



Emerging Trends in Regenerative
Medicine and Aging

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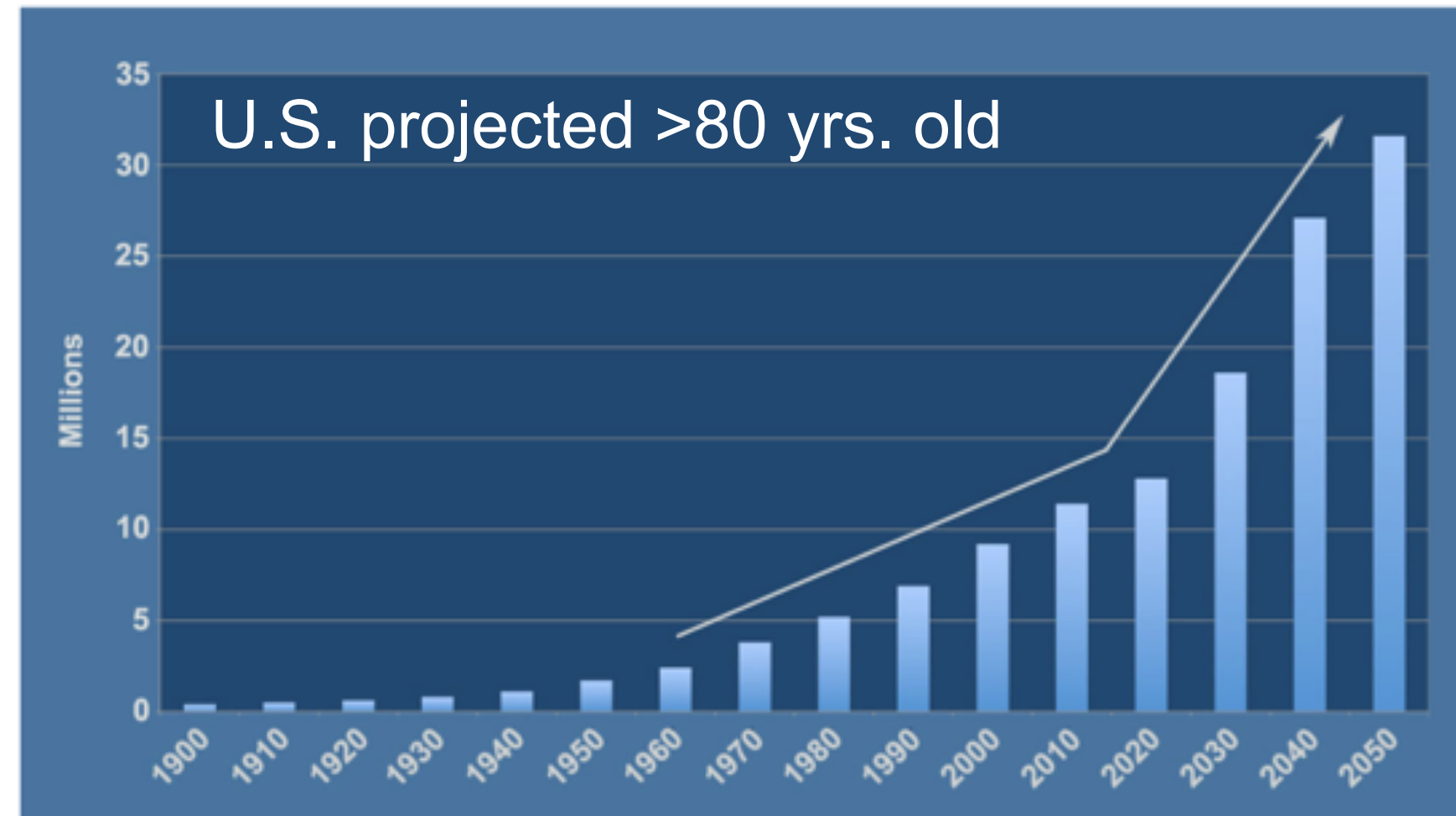
May 24, 2017

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The Market

Aging: The demographic trend of our time

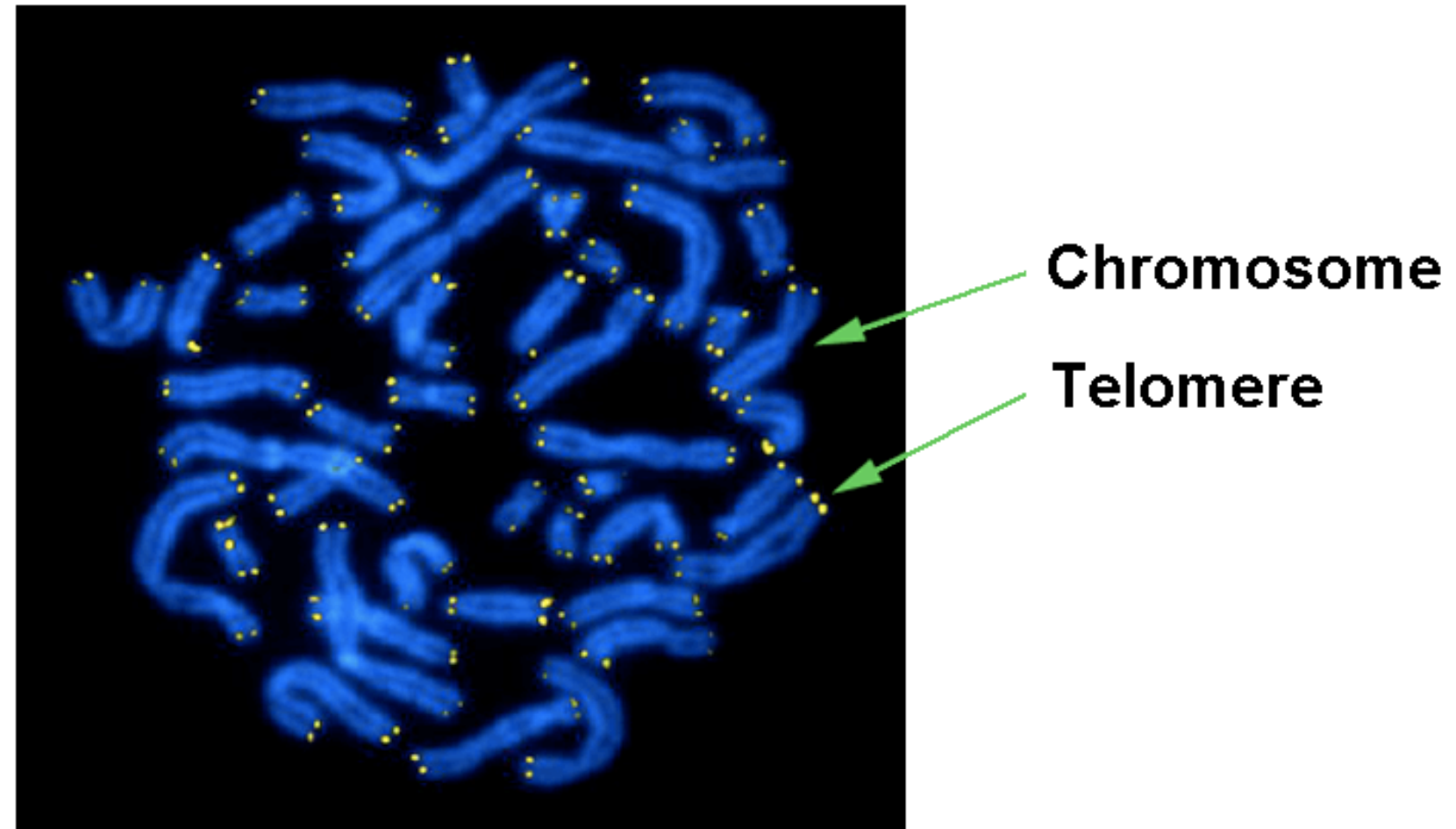


- 80% of \$2.5T health care costs associated with chronic disease
- 92% elderly have one chronic disease, 77% two or more

The Telomere Clock of Cell Aging

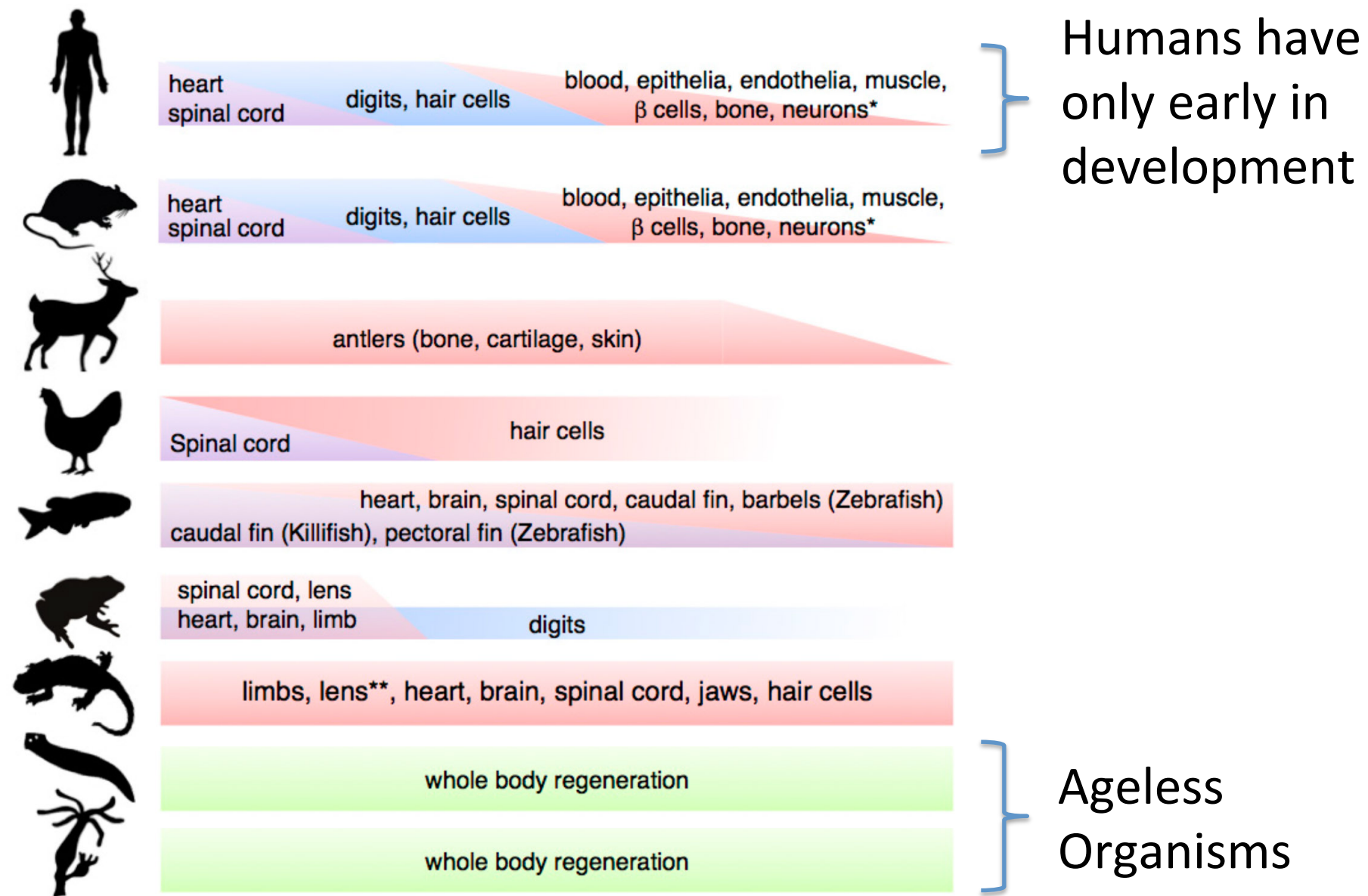
- Telomerase is normally off in most cells in the body that age so that telomeres shorten (i.e. telomeres function as a clock of cell aging).
- The telomerase gene is capable of immortalizing human cells.

