LUNAR-COV19 Prophylactic Vaccine

International mRNA Health Conference

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FORWARD LOOKING STATEMENTS

This presentation contains forward-looking statements. These statements relate to future events and involve known and unknown risks, uncertainties and other factors which may cause our actual results, performance or achievements to be materially different from any future performances or achievements expressed or implied by the forward-looking statements. Each of these statements is based only on current information, assumptions and expectations that are inherently subject to change and involve a number of risks and uncertainties. Forward-looking statements include, but are not limited to, statements about: expectations regarding our capitalization and resources; the adequacy of our capital to support our future operations and our ability to successfully initiate and complete clinical trials; our strategy and focus; our efforts to develop a vaccine against COVID-19, the safety, efficacy or reliability of a our COVID-19 vaccine candidate; the development and commercial potential of any of our product candidates; the timing and success of our development efforts; the success of any of our trials and our ability to achieve regulatory approval for any product candidate; the entry into or modification or termination of collaborative agreements and the expected milestones and royalties from such collaborative agreements ; the potential market or clinical or commercial success of the clinical development programs of Arcturus; and any statements other than statements of historical fact, including those related to Arcturus' future cash, market or financial position.

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Arcturus: Building the Next Generation of Vaccines and RNA Medicines

Arcturus

Arcturus is a U.S.-based leader in cutting-edge vaccine and medicine development. Over the past eight months, Arcturus has worked to develop LUNAR®-COV19, a vaccine that provides a robust, rapid, and potential single and multiple dose vaccination against COVID-19. LUNAR®-COV19 employs Arcturus' groundbreaking and proprietary mRNA technology to generate a robust immune response without the use of adjuvants, viruses, or viral vectors.

Company Highlights

BUILDING INNOVATIVE RNA MEDICINES

- Founded in San Diego, CA in 2013, with over 120 full-time employees and researchers
- Publicly traded on the U.S. Nasdaq exchange
- Deep pipeline of promising therapeutic and vaccine candidates using proprietary mRNA technology
- Multiple therapeutic programs in clinical development with milestones reached in 2020
- Technologies and treatments have been validated by multiple strategic partners with leading pharma firms

Strategic Partnerships

Arcturus has partnered with the prestigious Duke-NUS Graduate Medical School in Singapore to undertake clinical testing of LUNAR®-COV19 in anticipation of a global roll-out by the end of 2020. Additionally, its proprietary mRNA technology has been validated through partnerships with many of the world's leading vaccine and pharmaceutical firms.

