UNC | BOARD OF TRUSTEES

STRATEGIC FRAMEWORK COMMITTEE

September 26, 2018, 4:30PM
Chancellor's Ballroom East, Carolina Inn

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## OPEN SESSION

**FOR INFORMATION ONLY**
(No formal action is requested at this time)

1. Creativity Hubs: Heterogeneity in Obesity
   *Penny Gordon-Larsen, Professor & Associate Chair for Research, Dept. of Nutrition*

2. Student Startup Pitch: Phyta
   *Eliza Harrison, Class of 2019*
   *Lucy Best, Class of 2019*
   *Emily Kian, Class of 2020*

**COMMITTEE MEMBERS**
**Julia Grumbles, Chair**
**Kelly Hopkins, Vice Chair**
**Jeff Brown**
**Lowry Caudill**
**Allie Ray McCullen**
**Hari Nath**

***Administrative Liaison:***
***Bob Blouin, Executive Vice Chancellor and Provost***
***Judith Cone, Vice Chancellor for Innovation, Entrepreneurship, & Economic Development***

# CreativityHubs

## HETEROGENEITY IN OBESITY

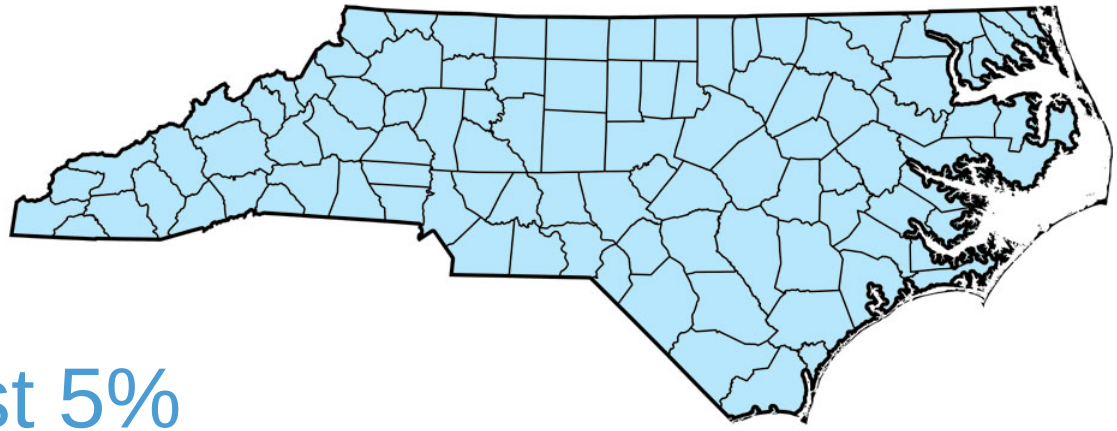
*Transdisciplinary Approaches for Precision Research and Treatment*

**Penny Gordon-Larsen, PhD**
Professor of Nutrition | Associate Dean for Research
Research, Innovation and Global Solutions
Gillings School of Global Public Health

On behalf of The Obesity Hub

# Obesity is a major issue in North Carolina

North Carolina has the 16th highest obesity in the US



Reduction of just 5% in obesity would save >$7 billion in 10 years on health care in NC

Obesity Heterogeneity Hub

# Tremendous IMPACT of Obesity on Health

- **Cardiometabolic**
- **Structural**
- **Inflammatory**
- **Degenerative**
- **Neoplastic**
- **Psychological**

236

Comorbidities affecting **EVERY** organ system and medical specialty

$190 Billion

spent per year in U.S.