Science 1994 Dec 23;
266(5193):2011-5



Telomerase & Regeneration

Animals that have telomerase expression and full regenerative potential do not age



Int. J. Mol. Sci. 2015, 16, 25392-25432

Regeneration & Pluripotency

Tissue Regeneration



1

Spinal Injury

2

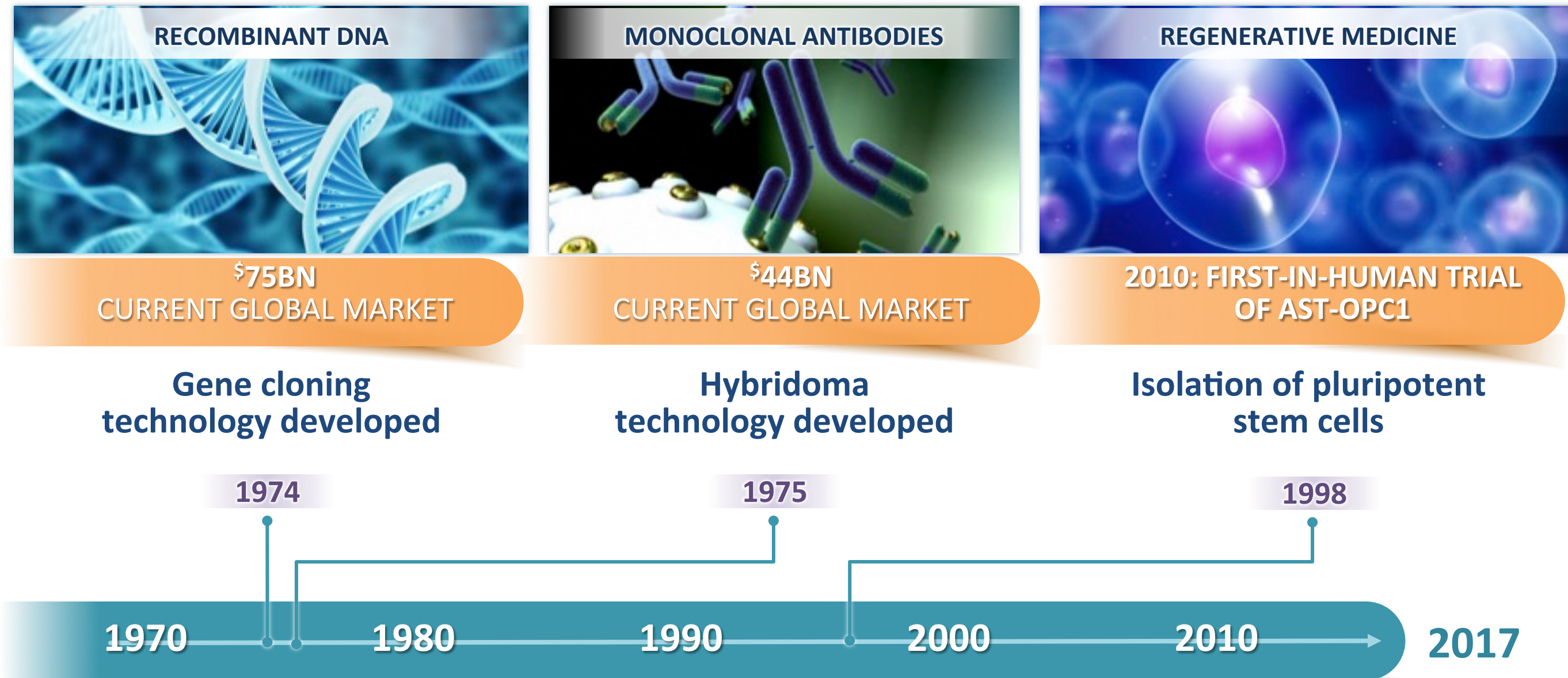
Macular
Degeneration

3

Heart Disease

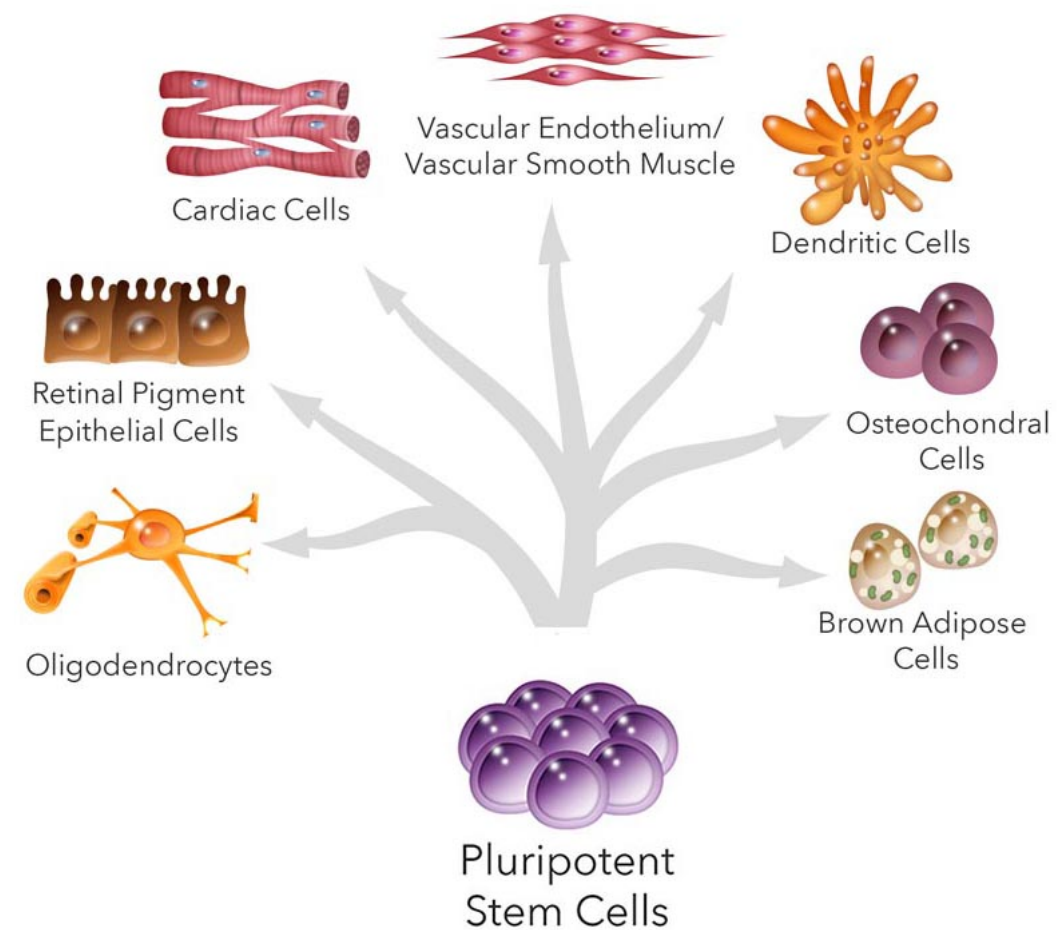
Imagine the future of medicine when therapeutics could unlock the potential of the human body to simply regenerate following trauma or degenerative disease

Regenerative Medicine is *the* Platform Technology for Aging



BioTime's Platform

Pluripotent [Cell-Based Therapies]