Takeda

DUKE NUS GRADUATE MEDICAL SCHOOL SINGAPORE

State of Israel Ministry of Health משרד הבריאות

CYSTIC FIBROSIS FOUNDATION

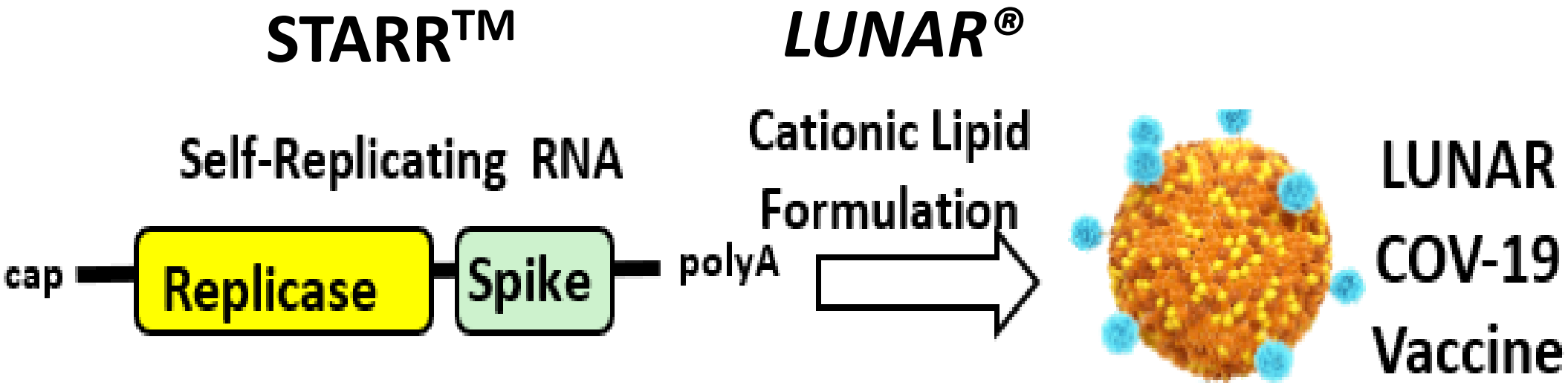
Catalent

Johnson & Johnson

ultragenyx pharmaceutical

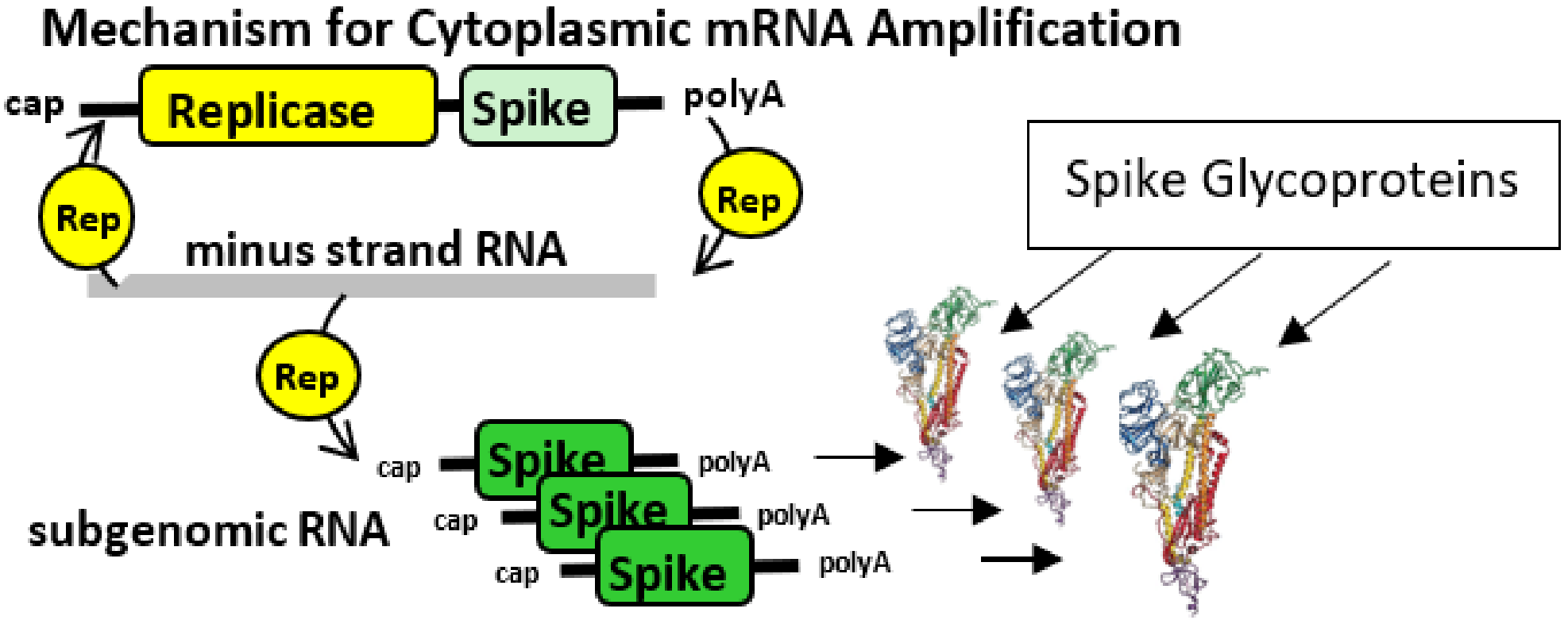
LUNAR®-COV19 Vaccine

Combination of STARR™ Technology and LUNAR®



LUNAR®-COV19 Vaccine

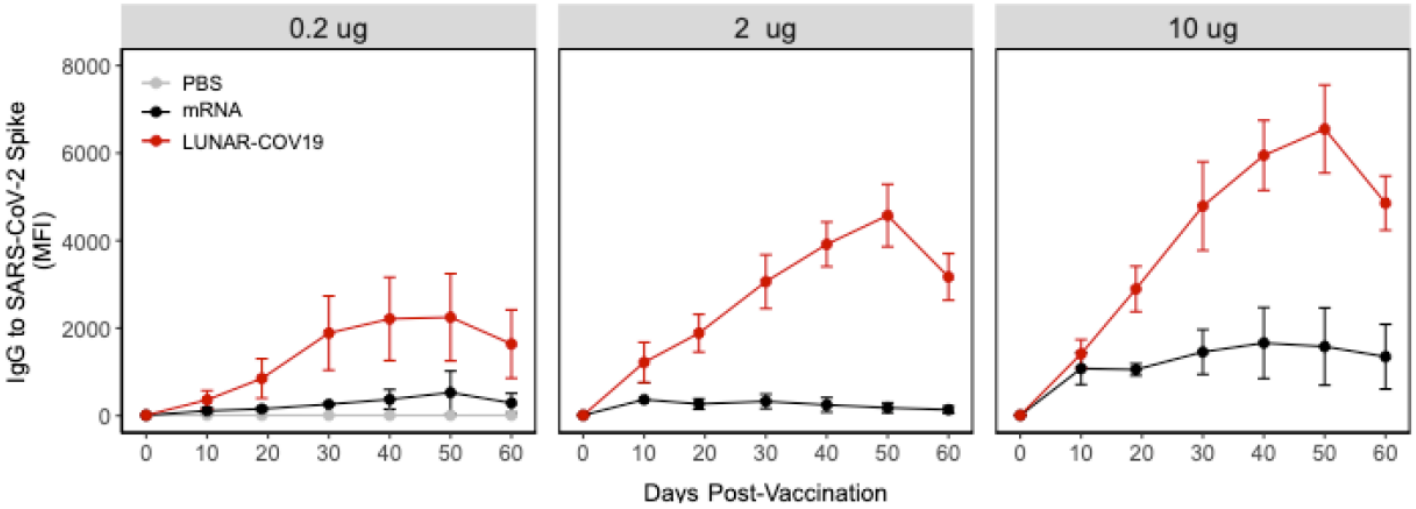
STARR™ Mechanism



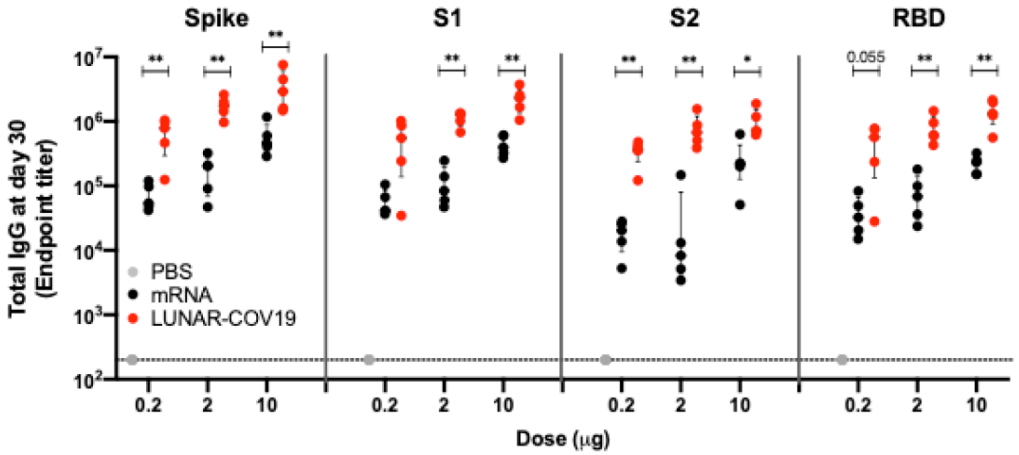
STARR™ technology can be used to generate a protective immune response or drive therapeutic protein expression

LUNAR-COV19 elicits higher antibody titers than conventional mRNA

Spike-specific IgG levels



End point titers of Spike-specific antibodies



IgG titers increase up to Day 50 with LUNAR-COV19 whereas a plateau is reached with mRNA

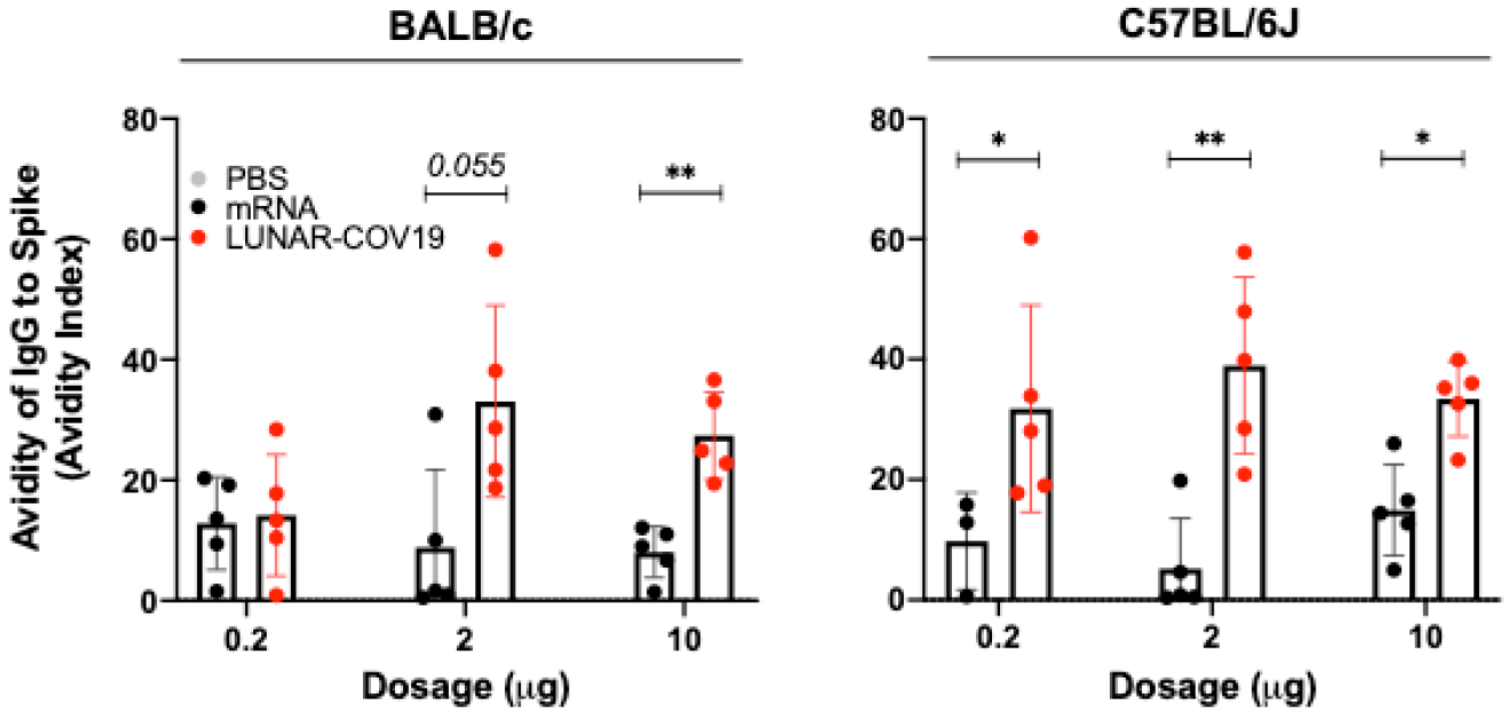
≥ 10 fold higher IgG titers elicited by LUNAR-COV19 compared to mRNA