$62 Billion

in Medicare & Medicaid spending

Obesity Heterogeneity Hub

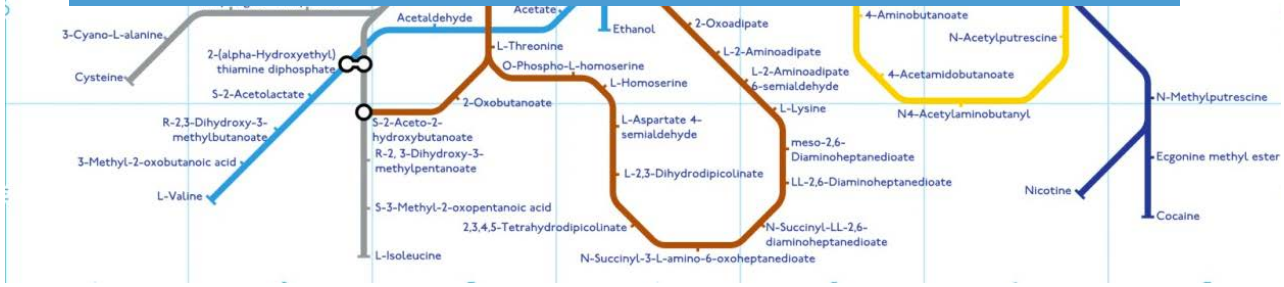
# The PROBLEM








**Yet – we treat everyone the same!**

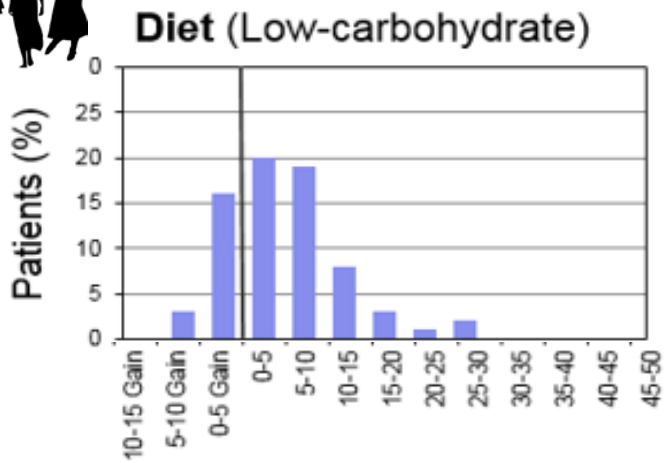



Obesity Heterogeneity Hub

# Genetic Diversity helps us solve problems

Differential Response

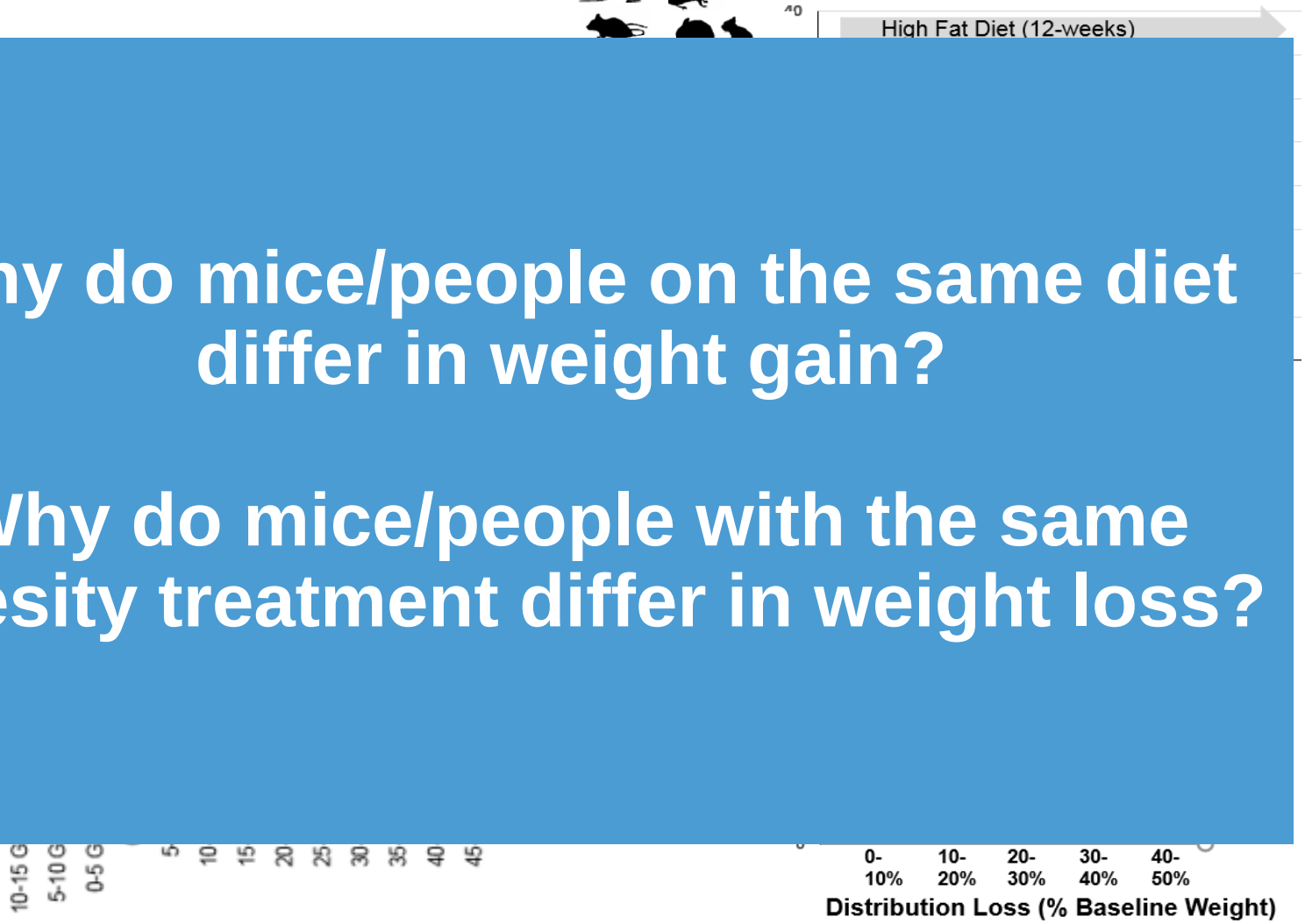
# Even with IDENTICAL diets and other treatments, weight loss varies among individuals



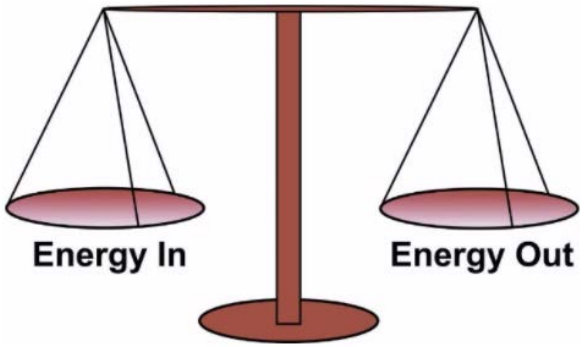
# Even with IDENTICAL diets and other treatments, weight loss varies among individuals

