Innovative Biomaterials Solutions to Preserve Vision

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Disclosures

- Patent Applications, OSU
- Equity Interest & Consulting, Vitranu

The Journey to Treatments for AMD

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Vice Chair of Innovation and Technology
Irene D. Hirsch Chair in Ophthalmology
Chief Medical Officer, Vitranu, Inc.

Millions of patients are receiving frequent injections to treat wet age-related macular degeneration (AMD)

2017
Ohio Lions Eye Research Foundation
Lois Hagelberger-Huebner Young Investigator Award

OHIO LIONS EYE RESEARCH FOUNDATION
RESEARCH TODAY...
VISION TOMORROW

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Clinical Need – Reduce Injections

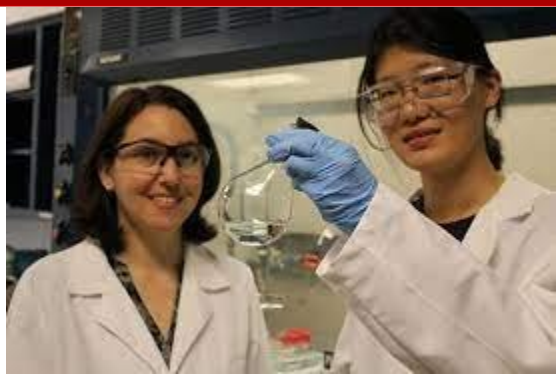
Design Criteria

- Injectable
- Sustain release >6 months
- Protect/maintain activity of therapeutic
- Biodegradable

How can we help these patients?

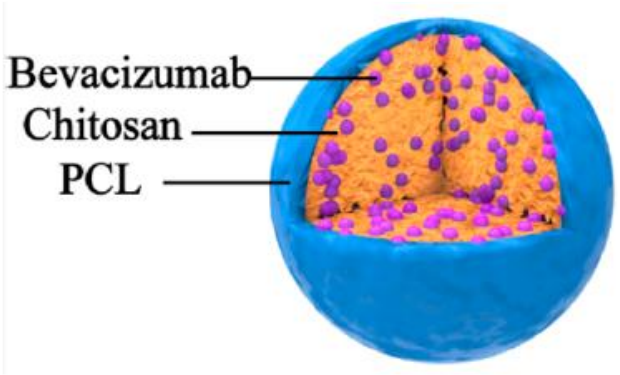
Ocular Drug Delivery Research

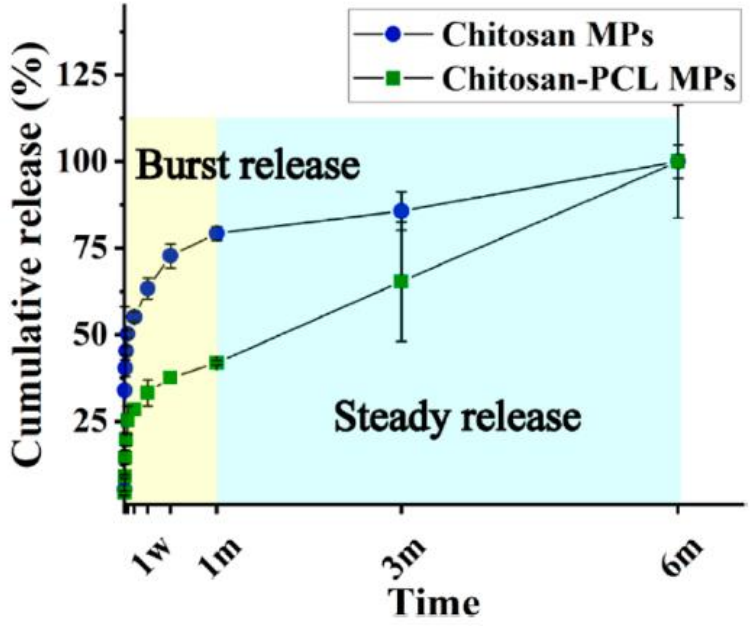
- Intravitreal drug delivery systems for AMD
- New anti-inflammatory therapeutics for retinal diseases
- Tunable hydrogels for corneal delivery
- New treatments for ocular trauma and optic neuropathy