Similar results obtained for both Balb/c and C57Bl/6 mice

Source: https://www.biorxiv.org/content/10.1101/2020.09.03.280446v1.full.pdf

LUNAR-COV19 produces higher avidity antibodies compared to mRNA

Avidity of Spike-specific IgG antibodies



IgG bound to Spike-immobilized after washes with 8M urea compared to washes with PBS

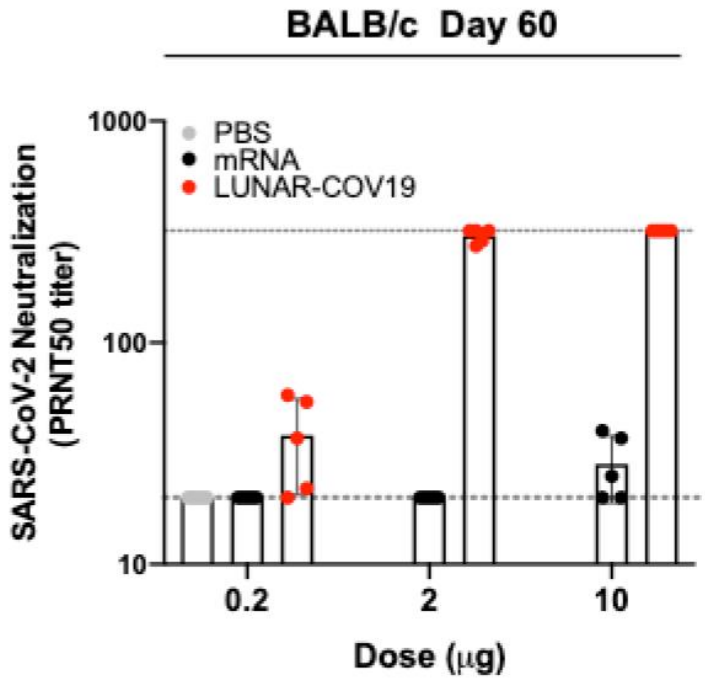
LUNAR COV-19 elicits antibodies with stronger avidity to the Spike protein

Higher titers and better antibodies imply a stronger neutralization capability

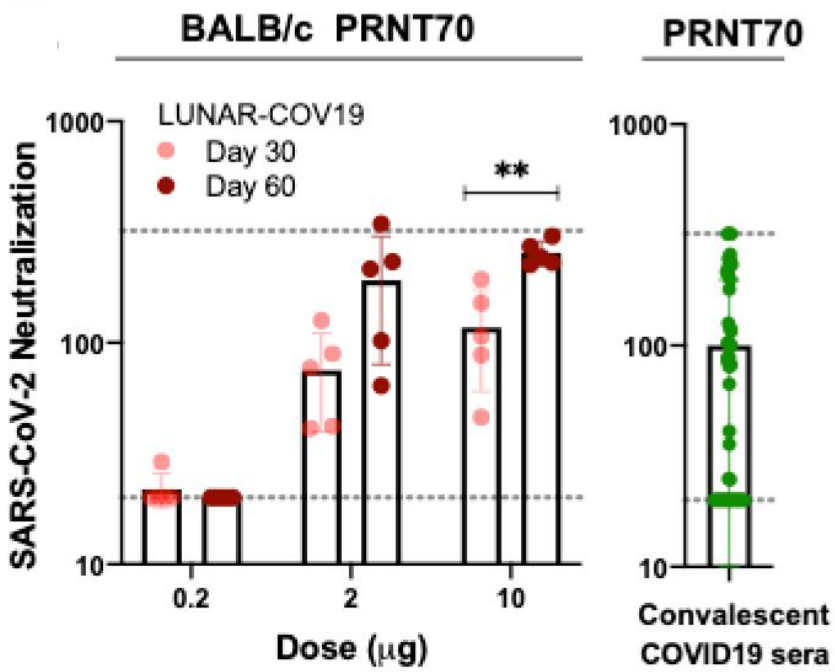
Source: https://www.biorxiv.org/content/10.1101/2020.09.03.280446v1.full.pdf

High Neutralizing Antibody Titers with LUNAR®-COV19

>10-fold higher titers with LUNAR-COV19 vs mRNA



Neut. Ab titers higher than in convalescent COVID-19 patients



LUNAR COV-19 leads to higher titers of neutralizing antibodies compared to mRNA

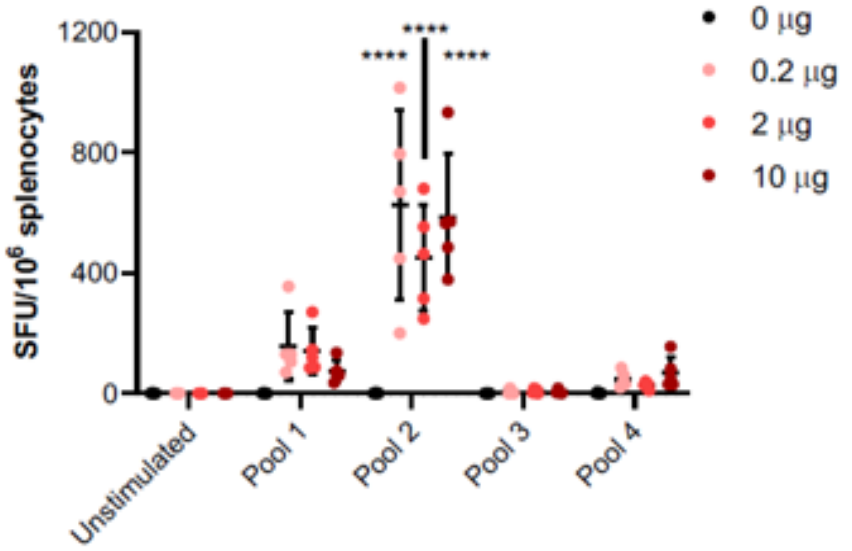
Levels of neutralizing antibodies titers on day 60 higher than in convalescent sera