**Why do mice/people on the same diet differ in weight gain?**

**Why do mice/people with the same obesity treatment differ in weight loss?**



# Our Hub will OVERCOME major gaps in the field



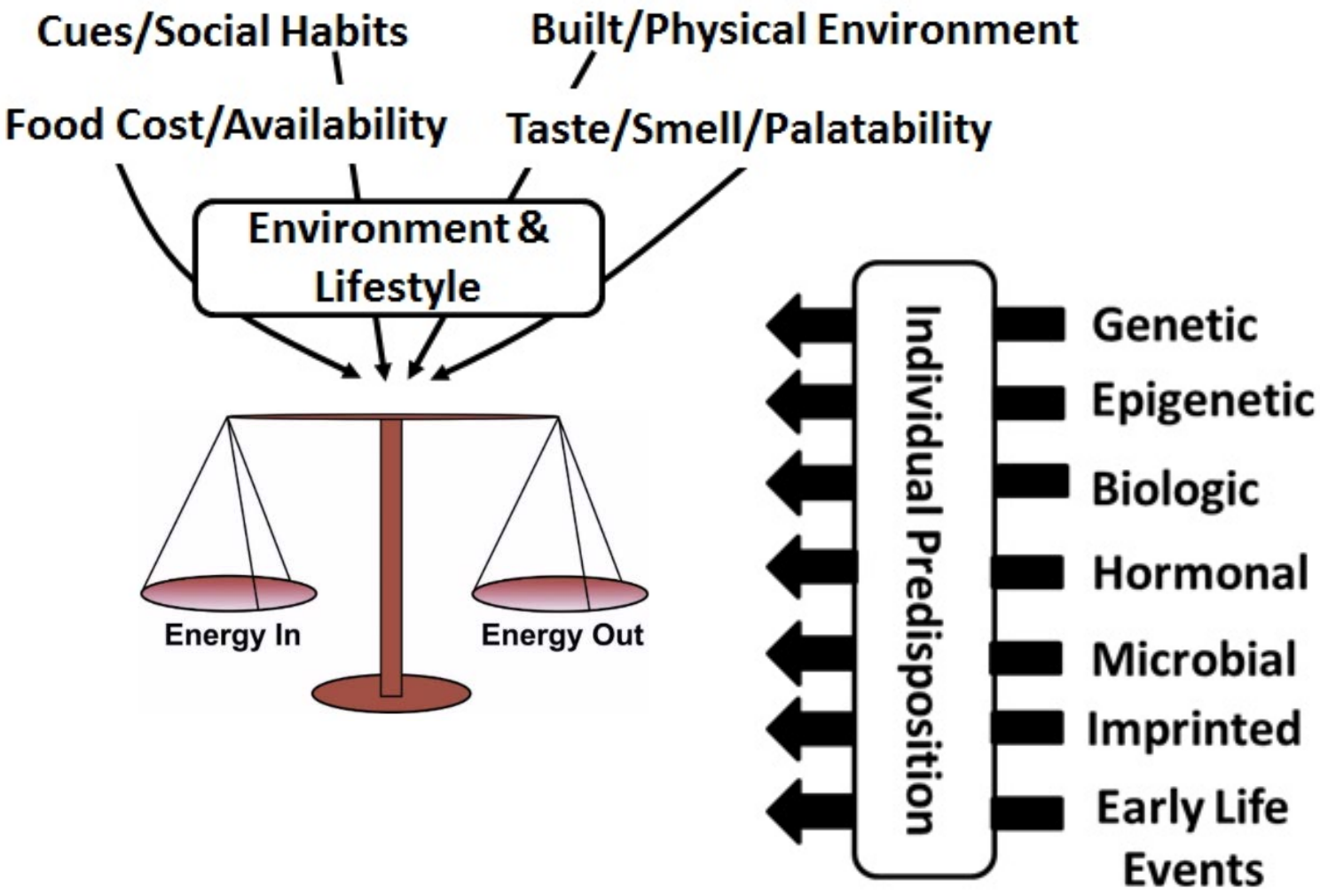

Obesity Heterogeneity Hub

# Our Hub features Creative Solutions

- **Novel collaborations**
- **Data innovations**
- **No one-size-fits-all approaches**
- **Multiple pathways/causes of obesity**
- **Individualized & tailored approach**

Obesity Heterogeneity Hub

# The Obesity Hub



# Dream Team

**Basic Scientists**
**Animal Models**

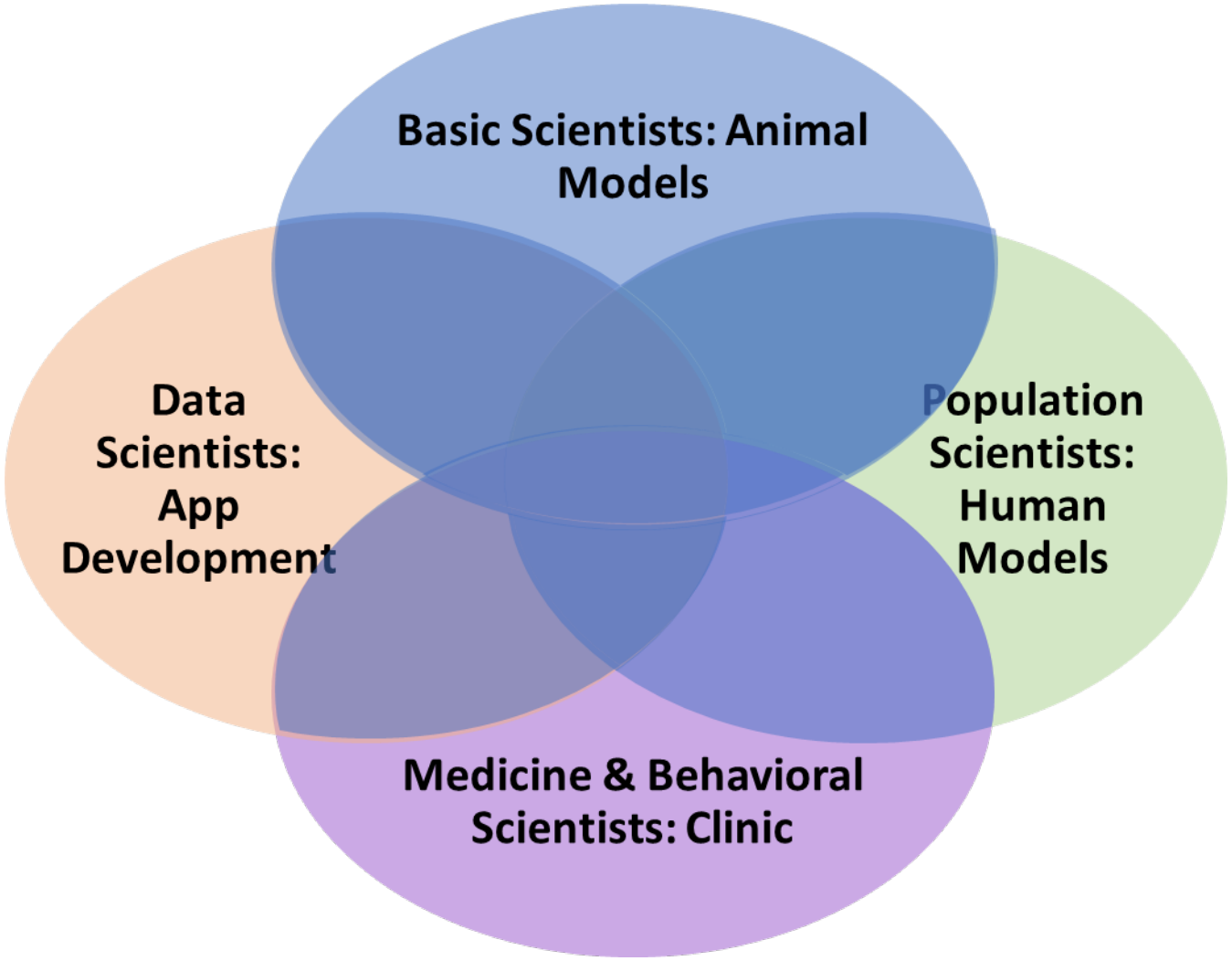
**Population Scientists**
**Human Models**

**Data Scientists**
**App Development**

**Medicine & Behavioral Scientists**
**Clinic**

Obesity Heterogeneity Hub

# Dream Team




Obesity Heterogeneity Hub

# The Obesity Hub TEAM: 28 Investigators, 6 schools, 17 departments, and leaders from 5 Centers/Institutes

Nursing

Pharmacogenomics
Pharmacotherapy

Endocrinology
Hematology

Biology
Psychology
Computer Science
Sociology

Pediatric
Periodontology

Nutrition
Epidemiology
Health Behavior
Biostatistics
Health Policy and Management

Nutrition Research Institute (**NRI**)

Renaissance Computing Institute (**RENCI**)

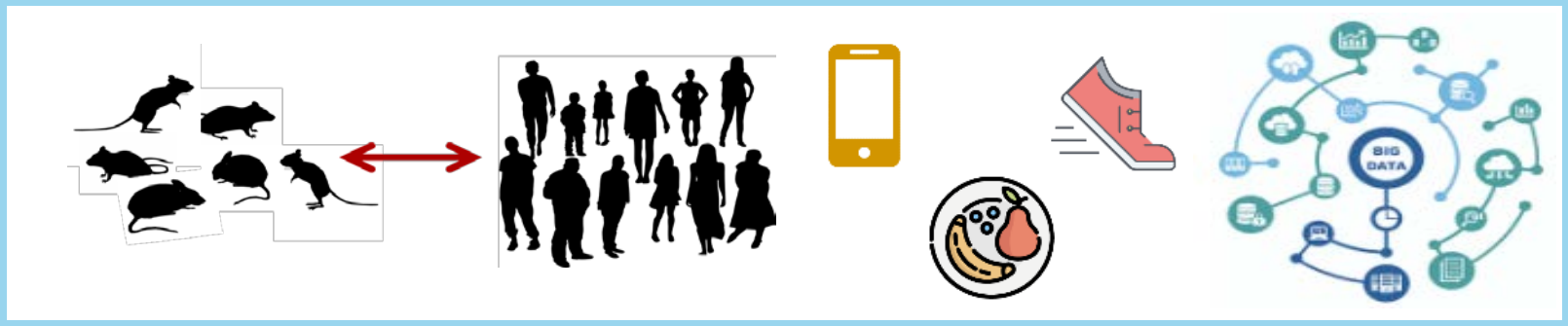
Carolina Population Center (**CPC**)