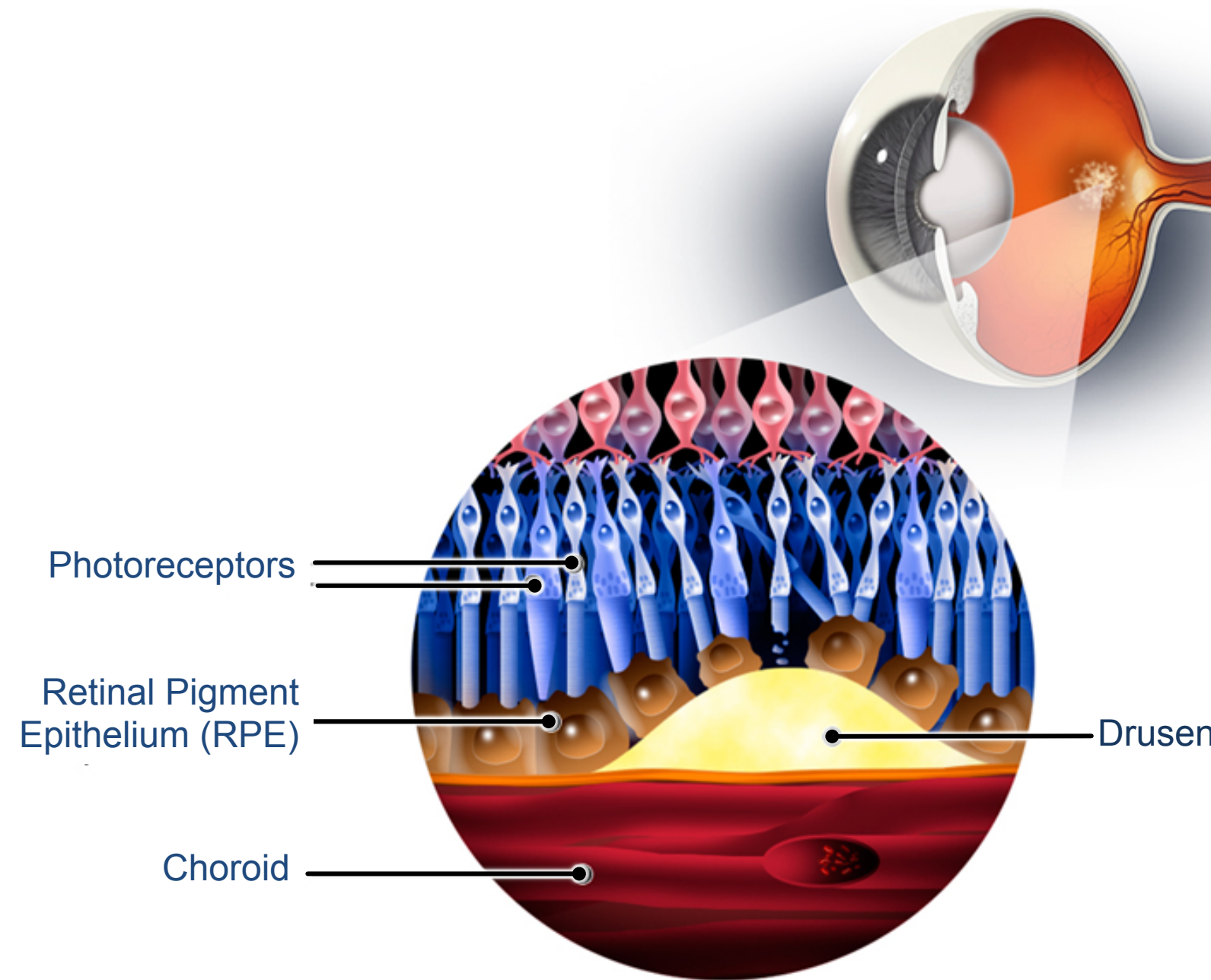
- Pluripotent Stem Cells (PSCs) allow the manufacture of all young human cell types on an industrial-scale
- Our clinical-grade master cell banks of PSCs propagate indefinitely as a source of product (are immortal)

HyStem® [Cell Delivery Matrix]



OpRegen[®]: Known Mechanism of Action

DRY AGE-RELATED MACULAR DEGENERATION (DRY-AMD)



Loss of RPE cells in the eye may cause both dry or wet AMD

The leading cause of blindness in people over age 60

Off-the-shelf injection as a one-time therapy

OpRegen[®] cells integrate into subretinal space to replace missing RPE cells

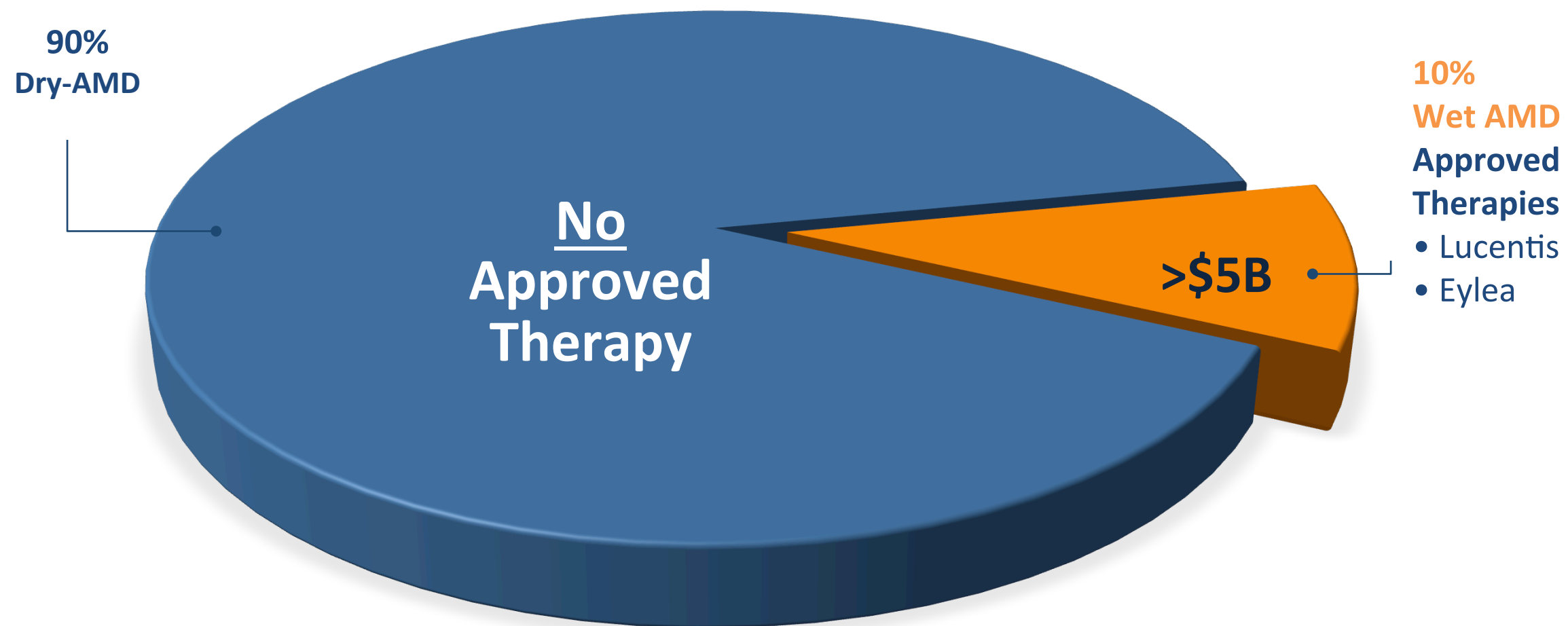
FDA Fast-Track designation

OpRegen[®]: Targeting Larger AMD Opportunity

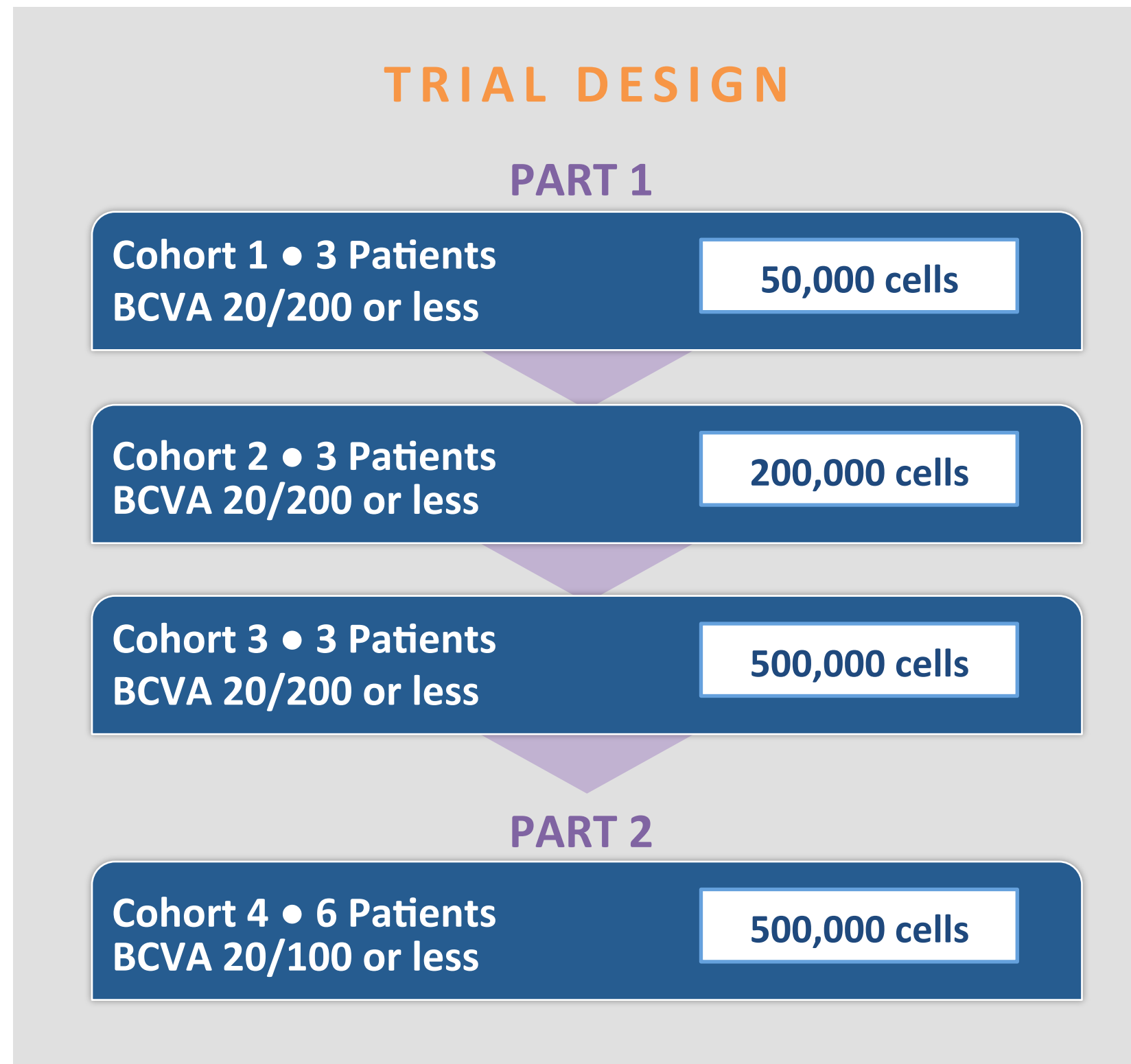
1.6M NEW DRY-AMD CASES

in the U.S. annually

- AMD afflicts 30+ million people worldwide
- Currently, no approved therapies available for this condition