Source: https://www.biorxiv.org/content/10.1101/2020.09.03.280446v1.full.pdf

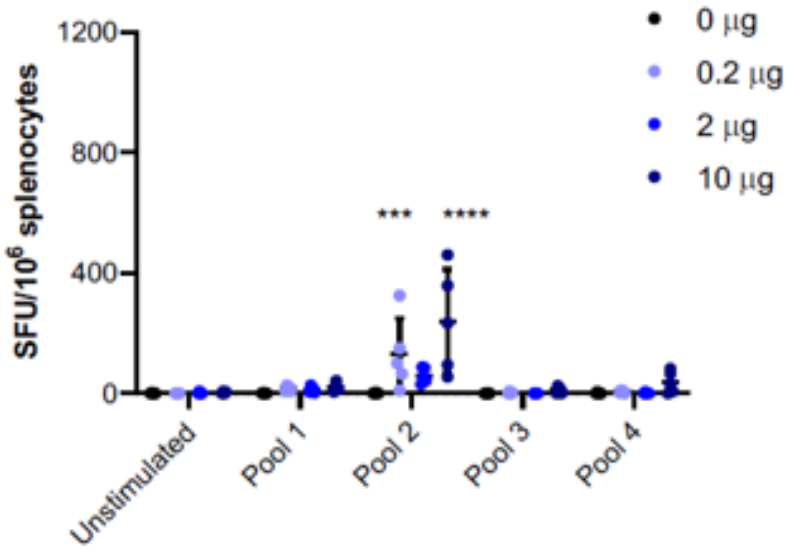
Strong T-cell immune response with LUNAR®-COV19 Vaccine

ELISPOT results: *Spike Glycoprotein Specific T Cell Immune Response*

LUNAR-COV19



mRNA

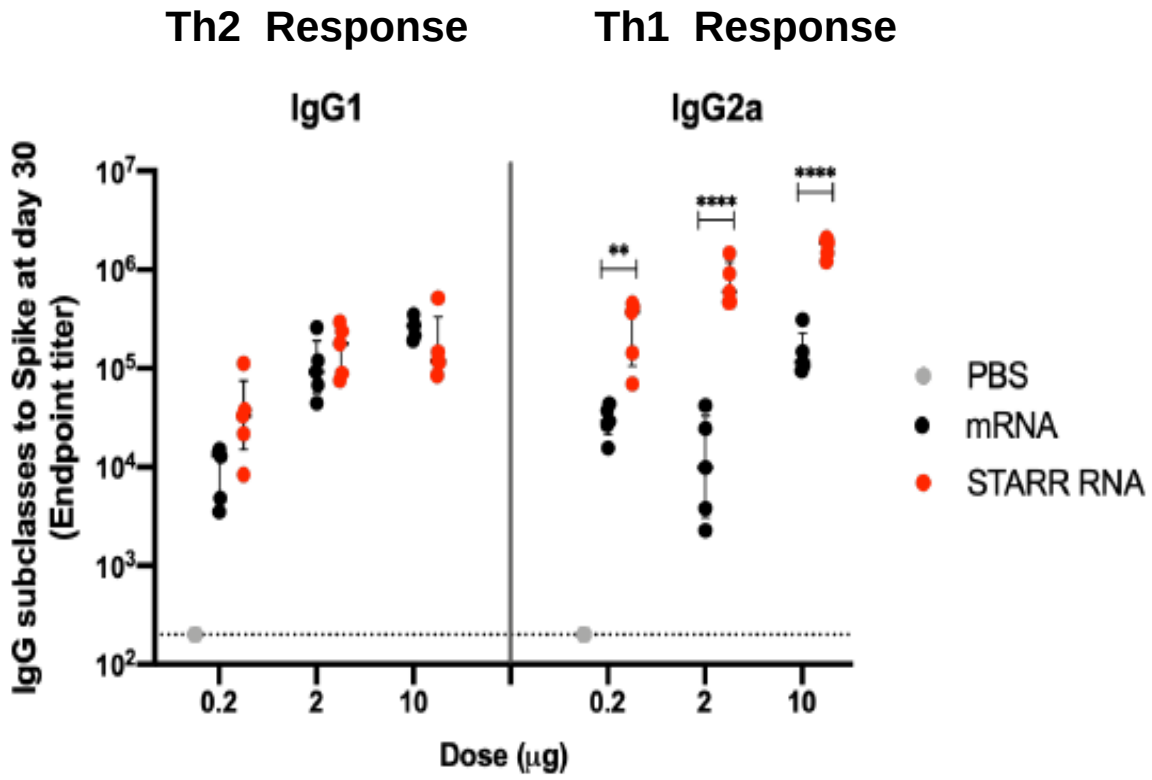


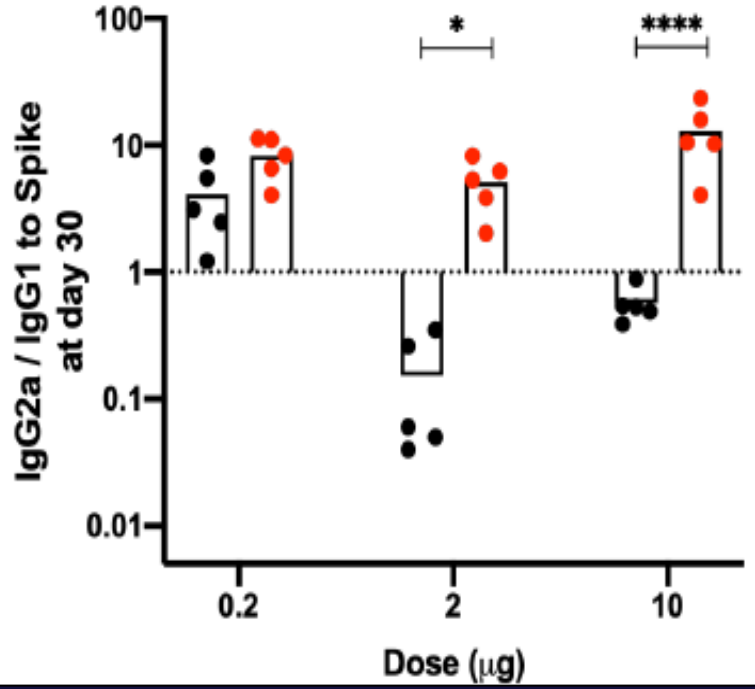
Pools composed of 35 X 15 mer overlapping peptides: Pool 1-S1 NTD; Pool 2-S1 RBD; Pool 3-S2; Pool 4-Transmembrane and cytoplasmic domains