Pengfei Jiang supported by OLERF
MS CBE 2018
PhD CBE 2020
Currently Program Leader at PTC Therapeutics

First Approach - Microparticles

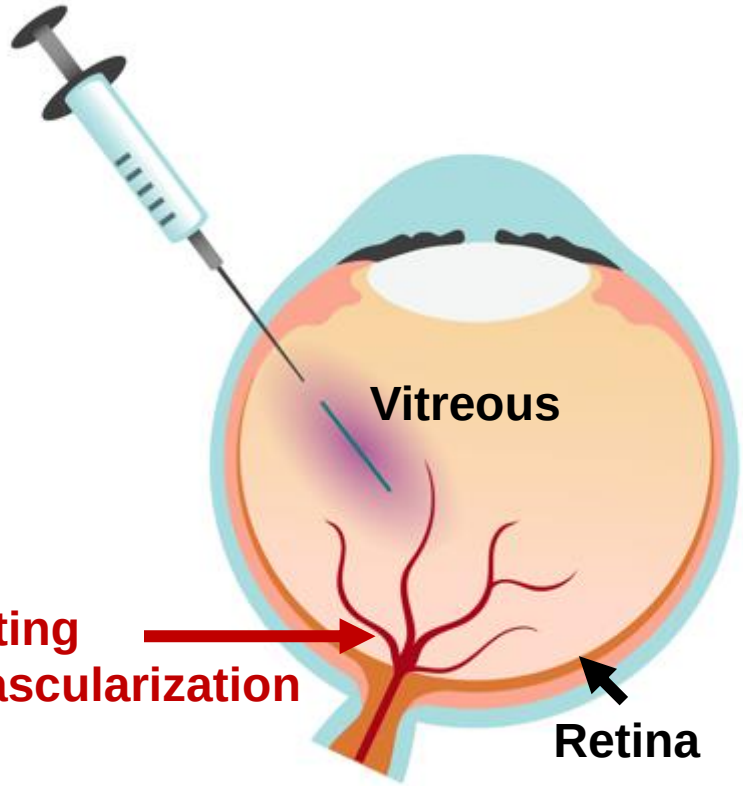




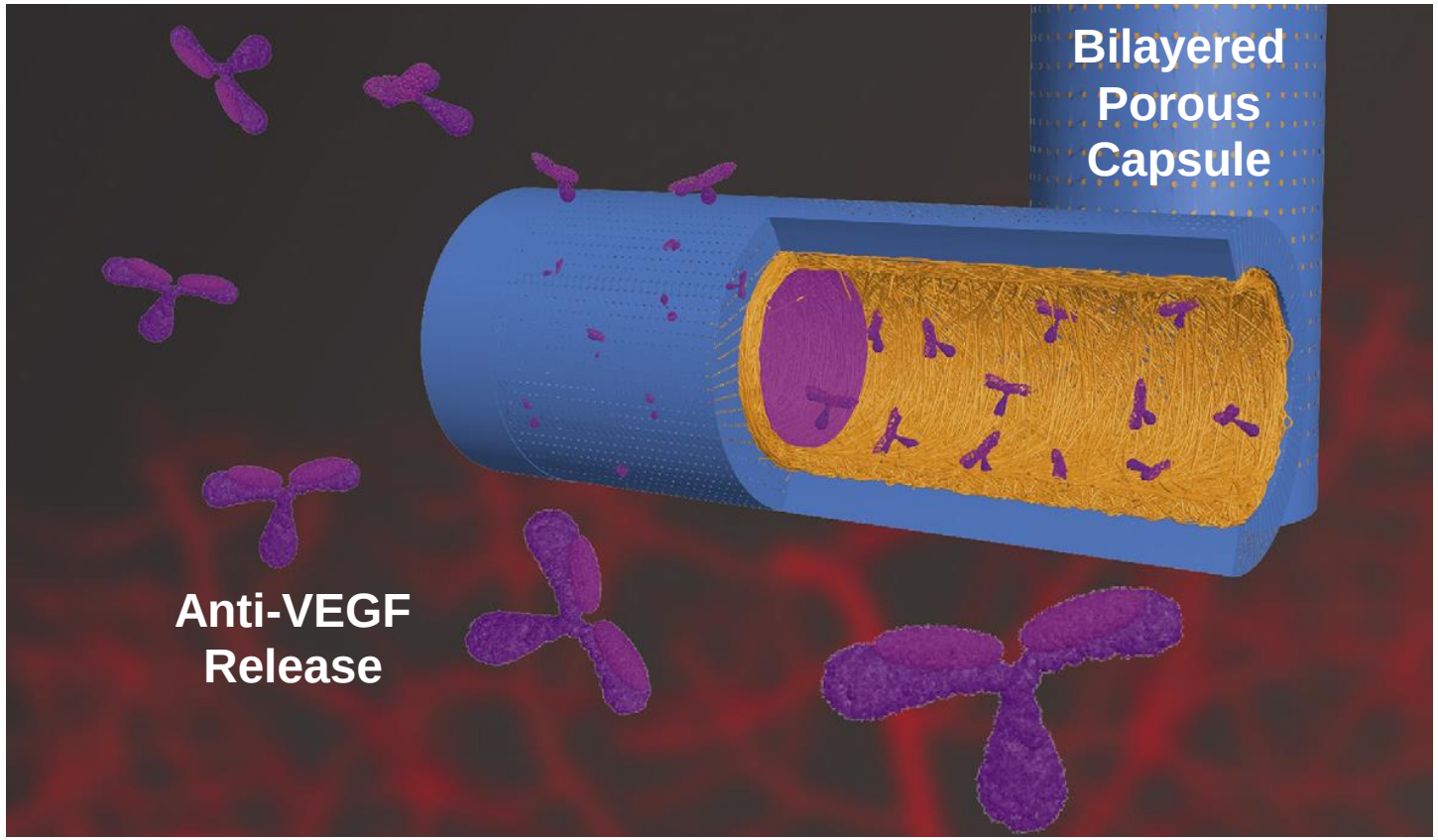
Anti-VEGF loaded inside injectable polymer particles
Release lasted up to 6 months