OpRegen[®] Phase I/IIa: Cohort 2 Ongoing



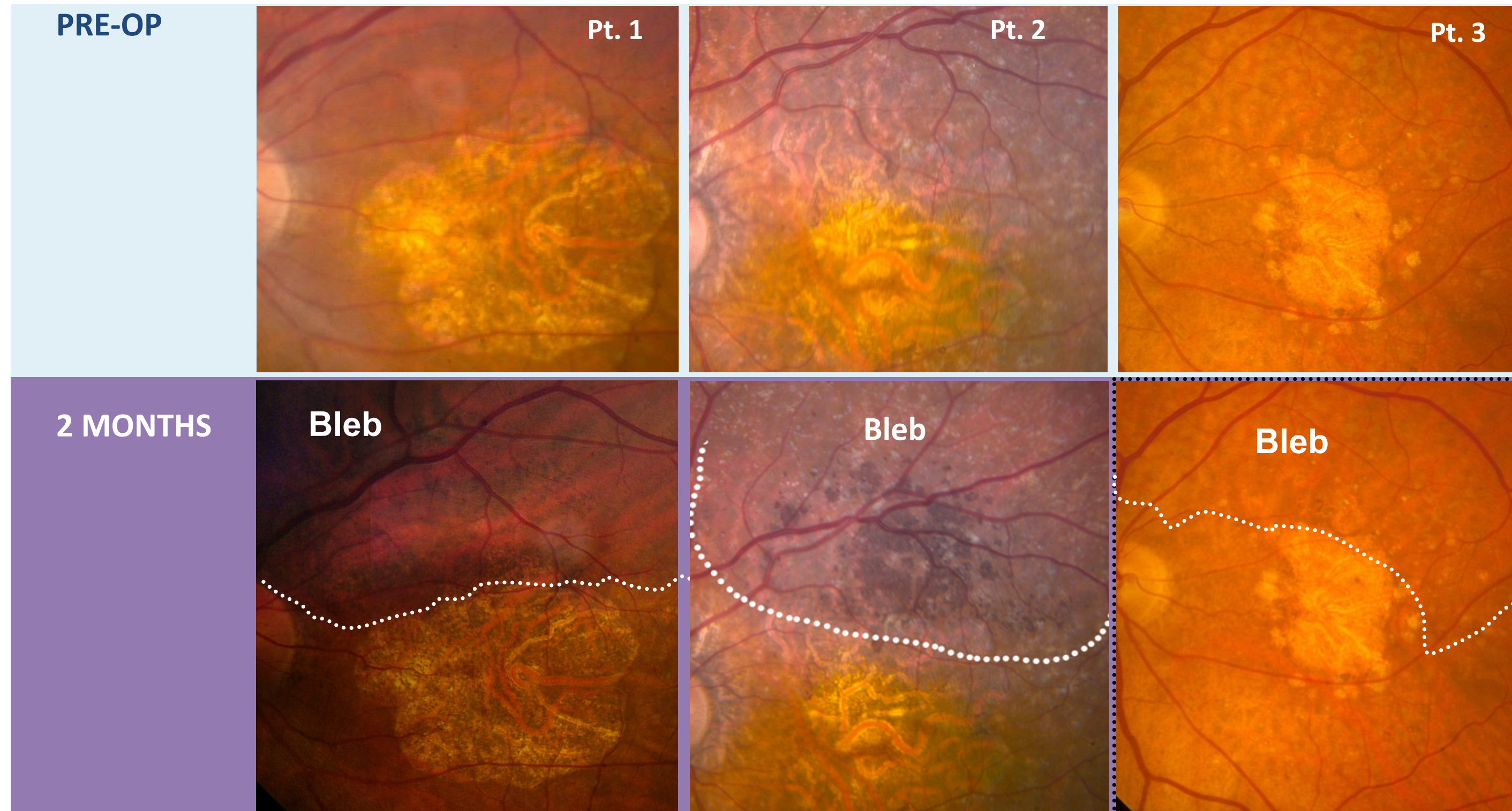
Phase I/IIa Study: Dose escalation safety and efficacy study of *OpRegen*[®] transplanted subretinally in patients with advanced dry-form of AMD (Geographic Atrophy – GA)

US Approved IND: Open label, non-randomized, sequential, single center trial for phase I

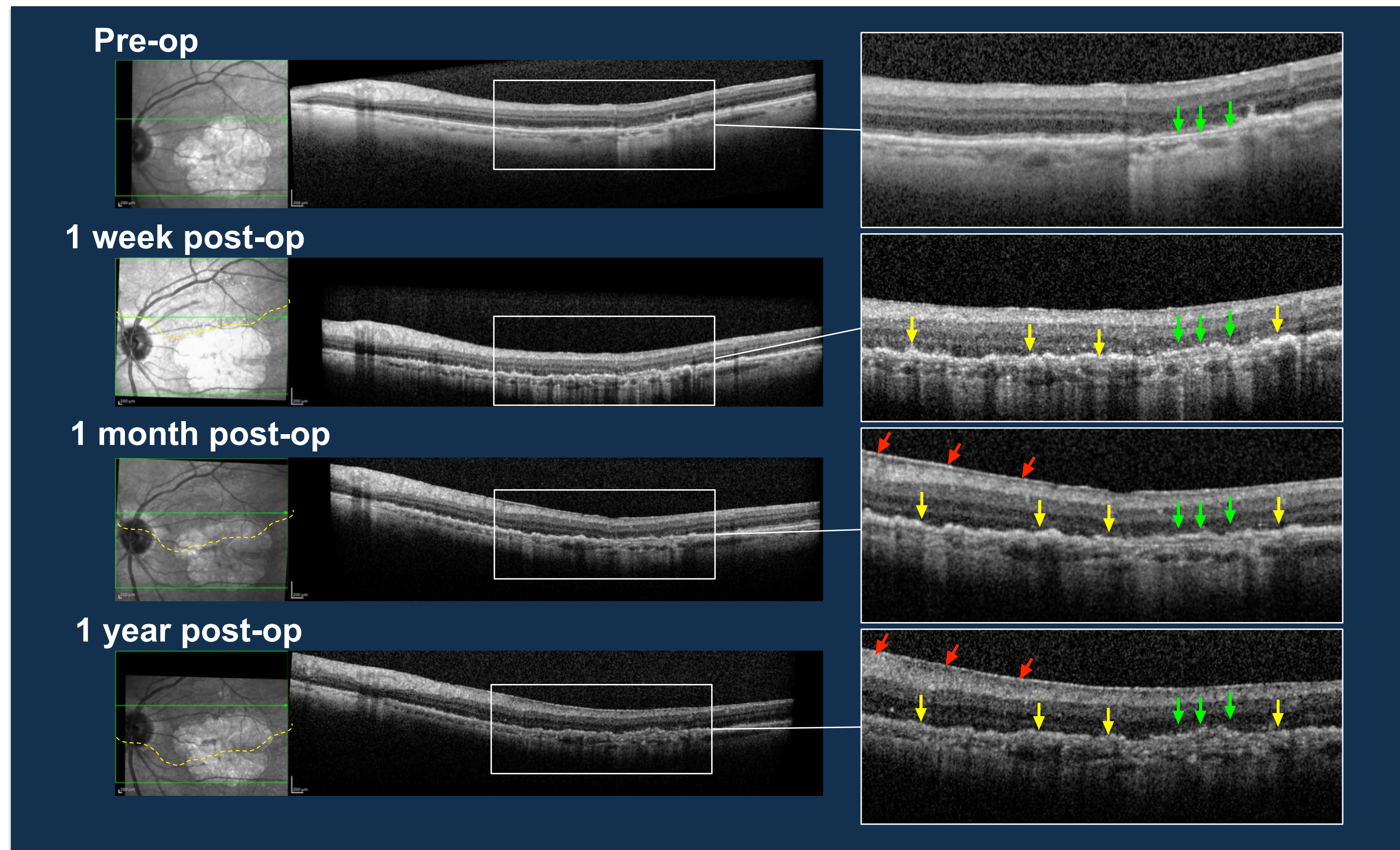
Dose and Administration: Single escalating doses of cells in saline injected into subretinal space

Study Sites: Currently three sites in Israel and two in process in the U.S.

