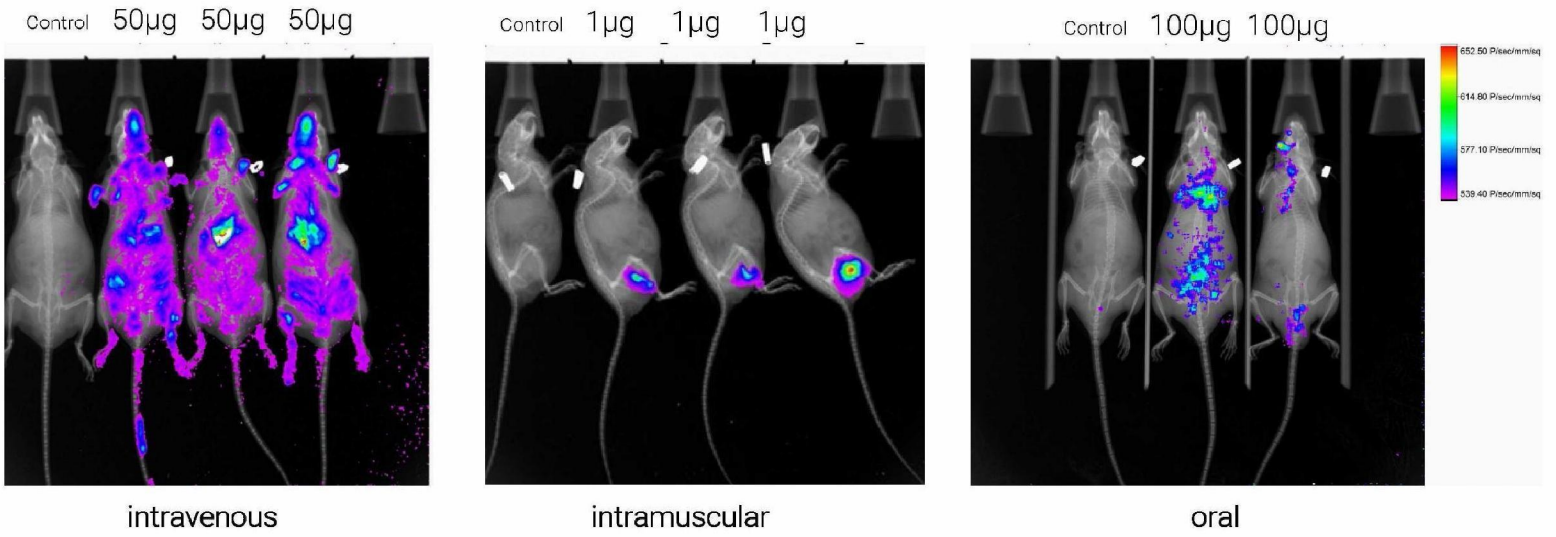


Expression

Fusogenix PLV vs. Cationic LNP



Fusogenix can be delivered via multiple routes



intravenous intramuscular oral

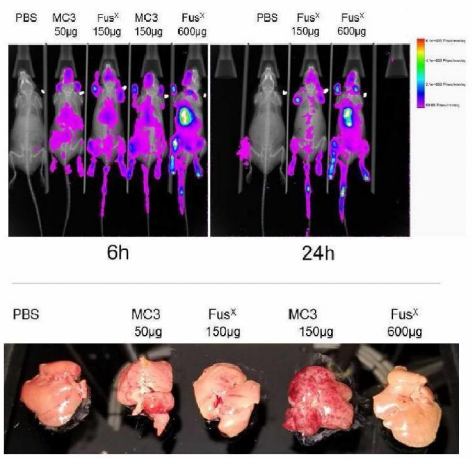
Aegis can lyophilize its formulation to enable the development of a pill vaccine