FACS analysis yielded CD4+IFNγ/CD4+IL-4 >1 supporting Th1 immune response

Source: https://www.biorxiv.org/content/10.1101/2020.09.03.280446v1.full.pdf

LUNAR®-COV19 Elicits Th1 Immune Response





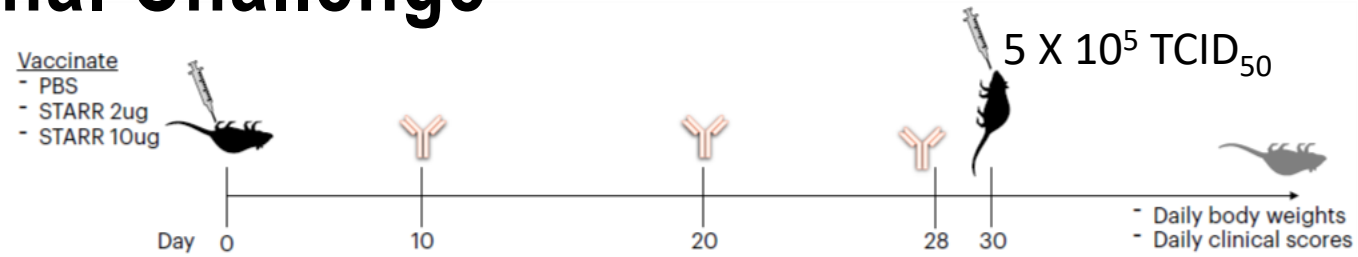
Clear Th1 response at 2.0 µg and 10 µg LUNAR-COV19 doses

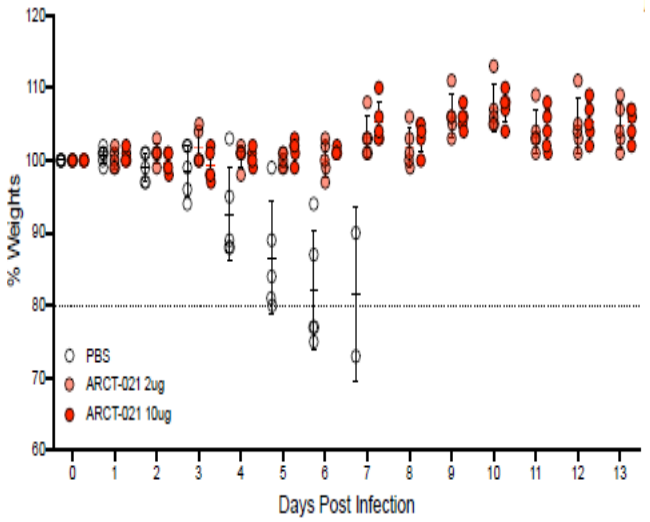
mRNA-based vaccine has a Th2 response (IgG2a/IgG1 <1) at these same doses

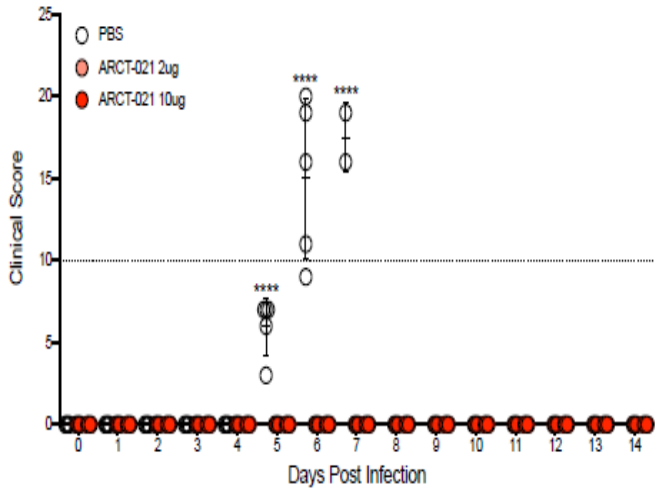
Th2 responses are associated with immunopathology

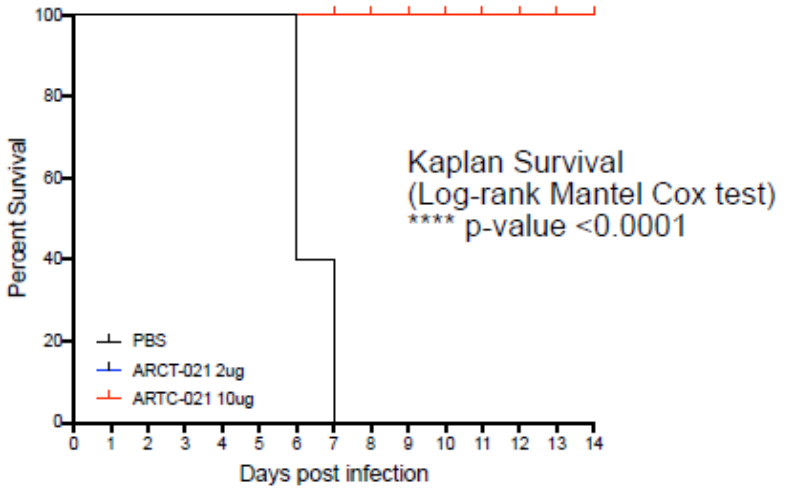
Source: https://www.biorxiv.org/content/10.1101/2020.09.03.280446v1.full.pdf