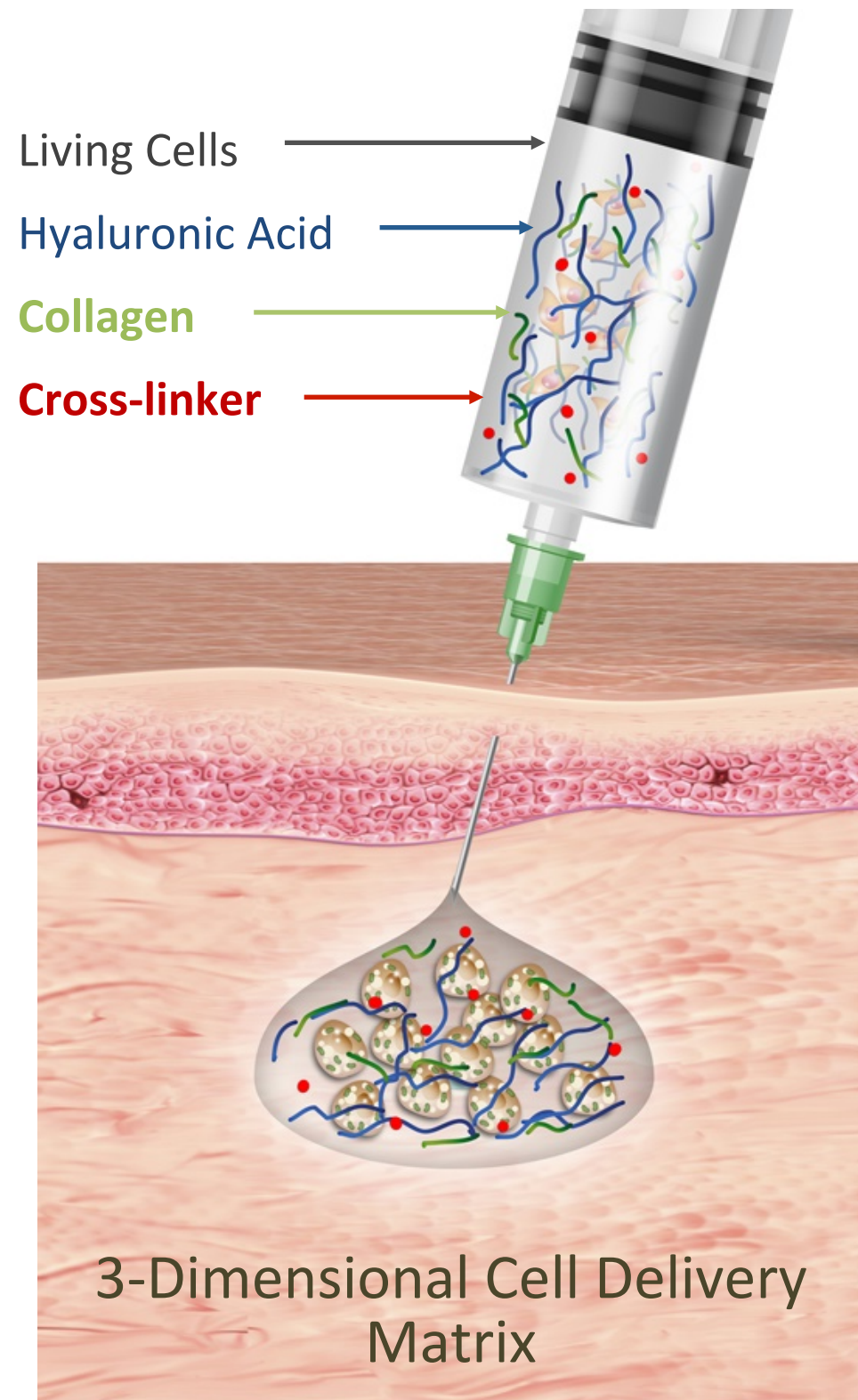
Cohort 1: Subretinal Administration



Cohort 1, Pt 1: Appropriate Engraftment



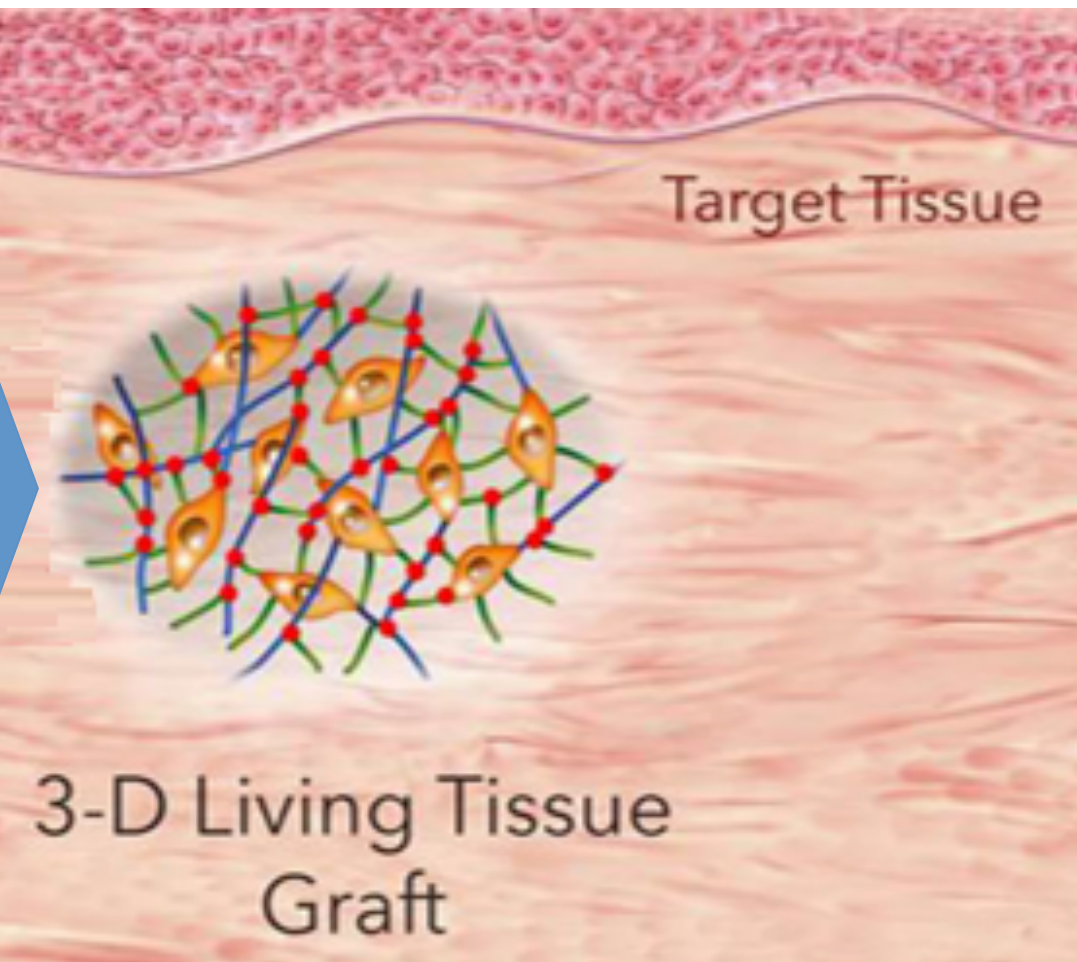
Renevia[®]: Significant Need for Cell Delivery Matrix



Key Advantages:

- Localizes transplanted cells at the intended site
- Support structure needed for successful cell engraftment & survival

Polymerization
Over Time



Renevia[®]: A “Gateway” Pivotal Trial

TRIAL DESIGN

Multicenter, randomized, more controlled trial

Treated vs. delayed treatment control
25 completers in each group with treatment effect
measured at 1, 3, and 6 months

PRIMARY ENDPOINT

Increase in skin thickness as measured by
Ultrasound at 6 months

SECONDARY ENDPOINT

- Mid-face volume deficit score
- Global aesthetic improvement scale

TRIAL TO SUPPORT CE MARK

INITIAL TARGET:

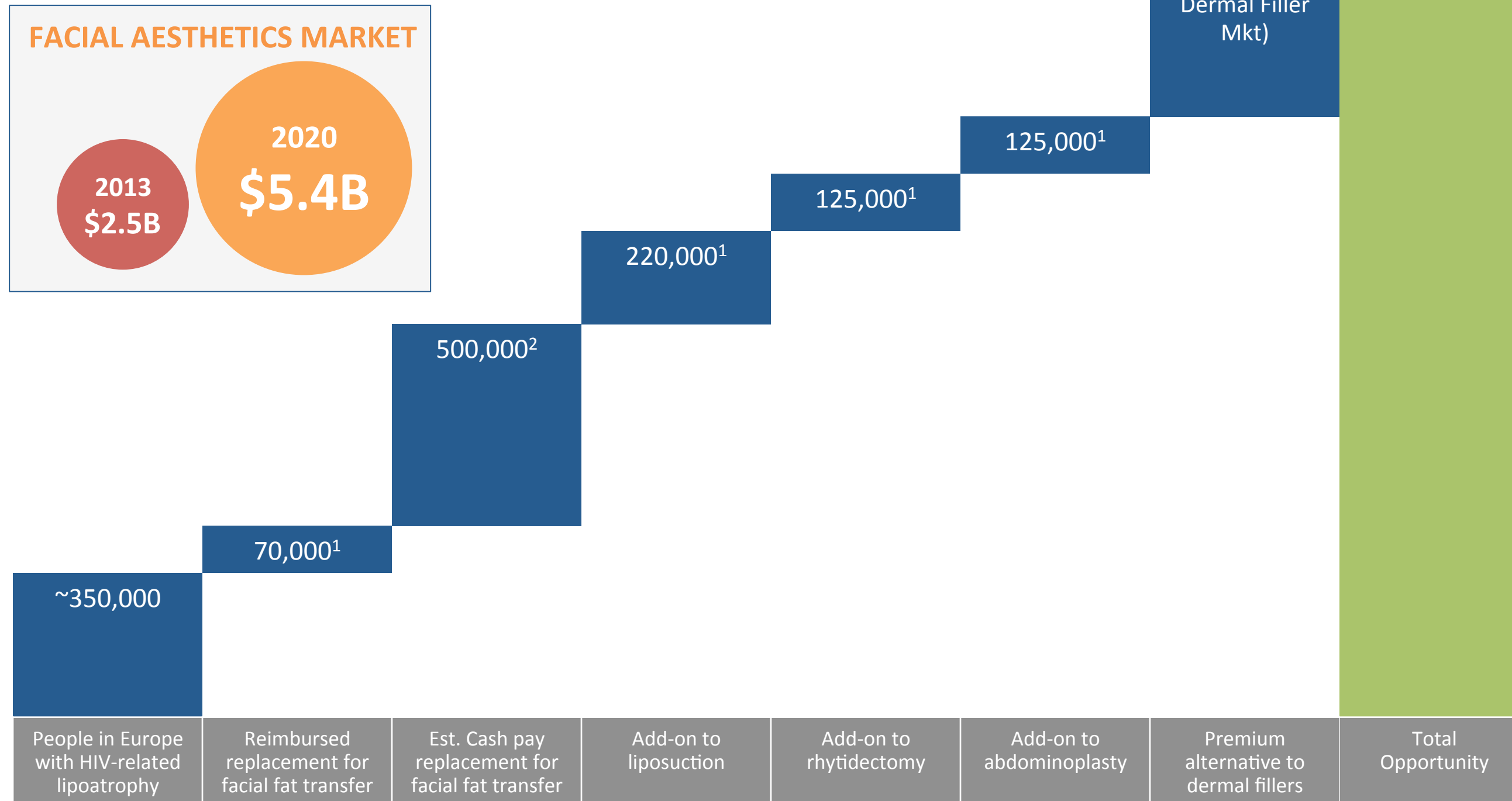
HIV-associated Lipoatrophy
(facial fat loss) in combination with
autologous fat precursor cells



HIV-Related Lipoatrophy

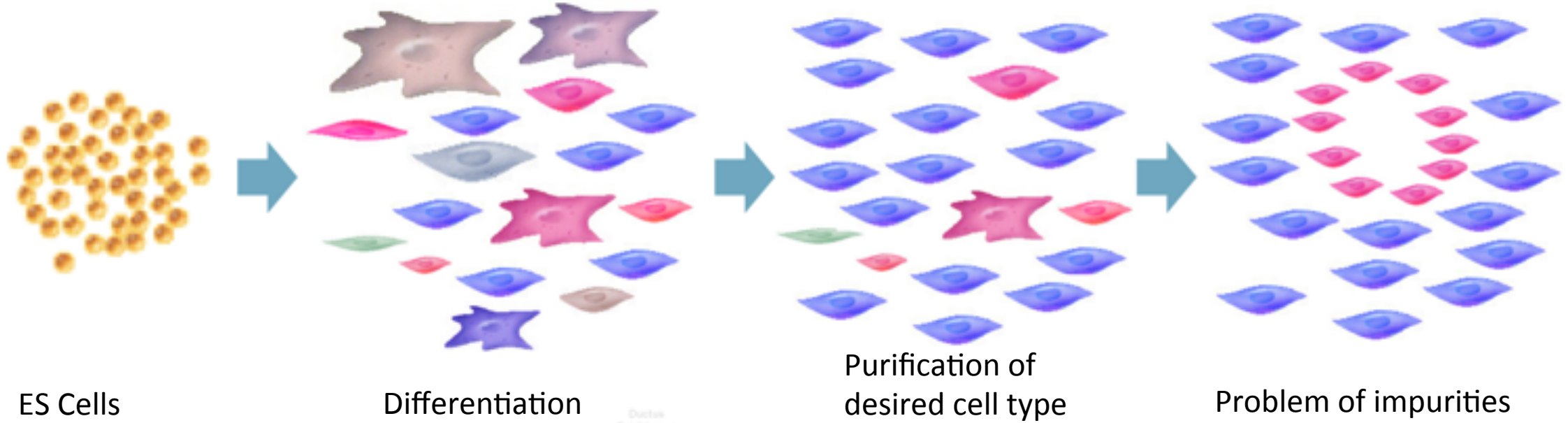
Renovia[®] Market Potential

Renovia[®] could replace facial fat transfers and be utilized as an add-on with other cosmetic procedures

