



### Human Age Reversal through Mitochondrial Transplantation

Investor Presentation 2022

Copyright © 2019-2022 Mitrix Bio Inc. All Rights Reserved.

# True Human Age Reversal Using Mitochondrial Transplantation

Primate/human trials commencing 2023



## Why Mitochondria for Human Age Reversal?



- Reduced energy production
- Slower regeneration of vital metabolic systems
- Cellular Senescence



Mitochondrial dysfunction:

> 50% of human biological aging

Younger mitochondria = better function and younger phenotype



# **Solution: Mitochondrial Transplantation**

### External Mitochondrial Transplantation:

Mitochondria in solution

Inject into body

Restore cellular energy

Tissues grow younger

Aging (and disease) reversed





Stem cells and extracellular vesicles in the bloodstream transfer mitochondria routinely



# **Originally Discovered at Harvard**

"... mitochondrial transfer is an evolutionarily-conserved and pervasive biological process..."

- McCully et al Nature 2017, Harvard University -

# Dying Heart Restored to Life in Novel Experiments

Tissues thought to be hopelessly damaged, like the heart and brain, can be revived.

- The New York Times – July 2018

### Improvement of Cognitive and Motor Performance With Mitotherapy in Aged Mice

Mitotherapy significantly improved cognitive and motor performance.

- Int J Biol Sci – 2020

### Team Demonstrates Ability to Supercharge Cells With Mitochondrial Transplantation

Mitochondrial transplantation could one day be employed to cure various cardiovascular, metabolic and neurodegenerative disorders—and even cancer.

- Medical X press – March 2020

### Intercellular Mitochondrial Transfer as a Means of Tissue Revitalization

It may catalyze tissue revitalization and homeostasis and tumor suppression.

- Sig Transduct Target Ther - 2021



# Mitlets - Nature's Fountain of Youth, Discovered by Mitrix

- 100s of billions of extracellular vesicles containing mitochondria (mitlets) travel in the human bloodstream. Discovered by Mitrix scientists in 2014.
- Constantly trading mitochondria between similar tissues to sustain "youth"
- Dozens of disease-specific varieties now uncovered: neural, cardiac, platelet (immune system) and more





## **Scaling Up Solution**

### **Mitlet Production in Bioreactors**



1. Get source of Stem Cells

Young mitochondria in stem cells, matching patient's haplotype → From cord blood or placenta 2. Grow and Encase

Expand stem cells in bioreactor→ Extract mitochondria → Encase in protective membranes + receptors 3. Transport and Transfuse

Ship to treatment centers  $\rightarrow$ 

Transfuse via IV or directly to specific organs



# **Proof of Concept - Immune System Age Reversal in Mice**

### 1. Transplanted Mitlets Taken Up Preferentially by Immune Cells



Mitlets injected into mice were quickly absorbed by platelets, leukocytes, bone marrow, and spleen.

### Mitlets with fluorescent mitochondria





Mouse Monocyte 60 min Mouse Monocyte 24 hours

Over time the glowing mitochondria were absorbed by cells, increasing energy

### 2. Mitlets Fight Sepsis

- 13 mo mice infected with sepsis, injected with mitlets from 1 mo old mice
- Survival improved 3X
- Bacterial count reduced 12X



- Mice infected with H1N1
- Measured cytokines at day 1, 3, 7.
- Survival, healthy, bronchial fluid at termination





## **Proof of Concept – Animal Age Reversal in Mice**

Mitrix Lab September 2021

• 7 liver mitochondria injections

• 14 young plasma injections

• 5 mitlet injections

### **Obvious signs of youth**

- Fast fur regrowth
- Rotarod improvements demonstrate
  stronger muscles/cognition
- Almost immediate improved activity







# **Proof of Concept - Mitochondrial Absorption in Retina**

### Mitochondria are central in retinal cell function and survival:

- 1. Retinal Mitochondria are particularly susceptible to **oxidative damage** with aging.
- 2. Many age-related retinal diseases have been associated with mitochondrial dysfunction.

### **Stanford: Mitochondria Transplanted into Retina** subretinal/intravitreal injection



- Mitochondria from injection migrate into retina
- 2. Mitochondria are absorbed by RPE cells and tissues nearby
- 3. Potential to regenerate retina and prevent macular degeneration (most common form of age-related blindness)

retinal pigment epithelium

**Red dots:** 





## **Age Reversal in Primates Then Humans**



### In 3 most critical areas of body

**Immune system** - IV injections of mitlets to restore youth, prevent occurrence of cancer. Indications: Sepsis, Covid, CAR-T therapy. **1 year.** 

**Retina** - Intravitreal injections of mitochondria by expert retinal surgeon. Initially patients with progressive blindness (compassionate use), then expand. **6 months.** 

**Skin** - Hundreds of tiny mitlet micro-injections by expert plastic surgeon to make skin biologically younger, eliminating wrinkles and age spots. **1 year.** 

Muscle (optional) - injections into small muscles. 1.5 years.

When? Primate tests start mid-2023, Human late 2023

FDA clinical trials on specific indications











# **Prerequisite to Other Longevity Therapies**



Mitrix delivers healthy mitochondria critical to the outcomes of multiple new longevity therapies



# Mitrix will be a Key Partner for all Rejuvenation Players



quadraScope

Courtesy Quadrascope.com

### Mitrix Has the Best Odds of a Breakthrough <u>Now</u>

Mitrix Model	Mitrix Target	Mitrix Approach
Elderly primates/Humans are 70- 80% mitochondria-limited	Mitochondrial repair should be      highest priority      for Longevity	The first to focus on aging- related mitochondrial transplant
Other Models	Other Targets	Other Approaches
Elderly mice only 30% mitochondria-limited, not useful for human aging research	ALTOS UNITY EIGTECHNOLOGY Cellular Reprogramming and Senolytics <u>may run into</u> <u>problems</u> if mitochondria are not fixed first, and their mitochondrial repair efforts are less proven	minovia mitobridge CELLVIE These other firms aren't focused initially on aging, or they use techniques that are several years behind



### **Broad Intellectual Property Strategy**



### Patents

- Encapsulated mitochondria as a therapy
- Bioreactor as a system to grow mitochondria
- Patents for various indications: AMD, brain, liver, heart, pancreas, kidney, immune system, etc.



INTELLECTUAL PROPERTY LAW

Same attorney who handled stem cell patents for 2012 Nobel-prize winner Dr. Shinya Yamanaka



### **Science Advisors**



Michael Snyder, PhD Science Advisor





Thomas Rando, MD, PhD Science Advisor





Tom Benson CEO

Eric Boilard, PhD

**Principal Investigator** 

université LAVAL



**Executive Team** 

Benedict Albensi, PhD Principal Investigator





Martin Pelletier, PhD Asst Principal Investigator





Vinit Mahajan MD PhD Principal Investigator



George Wu, MD PhD Principal Investigator





# **Roadmap to Commercializing the Platform**



## **Executive Summary**

- First-ever trials of true Human Age Reversal
- Breakthrough mitochondrial transplantation platform
- Crucial partner for the entire longevity medicine space
- Expert executive team with world class Scientific Advisory Board
- Opportunity to invest in \$45mm Series A round



Disclaimer: all concepts in this document are unproven and preliminary. Not yet tested or approved for human use.

Copyright © 2019-2022 Mitrix Bio Inc. All Rights Reserved.