**Lineberger** Comprehensive Cancer Center

North Carolina Translational & Clinical Sciences Institute (**NC TraCS**)

Obesity Heterogeneity Hub

# Aim 1: Parallel Mouse & Human Studies




**Models of Weight Change**
**Genes, metabolome, microbiome, social factors & behaviors**

Obesity Heterogeneity Hub

# Aim 2: Precision Weight Loss Pilot

UNC HEALTH CARE

**Precision vs standard approach**
**Genes, metabolome, microbiome, social factors & behavior**

Obesity Heterogeneity Hub

# Aim 3: Application Programming Interface


**Machine Learning & Data integration**
**Genes, metabolome, behavior**

Obesity Heterogeneity Hub

# Novel cross talk to address *Heterogeneity of Obesity*

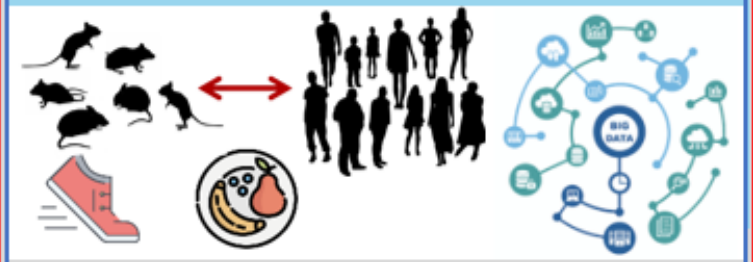
# Deliver outstanding TANGIBLE RESEARCH PRODUCTS


- Outstanding pilot data for LARGE grants
- Research publications
- Proof-of-principle for providing precision obesity care
- App for machine learning across ***big data:*** diet, genetics, and metabolomics
- Platform to build upon with social, behavioral data and more
- Point-of-Care tool for future precision treatment

# SUSTAINABLE impact and future strategy

## YEARS 1 & 2

**Aim 1: Parallel Mouse & Human Studies**




**Aim 2: Precision Obesity Pilot**


**Aim 3: Application Programming Interface**


## YEAR 3-5

**Precision Testing:**

Large Mouse Cohort Experiments

Large UNC Obesity Clinic Randomized Controlled Trial

Cost Effectiveness of Precision Obesity Treatment in UNC Health Care System

Integrate Treatment & Analysis Apps

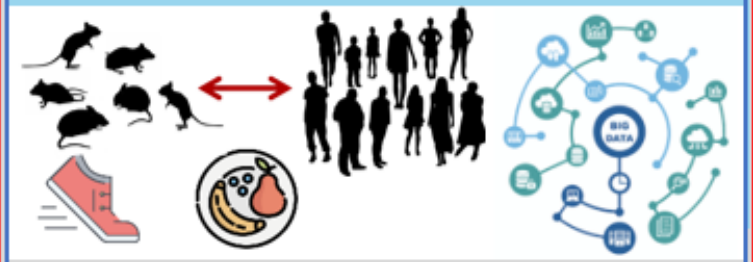
NIH Genetics of Treatment RFA

NIH Commons RFA

# Broad EXPANSION for research and treatment

## YEARS 1 & 2

**Aim 1: Parallel Mouse & Human Studies**




**Aim 2: Precision Obesity Pilot**


**Aim 3: Application Programming Interface**


## YEAR 3-5

**Precision Testing:**

- Large Mouse Cohort Experiments
- Large UNC Obesity Clinic Randomized Controlled Trial
- Cost Effectiveness of Precision Obesity Treatment in UNC Health Care System
- Integrate Treatment & Analysis Apps
- NIH Genetics of Treatment RFA
- NIH Commons RFA

## YEAR 5-10

**Expansion:**

- UNC as Landmark Precision Obesity Science and Treatment Center
- Define Essential Epic Measures at UNC and Beyond
- Replication in Geisinger & NIH's 'All of Us'
- UNC Roll Out and Evaluation
- Broaden to Cardiovascular Diseases, Precision Exercise, Precision Behaviors & Pediatric Populations

# The Obesity Hub: IMPACT

## Fundamental shift to science and treatment

- Generate critical pilot data for multiple large, team science grants
- Transform understanding of precision obesity science and treatment

## Benefit to Society

- Obesity affects every organ system, huge disparities
- NC has 16th highest obesity, reduction of just 5% would save >$7 billion in 10 years on health care alone

## Special Value to Carolina

- Carolina is about to amass big data but what is missing?
- Unique window to act
- Precision nutrition and obesity in IOM, NIH strategic plans
- UNC uniquely skilled to lead

# The Obesity Hub PROGRESS

- Mouse Study
  - Analysis
  - Sequencing
- Human Population Data
  - Analysis
- Clinic
  - Training & Protocol
  - Data Collection Tools
- Application Programming Interface
  - App Framework
  - Formatting Genetic, Diet, Metabolomics Data

Obesity Heterogeneity Hub

Circulation

ON MY MIND

# Obesity as a Disease, Not a Behavior

Penny Gordon-Larsen, PhD
Steven B. Heymsfield, MD

The American Heart Association (AHA) defines ideal cardiovascular health in its 2020 Impact Goals for cardiovascular health promotion and disease prevention to include a body mass index (BMI) <25 kg/m$^2$, which they recognize as an ideal health behavior.[1] We urge the AHA as it begins setting its 2030 goals to move beyond the concept of BMI as a health behavior. Equating BMI with behavior confuses the now widely accepted association between BMI and the mechanistically complex disease of obesity.[2] In our opinion, it makes little sense to establish goals and metrics that ignore a broad evidence base that supports the view of obesity as a complex, multifactorial disease and expect to achieve meaningful success in managing BMI to promote ideal cardiovascular health.