Jiang et al. Mol. Pharm. 2020

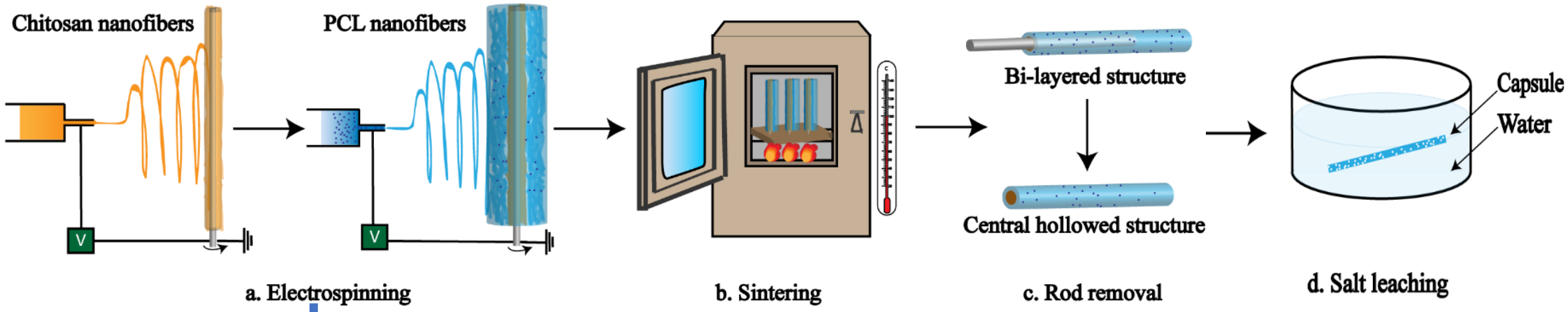
Drug Delivery System Design

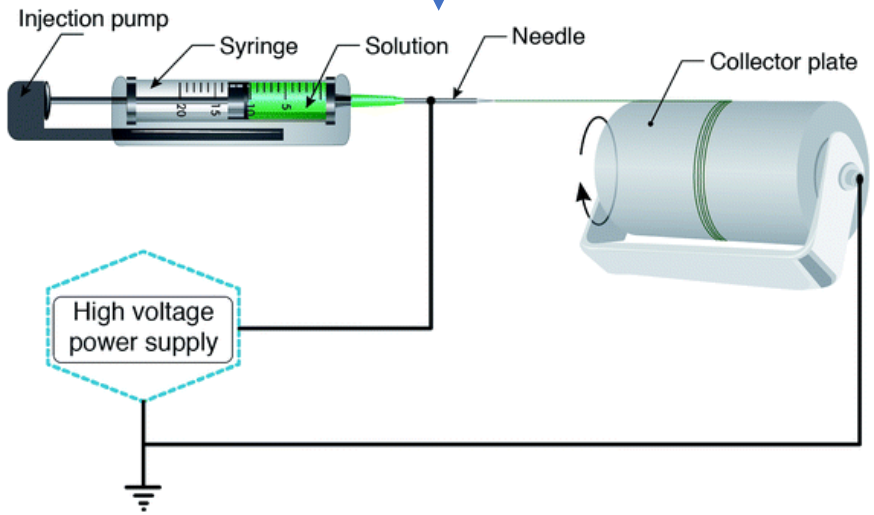


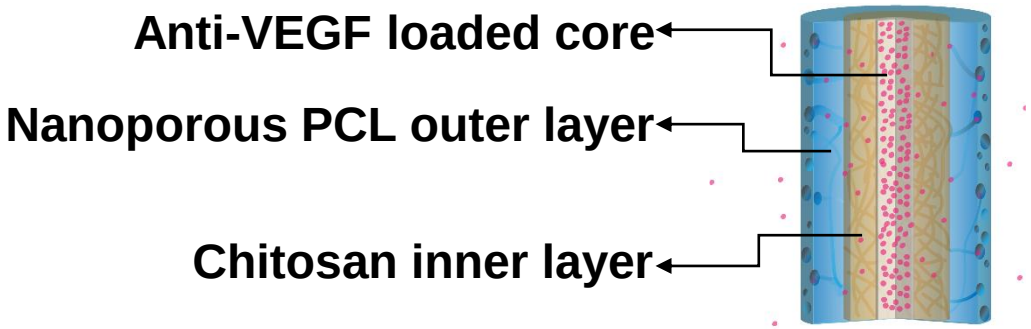
Journal of Controlled Release 320:442-56 (2020)