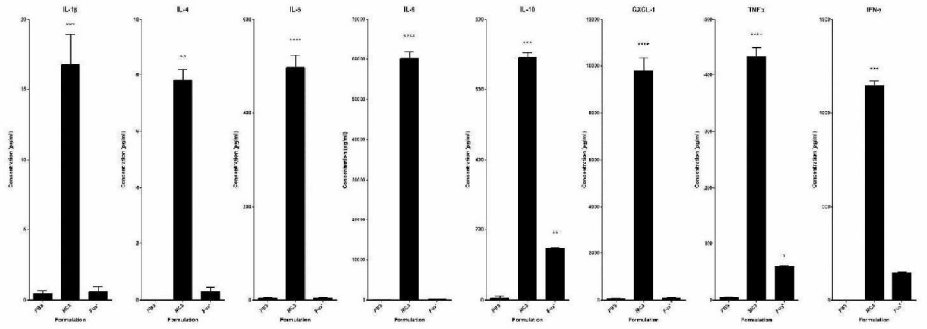
Fusogenix is non-toxic compared to competitors platforms

(in vivo)

Delivering pDNA at equal doses, Fusogenix performs similarly to MC3 (SNALP) formulations
pDNA-MC3 formulations are lethal at even low (2µg) doses, while Fusogenix is well tolerated at 300x that

Fus^X = Fusogenix PLV

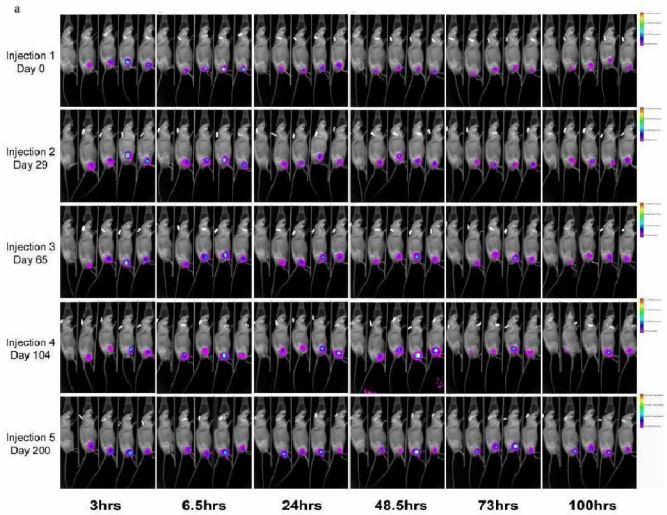


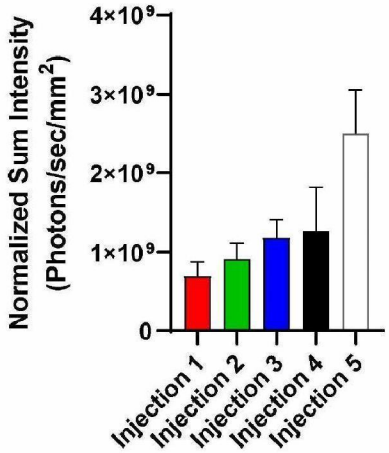


At a 150 µg pDNA dose, MC3/ionic lipid formulations cause significant elevations in inflammatory cytokines, while Fusogenix formulations do not (even at much higher doses)

Fusogneix: No decrease of effectiveness over multiple doses

Essential for boosting of vaccines for lifelong protection





Mice were repeat dosed **intramuscularly** with 1 µg Fusogenix every 4 weeks for 5 months

Fusogenix Advantages For Vaccine Delivery

	Aegis Fusogenix	Oxford/Cansino Adenovirus Vectors	Moderna/CuraVac/BioNTech LNPs
Toxicity	• Likely safe even at very high dose level • Likely non-toxic well above therapeutic level	Toxic beyond vaccine dose	Toxic beyond vaccine dose
Biodistribution	• Local distribution via injection • Systemic distribution via IV	• Local distribution via injection	• Local distribution via injection • Systemic Grade 3 adverse events recorded in Phase 1
Transfection Rate	High	High	High
Payload Types	• RNA • DNA • Peptides • Proteins • Small molecules	DNA	RNA
Maximum Payload Size	>15KB	4KB	4-6KB
Immunogenicity	None	High	Low
Therapeutic Dosage	Yes, we are developing a cure for COVID patients using the same technology	No	No

AEGIS
BIODEFENSE INC.

FOR MORE DETAILS

CONTACT US

John D. Lewis, CEO
john.lewis@aegis.bio
+1 (760) 704-9105

Dr. Hong Jiang
COO
(10)(2e)@aegis.bio