Despite the growing recognition of the complexity of obesity, like cancer decades ago, obesity has been treated as a single disease process with universal prevention and treatment strategies, rather than a fundamentally heterogeneous process with numerous underlying mechanisms and etiologies, each requiring unique prevention and treatment modalities. Obesity and related coronary artery disease, stroke, and other sequelae lead to increased health burden and billions of dollars in healthcare costs in the United States. Examining sources of heterogeneity in the etiology of obesity and in its complications will improve recognition of disease pathways and lead to actionable steps in community and clinical practice to tackle potentially distinct physiological mechanisms, disease courses, and individualized behavioral responses underlying successful weight management (ie, prevention, treatment, and weight loss maintenance). For the first time, we have access to technologies and methods to integrate large, complex biological and clinical data, which opens opportunities to identify and characterize mechanisms underlying obesity and its downstream complications, providing a critical window into personalized approaches to transform current prevention and treatment efforts as recently emphasized by Collins and Varmus.[3]

The most effective st[illegible]gies to prevent and treat[illegible]ity are evidence-based approaches that rec[illegible]nize heterogeneity in obesity and its complications, and interindividual variabil[illegible]in treatment/intervention respo[illegible]e, as well. Stepwise programs that are individually tailored and combine lifestyle changes (eg, diet, physical activity, sleep, stress reduction, and environmental triggers), medications, and surgery have been shown to be most effective in promoting weight loss and subsequent weight maintenance. An analogy is dyslipidemia, hypertension, and diabetes treatments that combine lifestyle changes with pharmacotherapy.

There are also adverse implications of viewing obesity as a health behavior rather than as a complex disease, such as the potential for weight bias and stigma. People with obesity already face bias and discrimination in employment, health care, and interpersonal relationships. Defining BMI, and by inference obesity, as an ideal health behavior belies the very real struggle that people with obesity face in addressing

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

**Key Words:** cardiovascular diseases ■ diabetes mellitus ■ life style ■ metabolism ■ obesity

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More to Come!

Obesity Heterogeneity Hub

# The Obesity Hub TEAM: 28 Investigators, 6 schools, 17 departments, and leaders from 5 Centers/Institutes

| Hub Leadership | |
|---|---|
| **Penny Gordon-Larsen** | Nutrition |
| **Deb Tate** | Nutrition/Health Behavior |
| **Steve Zeisel** | Nutrition |
| **Kari North** | Epidemiology |
| **Vicki Bautch** | Biology |
| **Sriram Machineni** | Endocrinology |
| **Stan Ahalt** | Computer Science |

| Hub Advisory | |
|---|---|
| **Elizabeth Frankenberg** | Sociology |
| **Ethan Basch** | Hematology |
| **John Buse** | Endocrinology |
| **Michael Kosorok** | Biostatistics |

| Hub Investigators | |
|---|---|
| **Ana Bardone-Cone** | Psychology |
| **Kimon Divaris** | Pediatrics |
| **Sylvana Barros** | Periodontology |
| **John French** | Nutrition |
| **Diane Berry** | Nursing |
| **Jennifer Leeman** | Nursing |
| **Tim Wiltshire** | Pharmacogenomics |
| **Craig Lee** | Pharmacotherapy |
| **Annie Howard** | Biostatistics |
| **Christy Avery** | Epidemiology |
| **Rebecca Fry** | Environmental Sciences & Engineering |
| **Leslie Lytle** | Health Behavior |
| **Sally Stearns** | Health Policy Management |
| **Ian Carroll** | Nutrition |
| **Katie Meyer** | Nutrition |
| **Steve Hursting** | Nutrition |
| **Susan Sumner** | Nutrition |

Obesity Heterogeneity Hub

# PHYTA

## SEAWEED FOR A SUSTAINABLE FUTURE

Lucy Best, Eliza Harrison, Emily Kian
University of North Carolina at Chapel Hill
Robertson Scholars