Capsule Fabrication

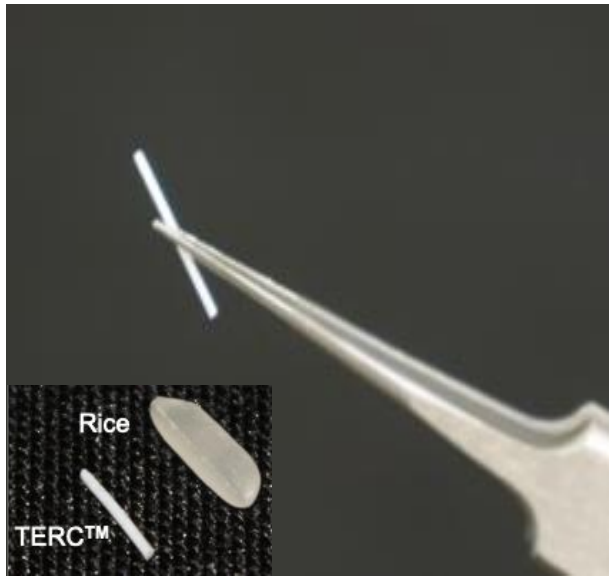






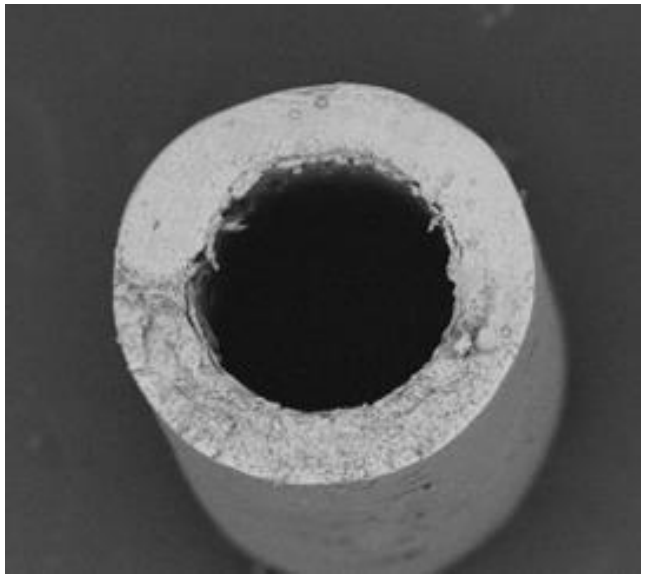
260 μm (<1 mm) diameter

Capsule Structure



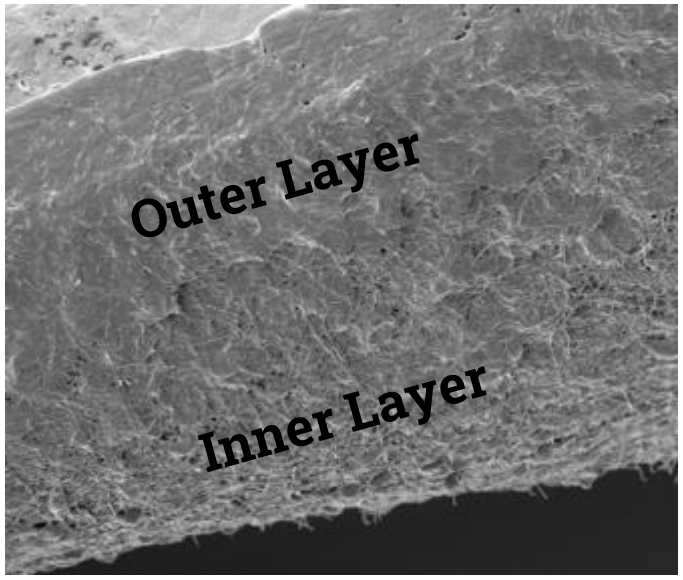
TERC™ prototype
260 µm diameter

Injectable



Hollow lumen for
drug loading