LUNAR®-COV19 Completely Protects Transgenic Mice from Viral Lethal Challenge





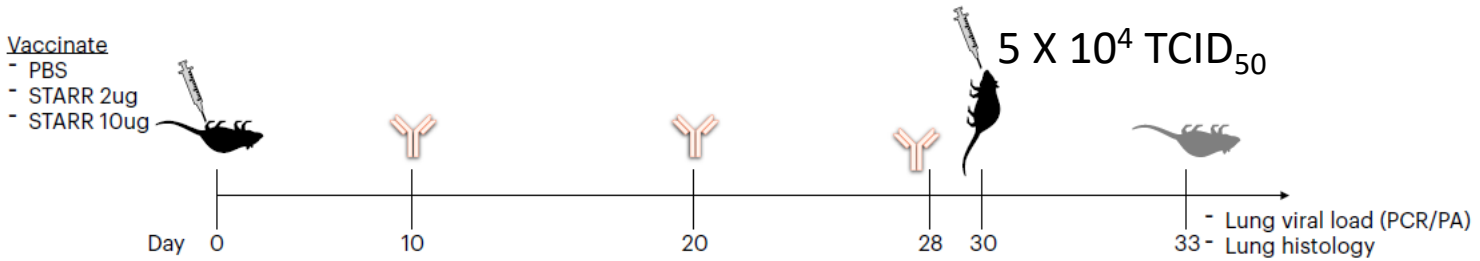


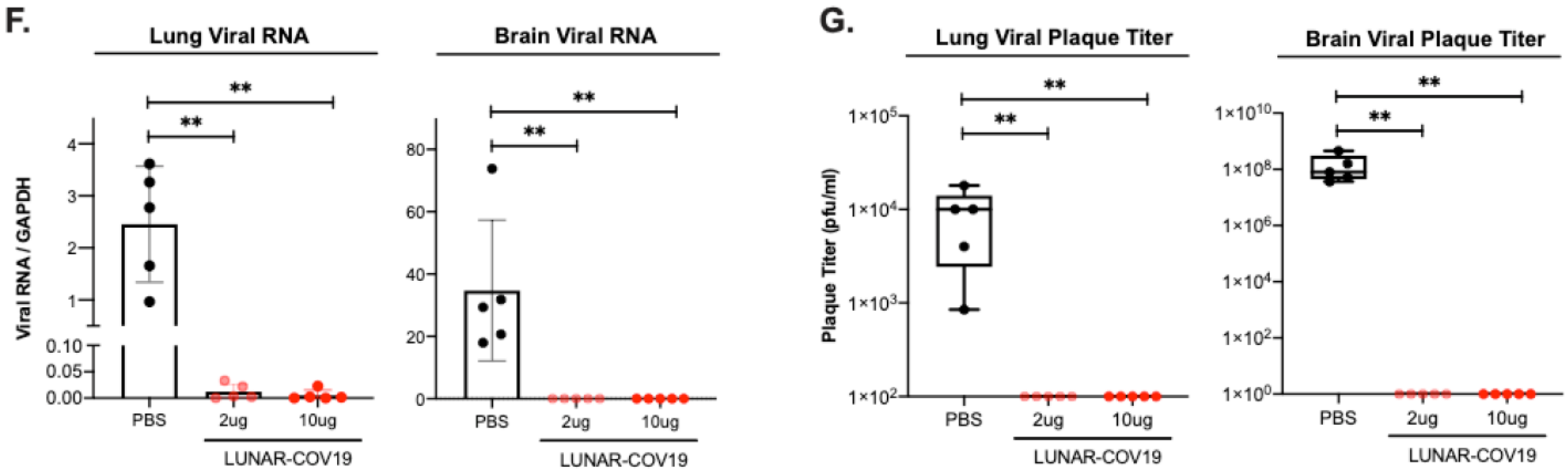


LUNAR-COV19 vaccination protected from SARS-CoV-2 infection for 14 days post viral lethal challenge

Vaccinated mice showed no sign of infection based on body weight, clinical scores and behavior

No Viral Infection Detected in LUNAR®-COV19 Vaccinated Mice





Neither detectable viral RNA nor infectious virus in lungs or brain of transgenic mice 5 days post viral challenge

LUNAR®-COV19 Data

Strong Efficacy Profile in Animals

- Superior humoral and cellular immunity compared to conventional mRNA
- Seroconversion Rate (Day 19, 2 µg dose): STARR™ mRNA (100%) vs. conventional mRNA (0%)
- Neutralizing antibody titers > 300 after single administration of 2 µg
- Neutralizing antibody titers continue to increase thru Day 50
- Strong T-cell response: Robust CD8/CD4 response
- Challenge model studies in transgenic hACE2r mice positive; effective protection

Promising Safety Profile in Animals

- Balanced Th1/Th2 cellular immune response *minimizes* potential for undesired immune responses - important to mitigate risk of VAERD (Vaccine-Associated Enhanced Respiratory Disease)
- Lower dose expected to yield *lower* injection site reactions (ISRs) and *less* systemic reactogenic events

Promising Human Safety Profile of LUNAR® Delivery Technology

- Arcturus has clinically-dosed mRNA systemically in its LUNAR®-OTC program at doses > 10,000 µg with no severe or serious AEs reported

Preclinical data expected to translate to human clinical testing, i.e. superior to conventional mRNA vaccines

LUNAR COV-19 Vaccine Clinical Development

Clinical Development Plan

Phase 1/2 Clinical Trial

Human Dosing Initiated August 11; Enrollment Now Complete

- Phase 1/2 clinical trial at single site: Duke-NUS Medical School in Singapore
- All cohorts (1 µg, 5 µg, 7.5 µg, 10 µg) completed dosing; two doses regimen ongoing

Primary Goal: Identify optimal dose
Primary Endpoints: Safety and tolerability
Secondary Endpoints: Measures of immunogenicity and virus neutralization

Also evaluating T-cell responses (CD4+,CD8+ and Th1/Th2 and epitope mapping)

Study Design:

- Randomized, placebo-controlled, blinded
- Dose regimens: single dose, two doses separated by 28 days
- Healthy volunteer adults (younger and elder groups included)

Clinical Development Plan

Phase 1/2 Clinical Trial Preliminary Results

Human Dosing Initiated August 11

- 106 subjects enrolled including older subjects
  - 78 subjects received single injection
  - 36 subjects received two injections
  - 28 subjects received placebo

Preliminary Optimal Dose:

5 µg to 7.5 µg

Preliminary Tolerability and Safety:

Generally well tolerated with favorable local and systemic adverse event profile

Preliminary Secondary Endpoints:

- All subjects showed robust anti-spike IgG immune response
- Anti-spike IgG titers have been dose dependent and increased through day 43 post vaccination
- PRNT 50 GMT neutralizing antibody titers were within the range of titers observed in COVID-19 patient convalescent sera
- ELISpot tests showed T cell responses to multiple peptide pools derived from SARS-CoV-2 spike glycoprotein
- CD4+ response was Th1 dominant

Clinical Development Plan

Next steps

Phase 2 Study (safety, immunogenicity) in adults is advancing to clinic shortly

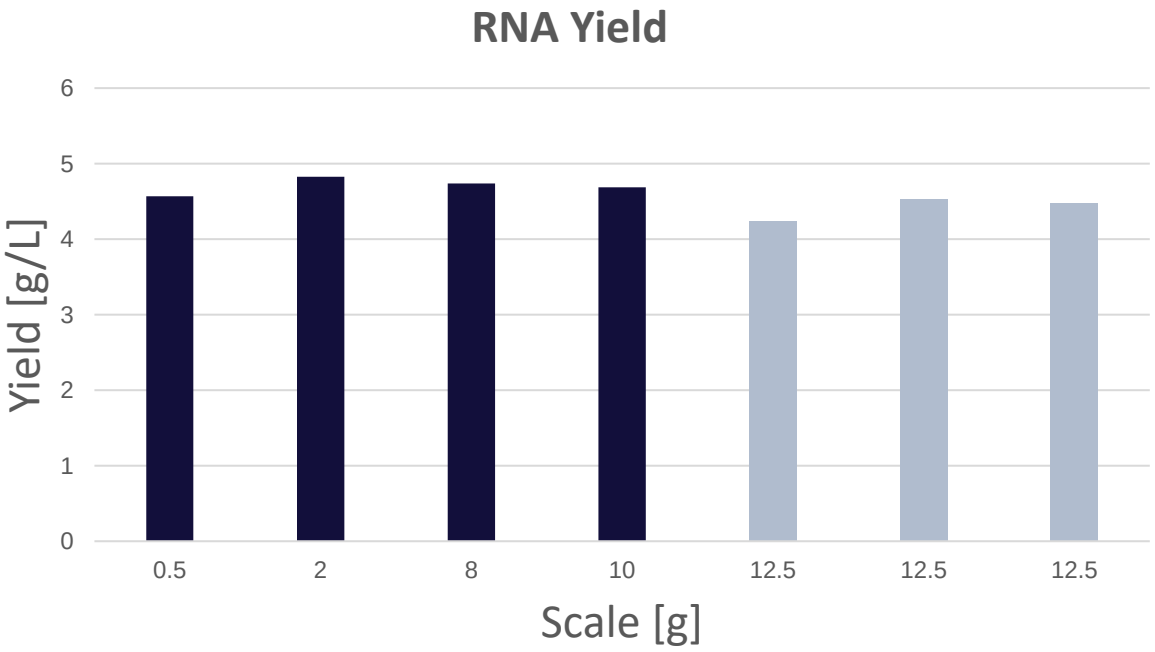
Phase 3 Study (efficacy, safety) in adults to follow interim analysis of Phase 2