# the PROBLEM

**“Water and air, the two essential fluids on which all life depends, have become global garbage cans.”**

**- Jacques Cousteau**

**SEAWEED**: A cost-effective and pollution-reducing resource

the SOLUTION

# WHAT **WE DO**

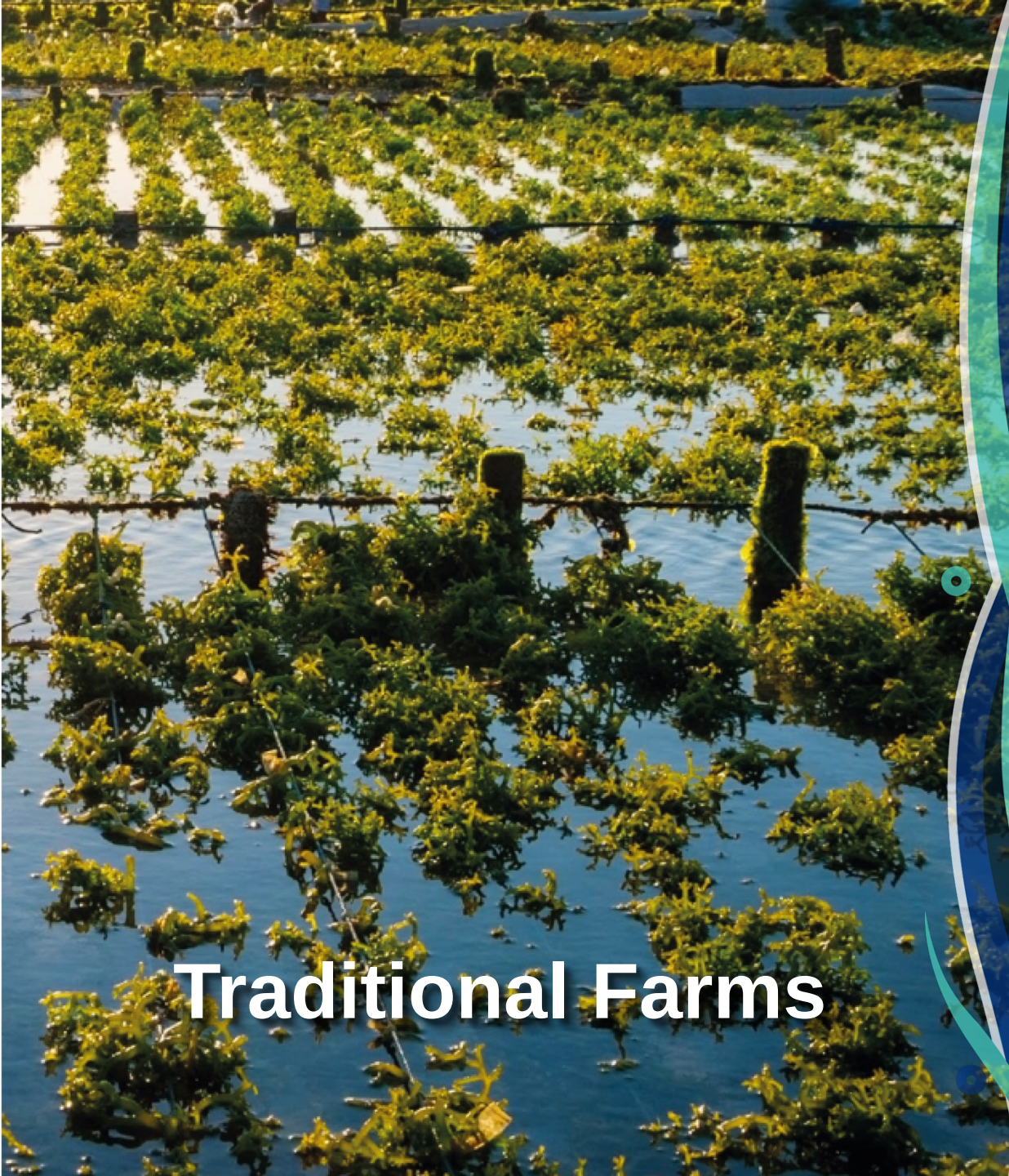
Hire fishermen to install rig

Grow, harvest, and package

Transport

Distribute to buyers

Sell nutrient removal credits



Traditional Farms

PHYTA

# COMPETITIVE **ADVANTAGE**

Versatile and easy to install

Existing seaweed farms harm ecosystems

Priced at ¾ the market rate

# PARTNERS & **CUSTOMERS**

DuPont Tate & Lyle BioProducts

seventh generation

BANTRY MARINE RESEARCH STATION

## Seaweed Buyers

NEWTRIENT

BSAG Baltic Sea Action Group

URBAN OFFSETS

## Credit Buyers

dk

FAO FIAT PANIS

## Partners

Unit

# ECONOMICS

Unit