High drug loading efficiency/protection

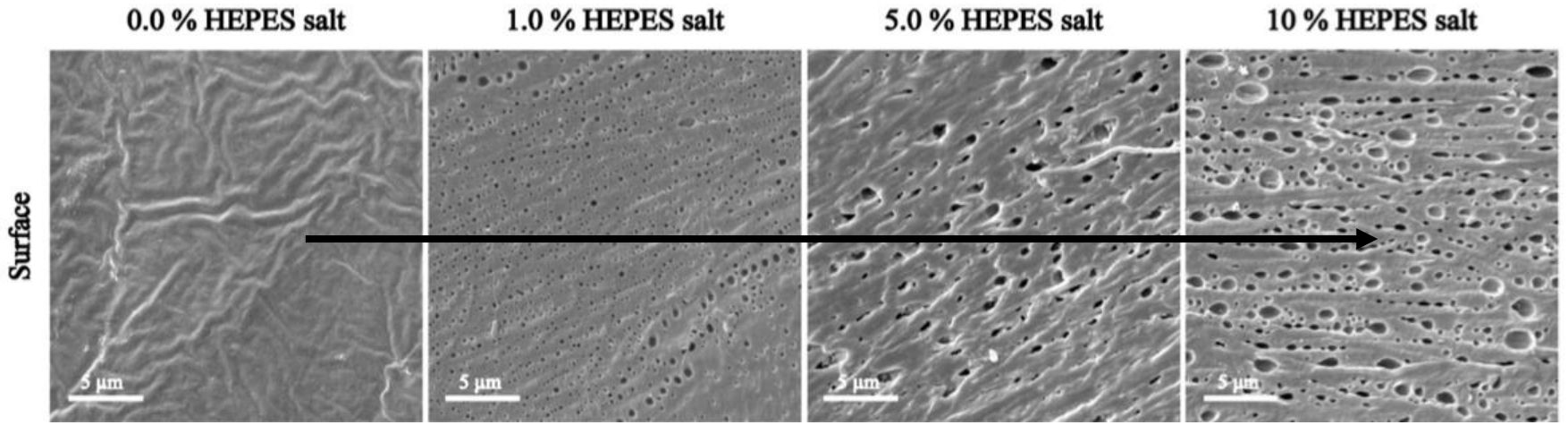


Bi-layer design and
pore size controls
release

Tunable and biodegradable

Sustained Therapeutic Release

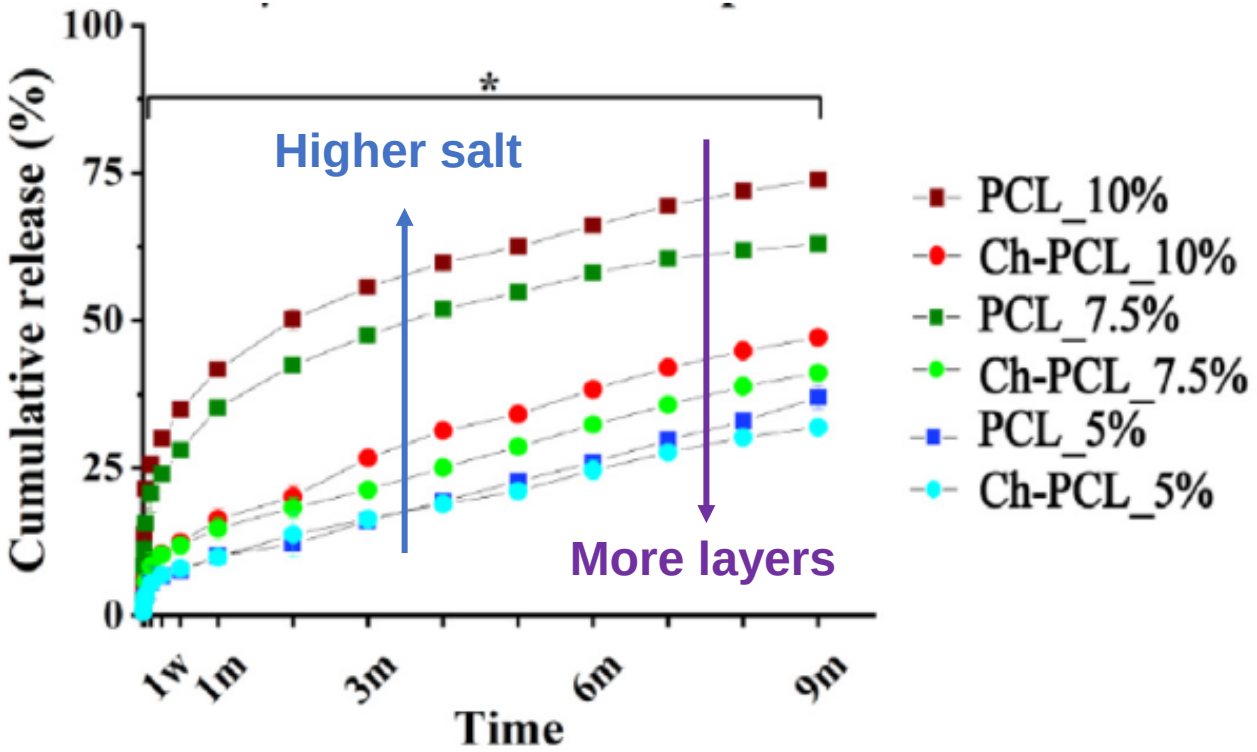
Increasing HEPES salt results in more pores in outer layer
→ faster release