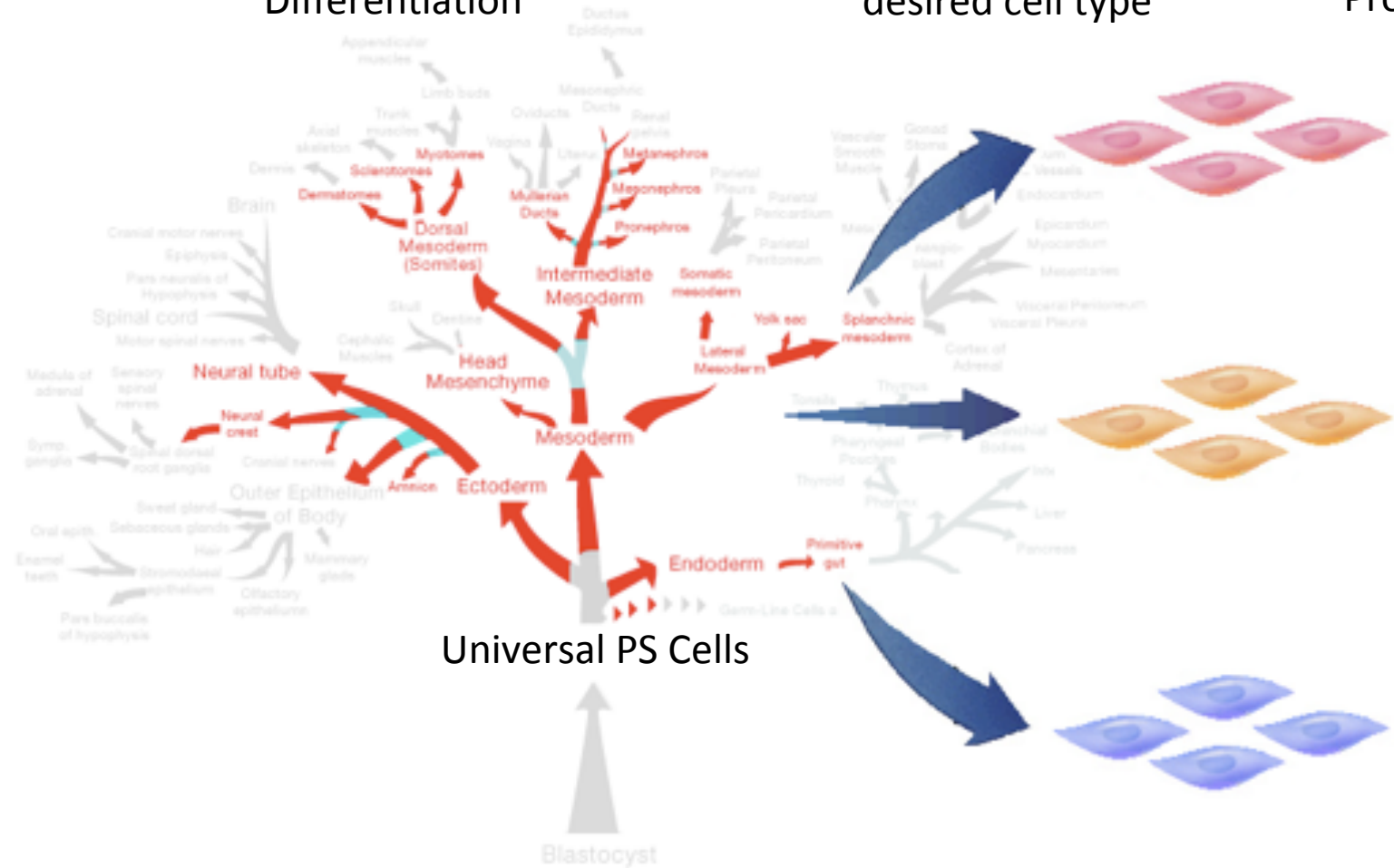


2nd Generation - Universal PureStem™ Technology

Traditional Manufacture

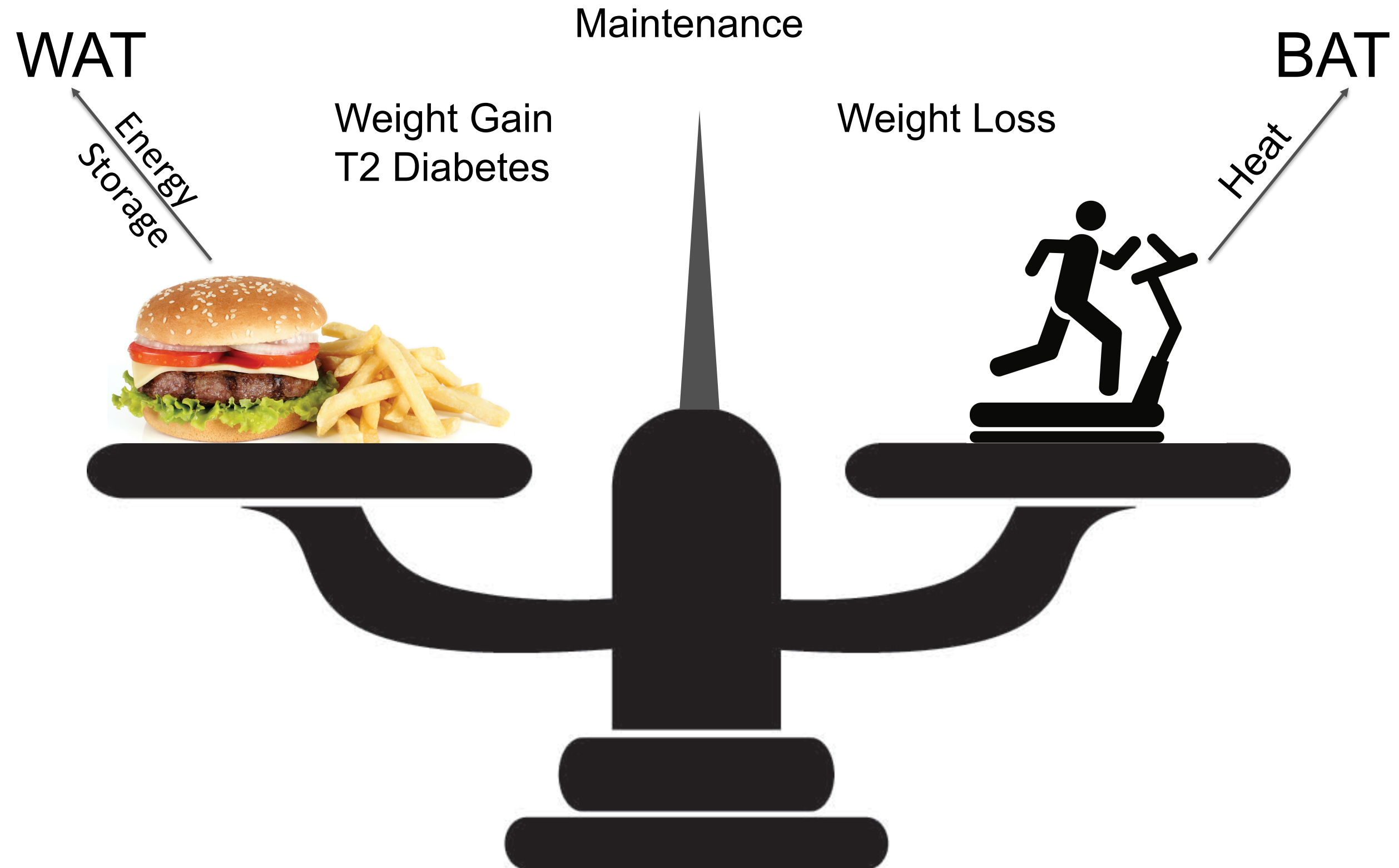


PureStem Technology

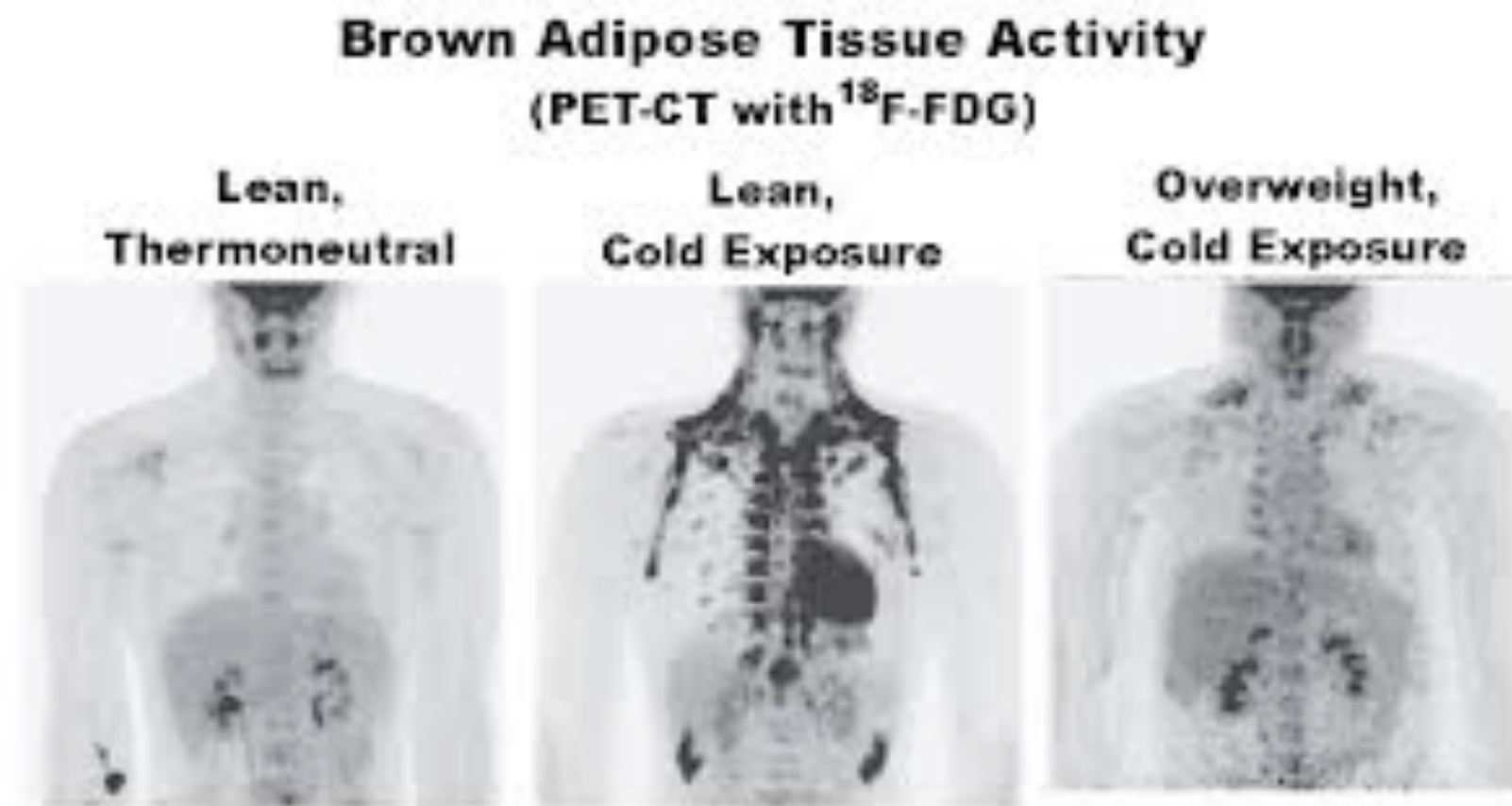
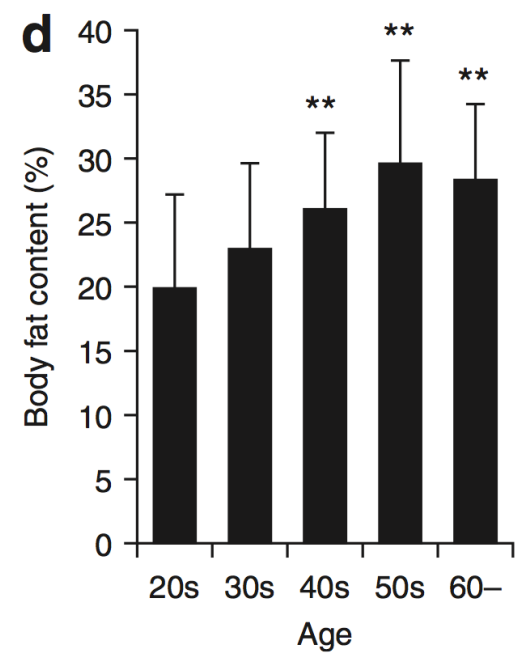
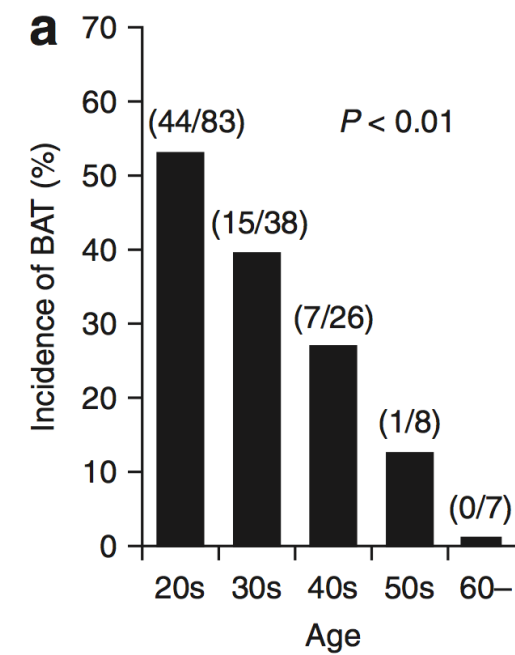


>200-fold diversity