# ECONOMICS

Unit
# ECONOMICS

Unit
# ECONOMICS

Unit
# ECONOMICS

CREDITS
**$47**

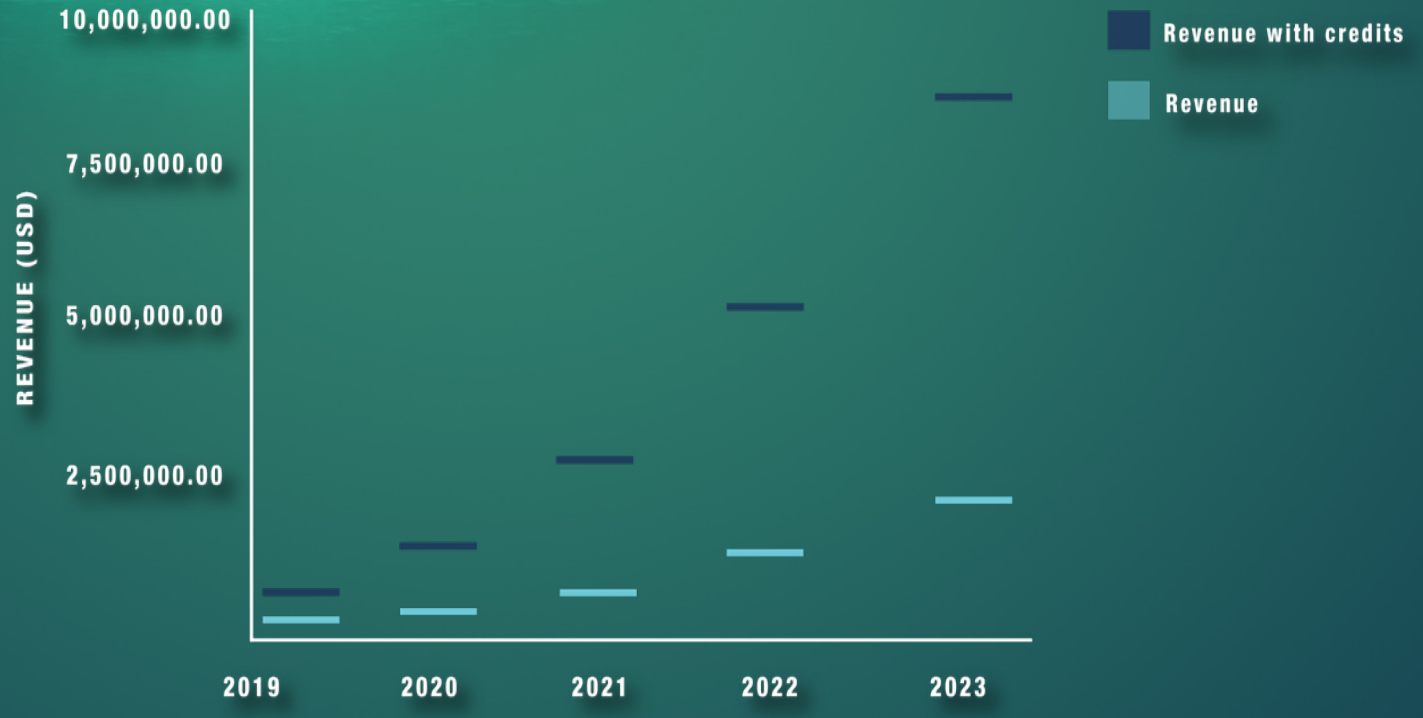
TOTAL PROFIT
**$108,000**

COST
**$4**

PROFIT
**$9**

YIELD
**1930 kg**

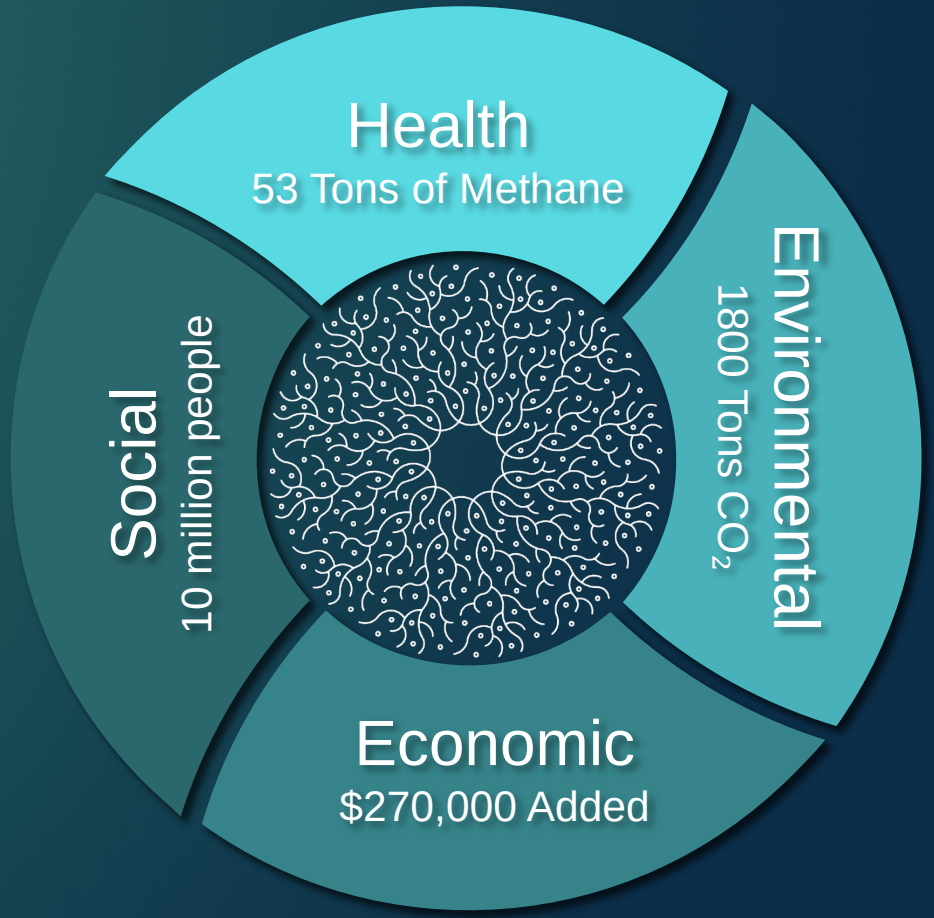
# FINANCIAL PROJECTIONS



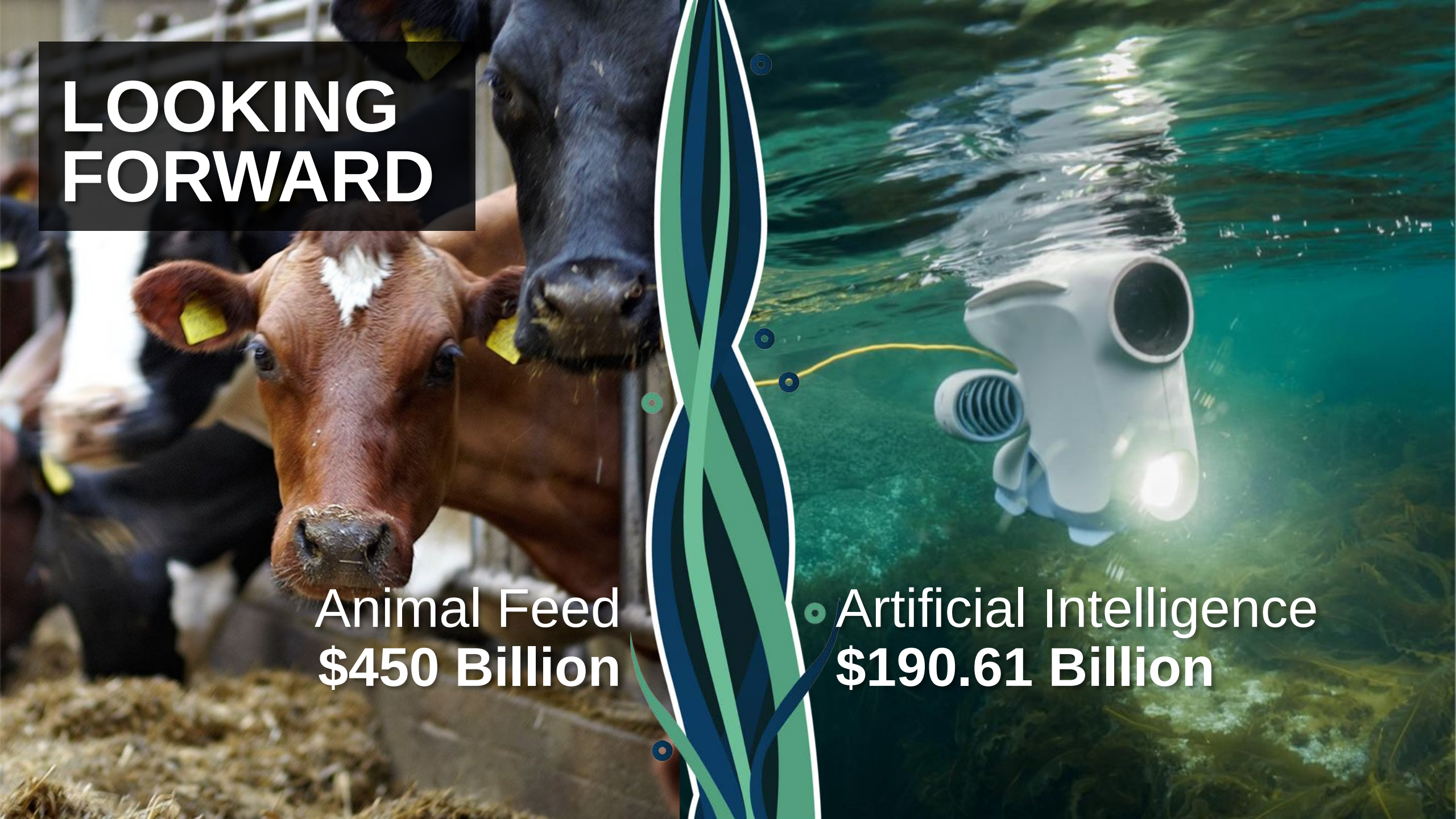

**Phase I**
U.S.A
10 farms

**Phase II**
Mexico
40 farms

**Phase III**
Brazil
60 farms



# LOOKING FORWARD



Animal Feed
**$450 Billion**

Artificial Intelligence
**$190.61 Billion**

# COMMUNITY IMPACT

=

**0**

Liters

# COMMUNITY IMPACT

=

**0**
Liters

**2,400**
Trees

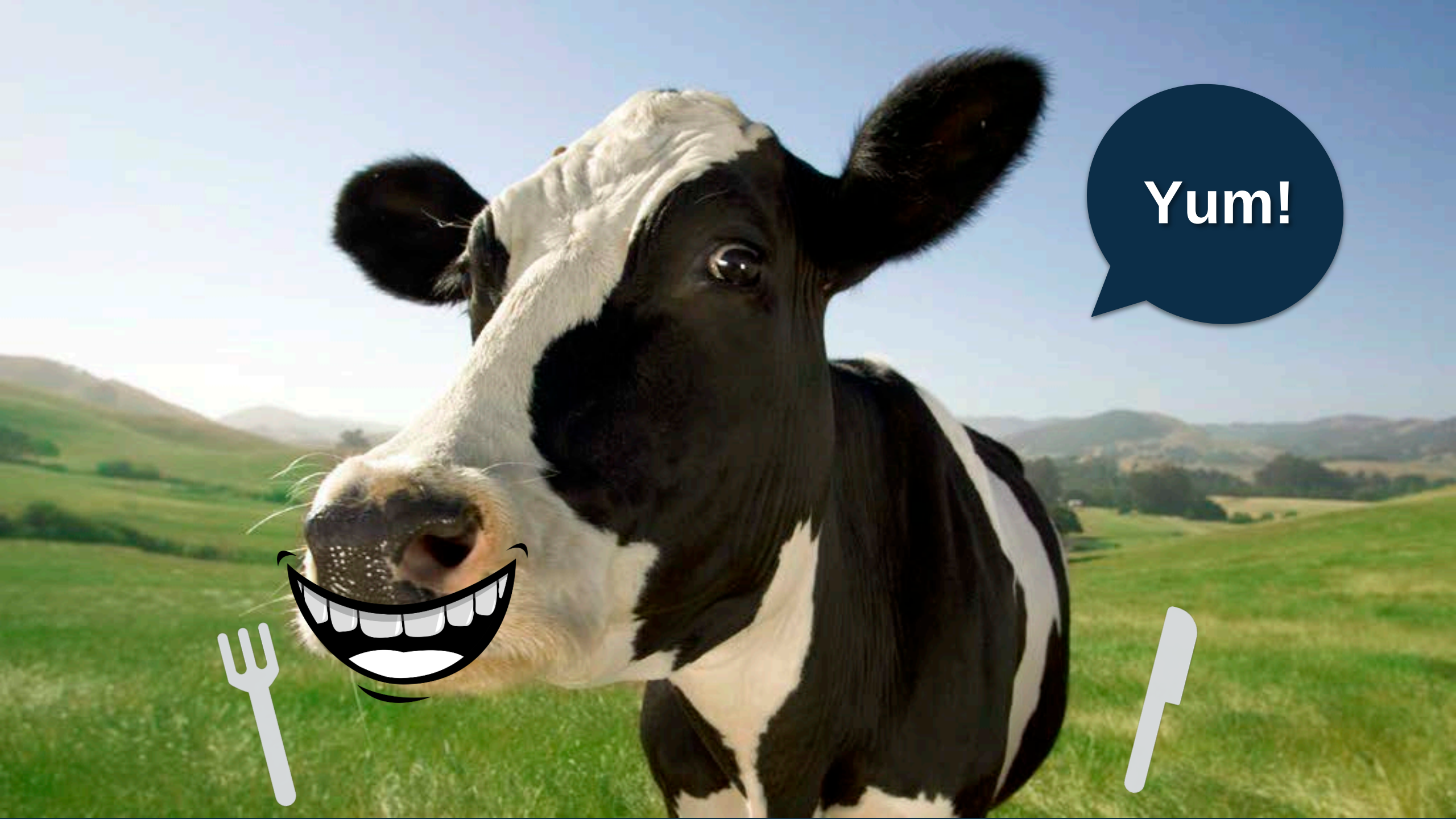
# COMMUNITY IMPACT

=

**0**
Liters

**2,400**
Trees

**99%**
Methane


Yum!

# TEAM & ADVISORS

**Lucy Best**
COO
Pragmatic Strategy

**Eliza Harrison**
CEO
Technical Solutions

**Emily Kian**
CMO