Long-term anti-VEGF release
>6 months

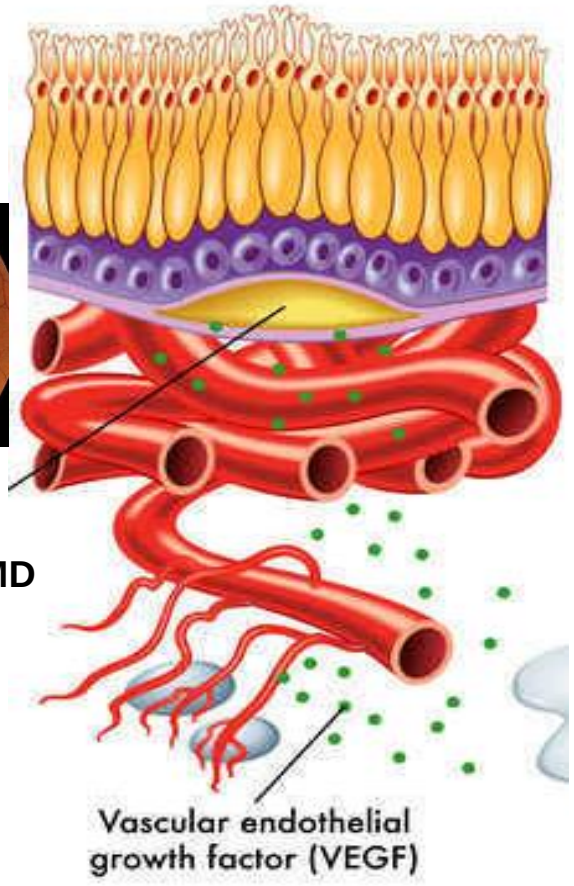
Uniform release after 1 month

Therapeutic activity maintained >9 months *in vitro*



New Therapeutic Approaches

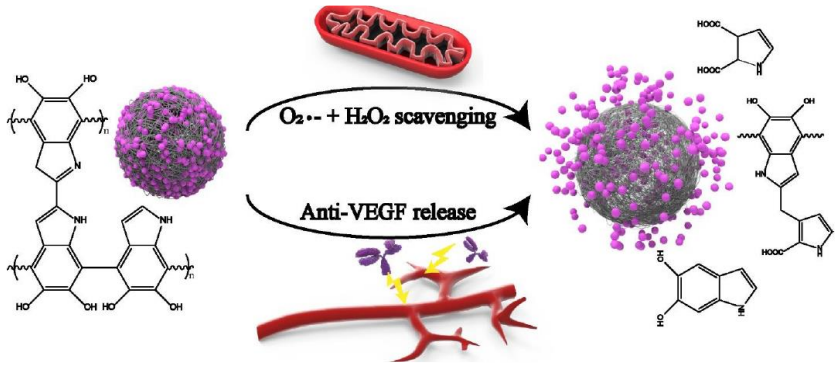
Yellow drusen
Early sign of AMD



Dry AMD (early stage – geographic atrophy)

- Oxidative stress (ROS) level increases
- Inflammation increases
- Aggregation of polyunsaturated fatty acids and proteins (drusen)

Redox-Responsive Nanoparticles



New Anti-Inflammatory Therapeutics

Nanoparticles as potential combinatorial therapy (VEGF and ROS pathways)

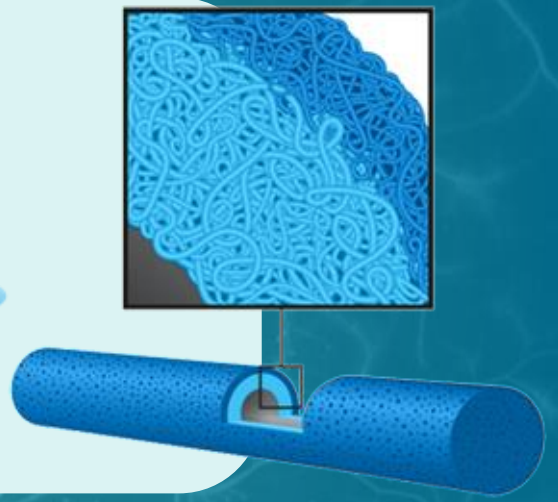
Jiang et al. Nanoscale. 2020
Allyn et al. Biomaterials Science. 2022