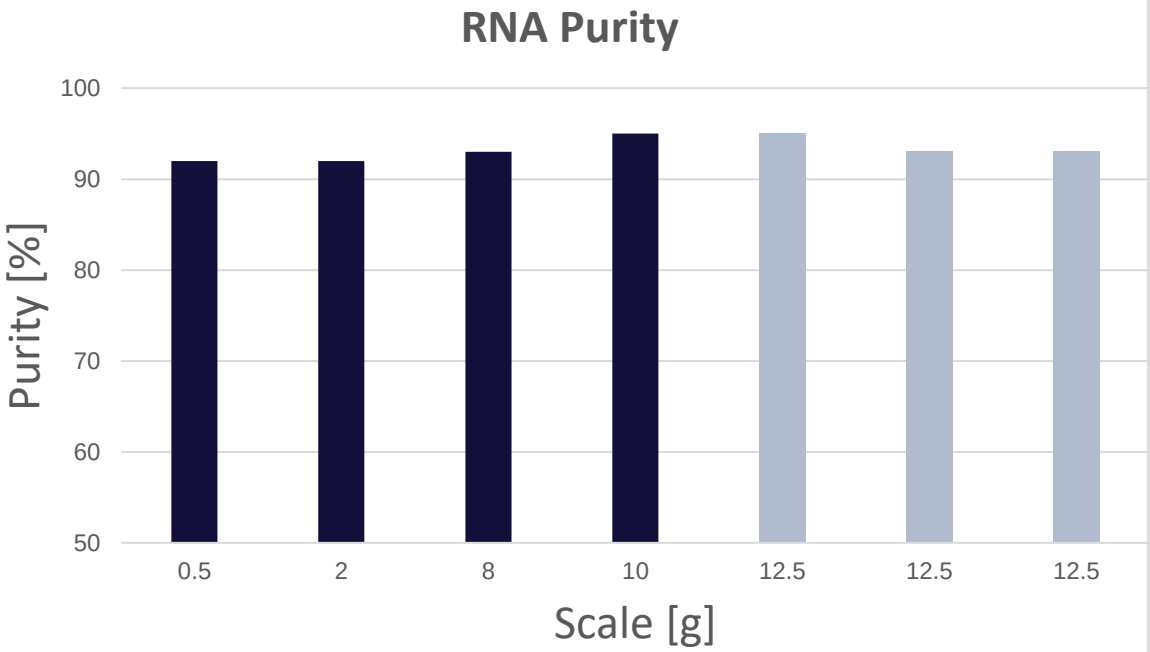
Phase 1/ 2 Study (safety, immunogenicity) in children under development

Manufacturing:
Drug Substance & Drug Product

Drug Substance: (mRNA) Manufacturing

BUILDING INNOVATIVE
RNA MEDICINES





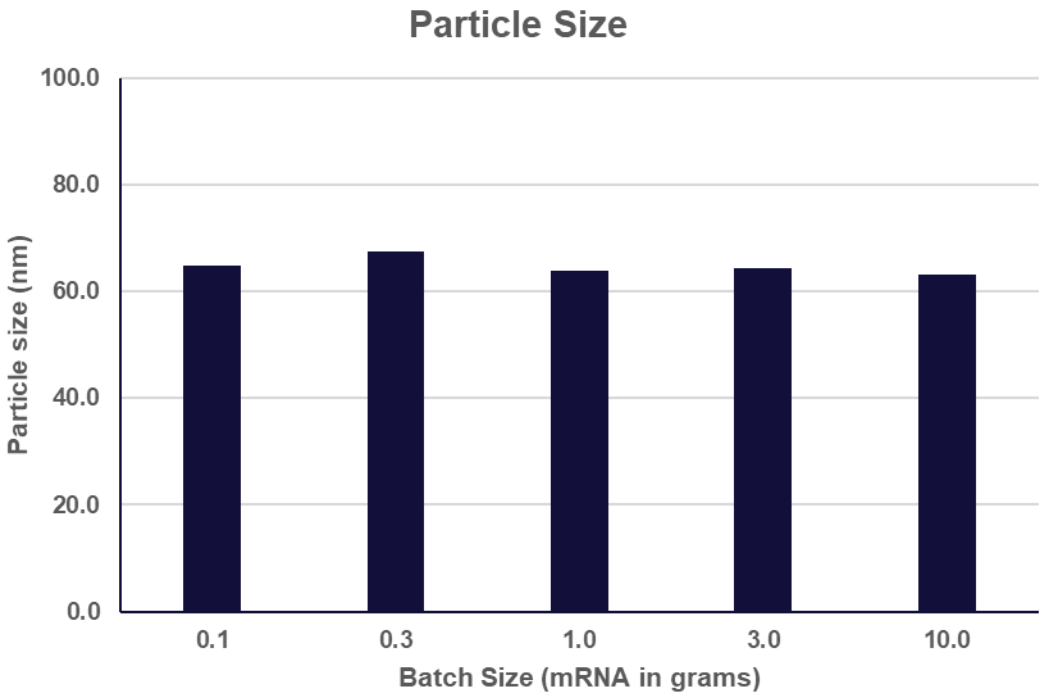
Non-GMP Lots Produced at Arcturus

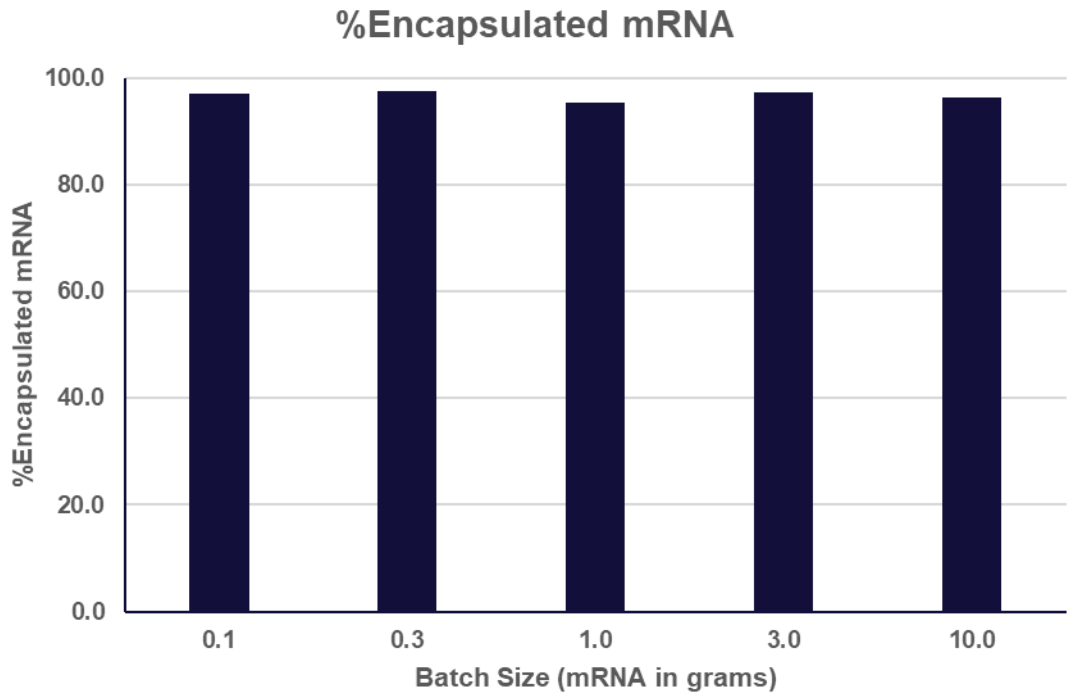
GMP Lots Produced at CMO as part of recent GMP campaign