Scalable, monoclonally-purified regenerative progenitors
universally histocompatible

Brown Adipose Cells Regulate Metabolism



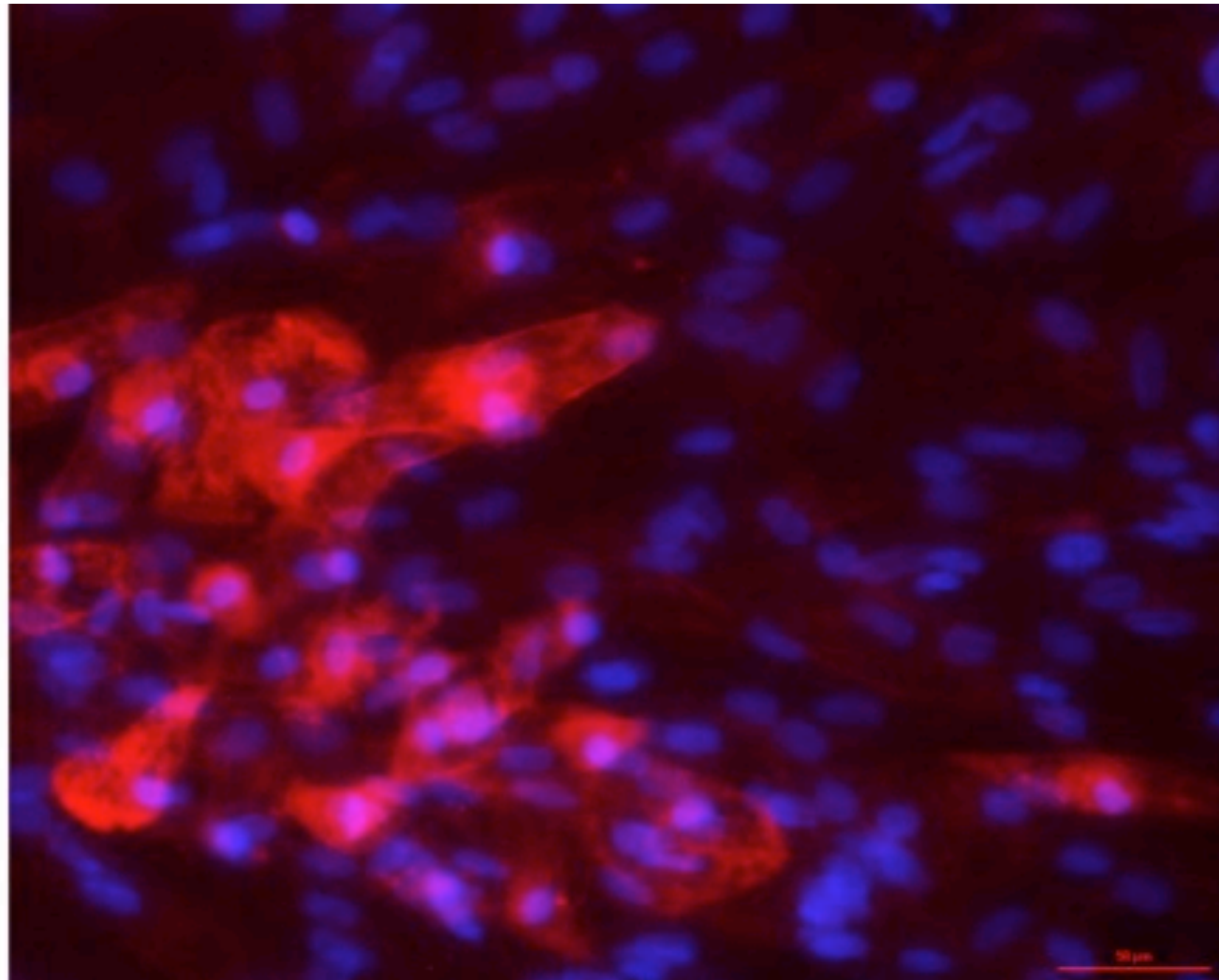
Brown Adipose Cells Regulate Metabolism



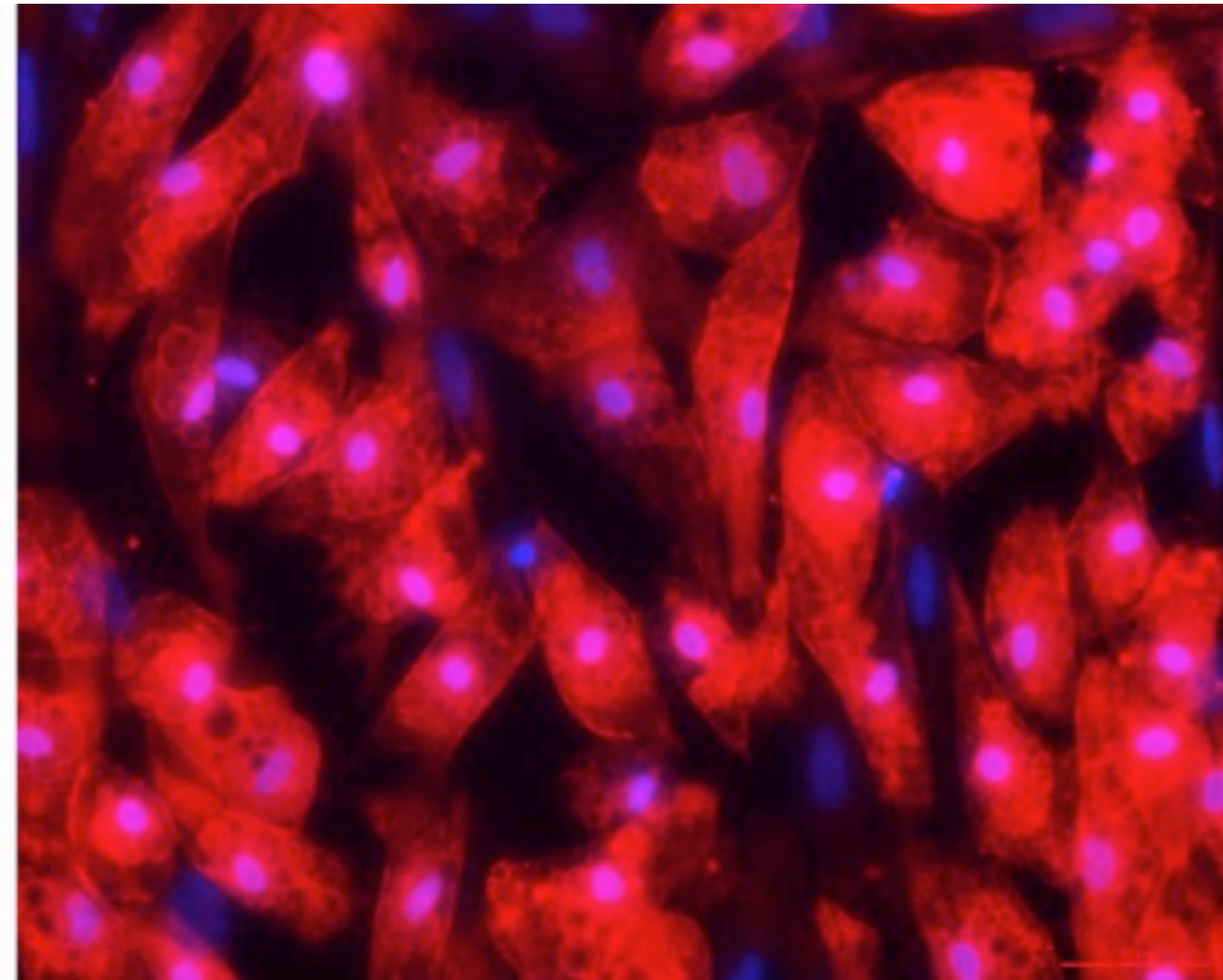
Obesity (2011) **19**, 1755–1760. doi:10.1038/oby.2011.125