Katelyn Swindle-Reilly, PhD
Chief Technology Officer

Matthew Ohr, MD
Chief Medical Officer

Tunable Extended-Release Capsule (TERC)™

VITRANU



Robin G. Sears
Executive Chairman

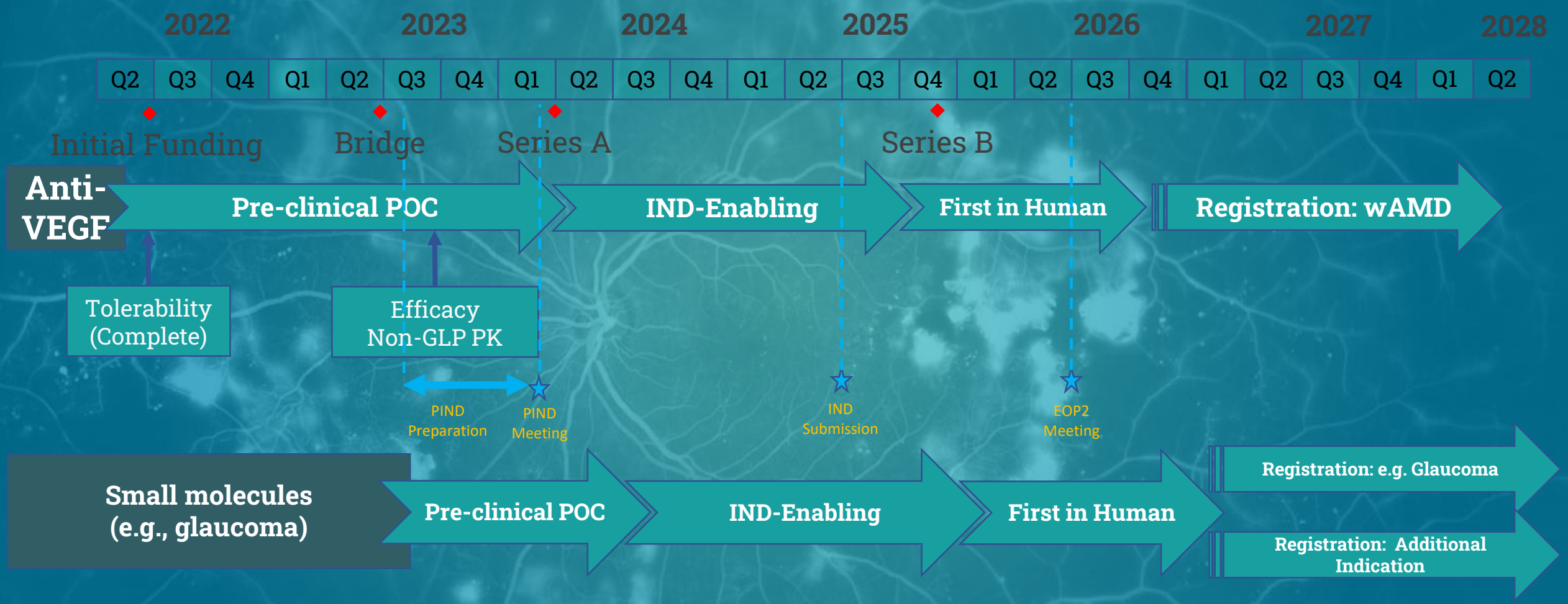
Brad Beasecker
CFO

Gordon Bethwaite
CEO

Project Timeline: Inception to Present

VITRANU

Projected Path



Approval for anti-VEGF delivery via **351(a) Biologics License Application (BLA)**
Approval for small molecule delivery via **505(b)(2) New Drug Application(NDA)**

Acknowledgements

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Currently advising 2 postdocs, 3 PhD students, 4 BS students

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Institute for Materials Research
Materials Science and Engineering
Ophthalmology & Visual Sciences
Optometry
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Research Today... Vision Tomorrow

IMR Institute For Materials Research

Department of Defense

NIH National Eye Institute

Owen Locke Foundation

TechOhio The Voice of Ohio Third Frontier

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