Three 12.5 g lots produced in recent GMP campaign are of equivalent quality and yield

Drug Product: (LUNAR® + mRNA) Manufacturing

BUILDING INNOVATIVE
RNA MEDICINES

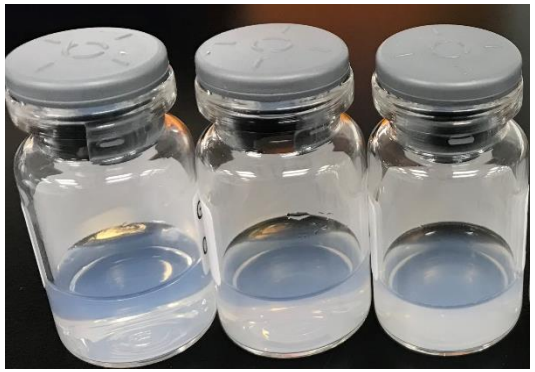




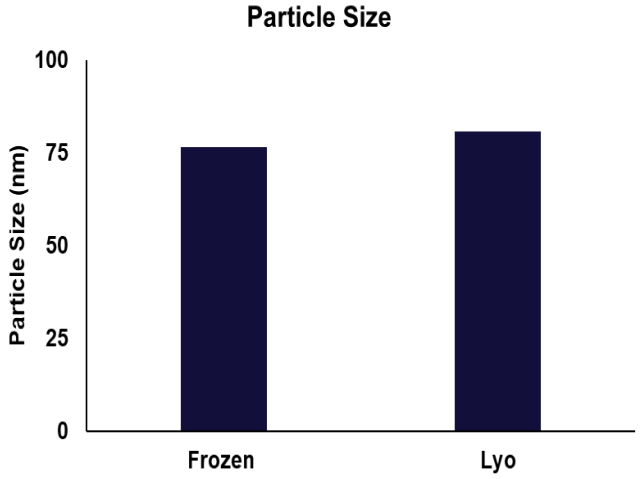
- **Manufacturing of Drug Product Demonstrated up to Multigram Scale with Yields ≥ 85%**
- **GMP Batch of LUNAR®-OTC (ARCT-810) Drug Product Manufactured and Released**

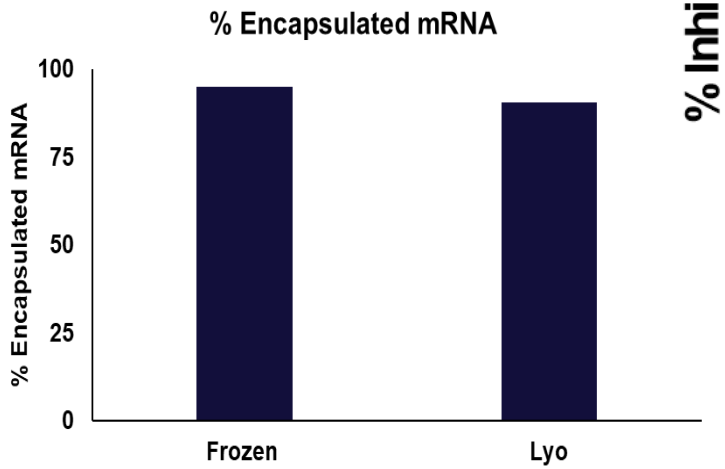
Lyophilized ARCT-021

Lyophilized

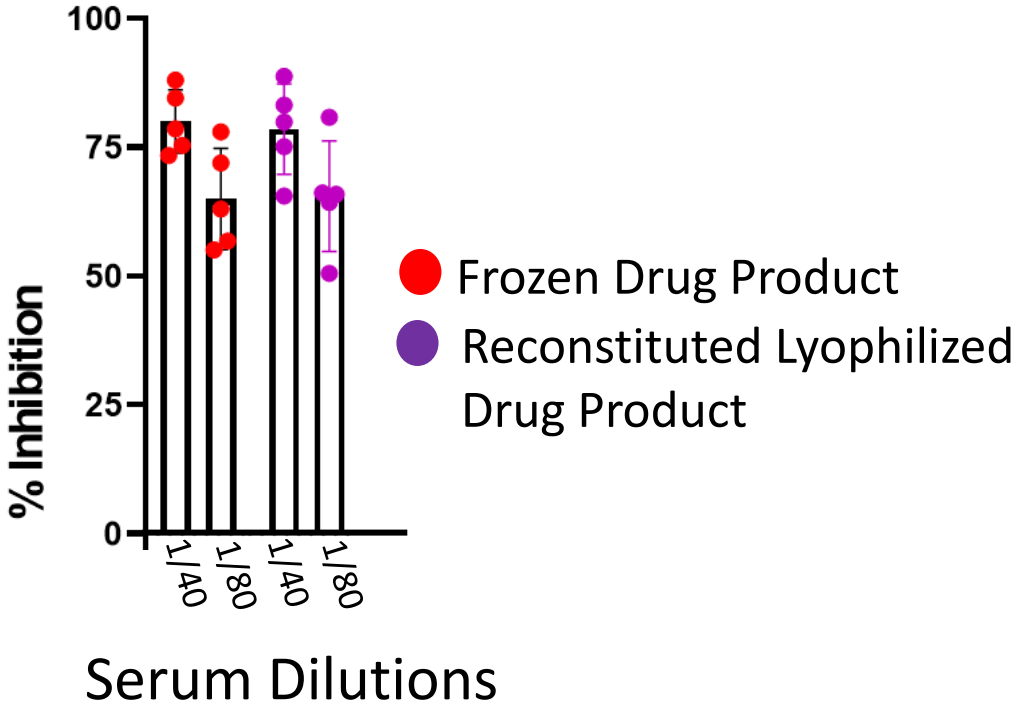


Reconstituted





Inhibition of Receptor Binding Domain



- Lyophilized ARCT-021 maintains key physicochemical properties
- Lyophilized formulation yielded equivalent mouse neutralizing antibody titers based on inhibition of ACE2 receptor binding assay (surrogate neutralizing antibody titer assay)

BUILDING INNOVATIVE RNA MEDICINES

LUNAR-COV19 Data Summary

- **Very low dose:** Strong neutralizing antibody response with just a single dose of 0.2 – 10 μg STARR™ RNA
- **Strong humoral response**: continuous increase in neutralizing antibodies beyond Day 60
- **Strong T-cell response:** dose response increase in IFN-g positive $CD8^+$ T-cells
- **Complete protection** against viral lethal challenge 30 days post single vaccination
- **Balanced cellular immune response** – minimizes potential for enhanced respiratory disease (ERD) and lower dose may yield lower local and systemic reactogenic events suggesting a promising safety profile
- **Superior** immunogenic profile of STARR™ compared to conventional mRNA
- **No virus material, adjuvants, preservatives or antibiotics:** reduces public concerns

Arcturus LUNAR-COV19 is a most promising COVID-19 vaccine

Acknowledgements

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