Industrially-Scalable *BAT1*

Stained for Brown Adipocyte Marker UCP1



Tissue-Sourced Brown Adipocytes



PureStem Brown Adipocytes

Obesity/T2D Market/Competition

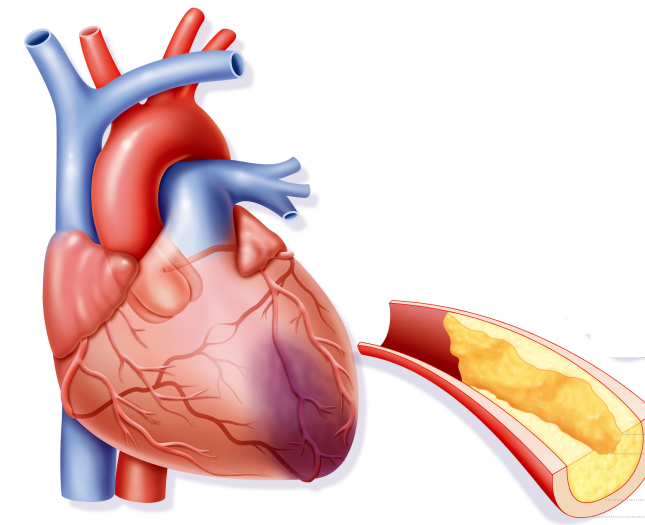
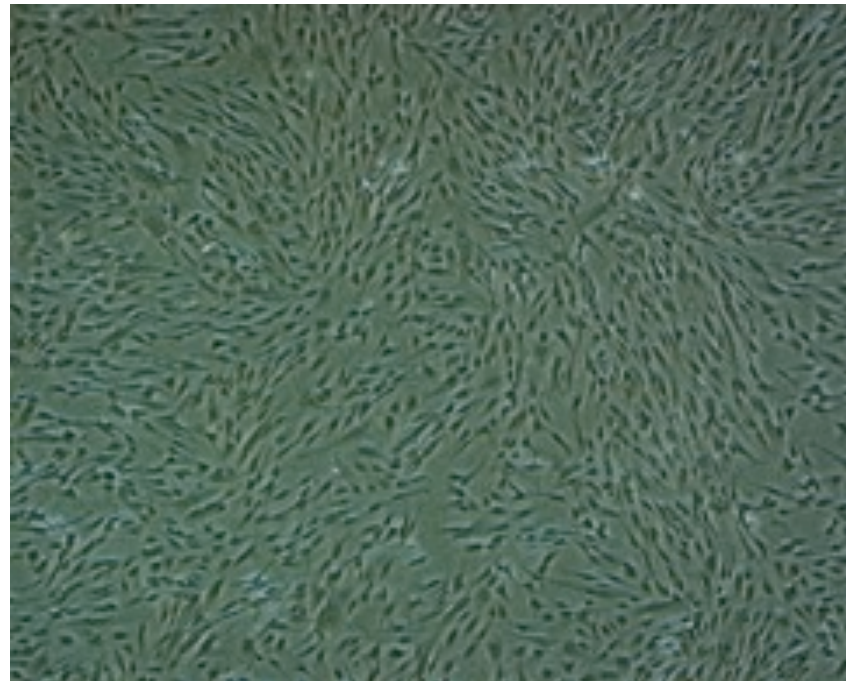
- 30M Americans have diabetes¹ 1:3 Americans will have diabetes by 2050
- The global market for diabetes mellitus and obesity is set to rise from \$70.8 billion in 2015 to \$163.2 billion by 2022, at a strong compound annual growth rate of 12.7%, according to business intelligence firm GBI Research.
- Invokana, which is marketed by Johnson & Johnson, is one of the key players in the disease cluster. It is expected to reach a huge \$3.23 billion by 2022, and is set to be approved across T1DM, T2DM and obesity.
- Invokana belongs to a newer class of Type 2 diabetes treatments called sodium-glucose co-transporter 2 (SGLT2) inhibitors, a class of medication that works by stopping glucose from being reabsorbed into the blood. The FDA warned Invokana can also cause ketoacidosis, a condition that requires hospitalization and can cause fatal swelling of the brain, severe dehydration and coma.

1) Centers for Disease Control and Prevention. National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States. US Department of Health and Human Services; Atlanta, GA: 2014.

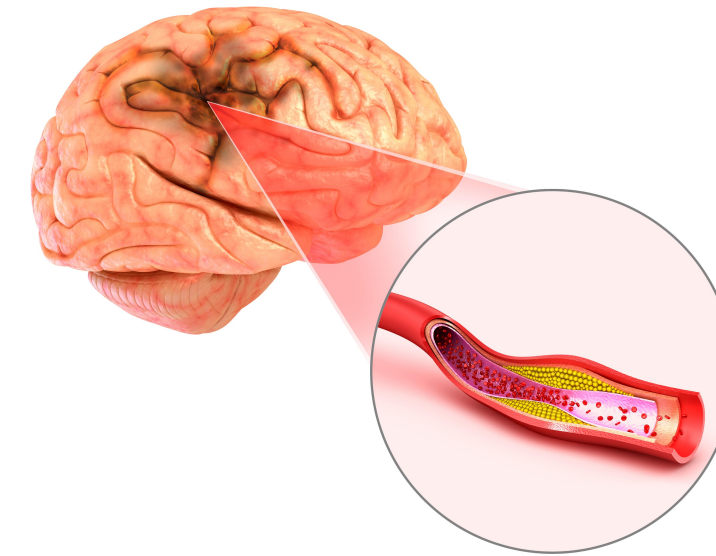
Ischemia: *AGEX-VASC1*

Regenerative Vascular Progenitors

AGEX-VASC1



Heart Disease



Stroke

- Highly scalable with high purity & potency
- Extensive IP estate
- Formulated in a proprietary matrix with documented safety profile for human cell transfer

Cardiovascular Market

> *\$Trillion Market Worldwide*



	Current	2035
Medical costs up 135 percent	\$318 billion	\$749 billion
Indirect costs up 55 percent (Lost productivity)	\$237 billion	\$368 billion
TOTAL COSTS	\$555 billion	\$1.1 trillion

The Cost Generators: Aging Baby Boomers

As Baby Boomers age, costs for CVD will shift from middle-aged Americans to individuals ages 65 and over. By 2035, Boomers who are 80 and older will be the source of the largest cost increases for CVD.

http://www.heart.org/idc/groups/heart-public/@wcm/@adv/documents/downloadable/ucm_491543.pdf

Induced Tissue Regeneration (iTR)

Repair > Breakdown

Repair = Breakdown

Breakdown > Repair

Embryonic



Fetal - Adult



Aging Adult



Highly Regenerative

Limited Regeneration

Non-Regenerative

Construction

Maintenance

Destruction

iTR: induced Tissue Regeneration

Unlocking Asset Value for BTX Shareholders

BioTime owns ~46% (~\$74M) of Asterias (NYSE MKT: AST)



With proprietary, industry-leading platforms based on its pluripotent stem cell and dendritic cell immunotherapy technologies, Asterias is focused on therapies to treat conditions in several medical areas where there is high unmet medical need and inadequate available therapies.

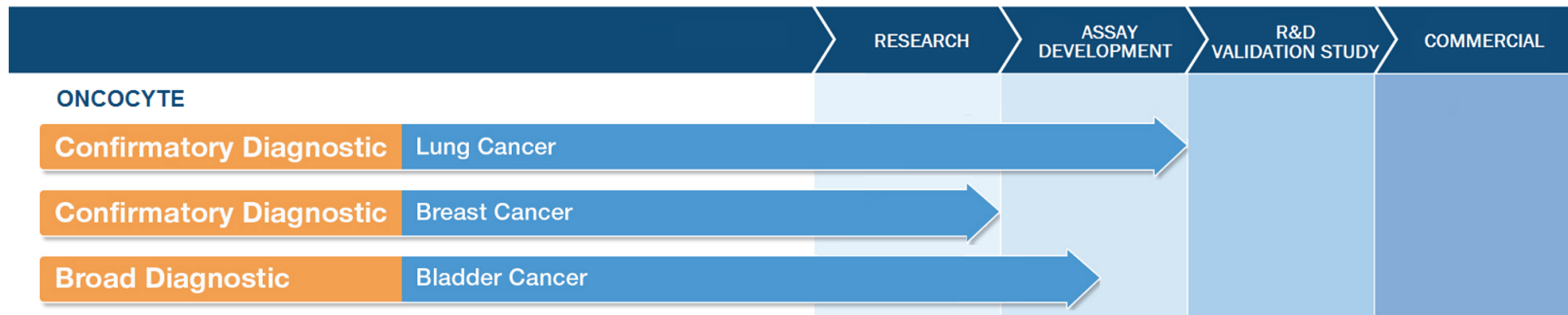


Unlocking Asset Value for BTX Shareholders

BioTime owns ~49% (~\$ 90M) of OncoCyte (NYSE MKT: OCX)



Focused on non-invasive blood and urine diagnostic tests for early detection of cancer to improve health outcomes through early diagnoses, to reduce the cost of care through the avoidance of more costly diagnostic procedures, including invasive biopsy and cystoscopic procedures, and to improve the quality of life for cancer patients.



2017 Milestones

OPHTHALMOLOGY

OpRegen[®] in Dry AMD:

- Promising Early Data Presented Recently
- Phase I/IIa data from Cohort 1
- Complete Cohort 2
- Begin Cohorts 3 and 4

FACIAL AESTHETICS

Renevia[®] in Facial Aesthetics:

- Promising Early Data Presented Recently
- Complete Pivotal Trial Enrollment
- Topline Data from Pivotal Trial
- File For European Approval

Combining Expertise + Leveraging Science to Generate Shareholder Value