Communications

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Don Holzworth
Entrepreneur, Gillings School of Global Public Health

**James Morris**
National Oceanic and Atmospheric Administration

**Kurt Ribisl, Ph.D.**
Chair, Gillings School of Global Public Health

**Sheryl Waddell**
Director, Global Innovate Carolina Network

# Transforming the World, One Farm at a Time

**Patented Structure**

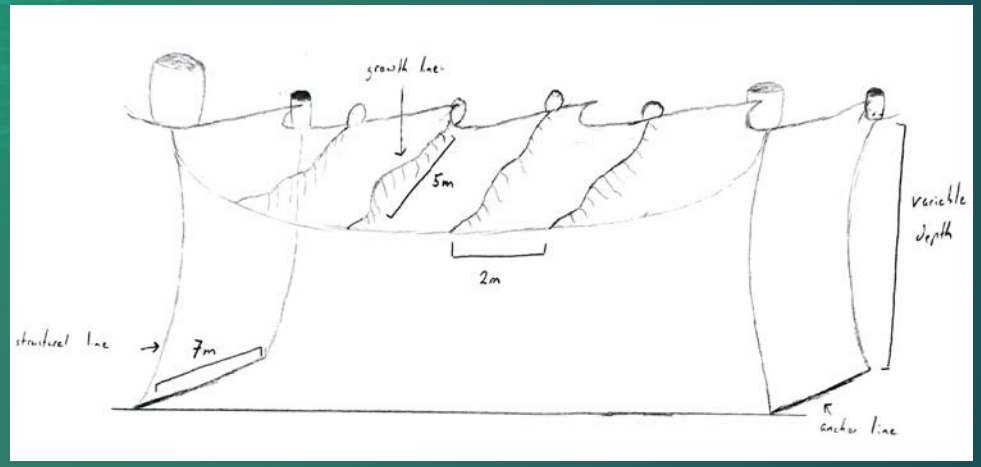
**Profitable Business**

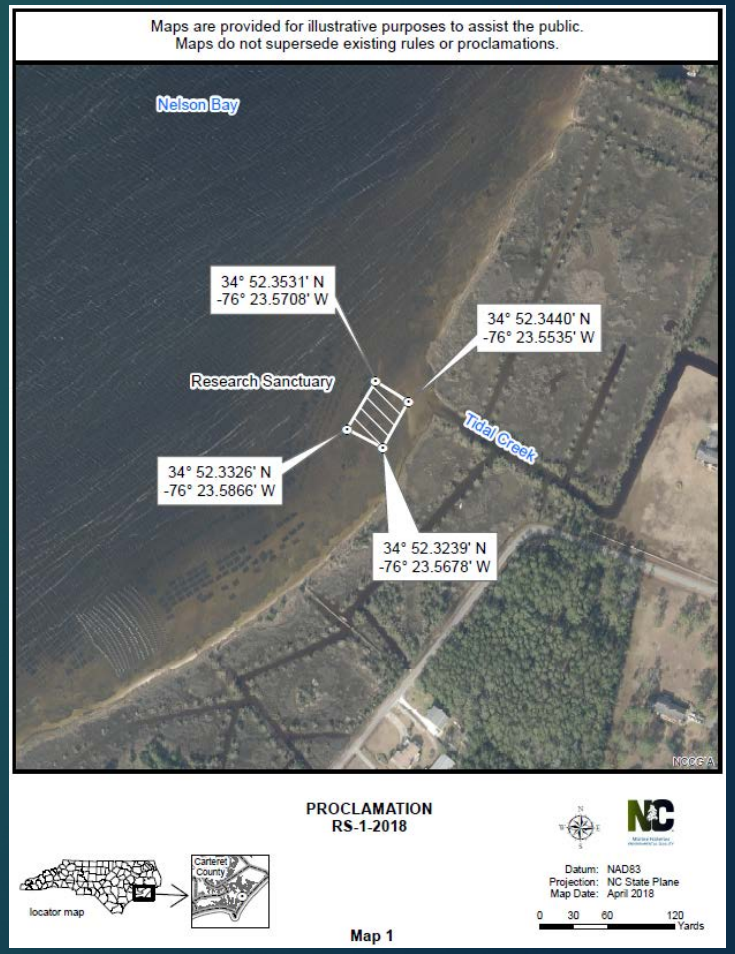
**Transformative Impact**

PHYTA phyta.org

Appendix: I

# PILOT INITIATIVE



Seaweed Buyers

Credit Buyers

Partners

Future Customers

DuPont Tate & Lyle BioProducts

NEWTRIENT

dk

AVEDA
THE ART AND SCIENCE OF PURE FLOWER AND PLANT ESSENCES

seventh generation

BSAG
Baltic Sea Action Group

3Degrees

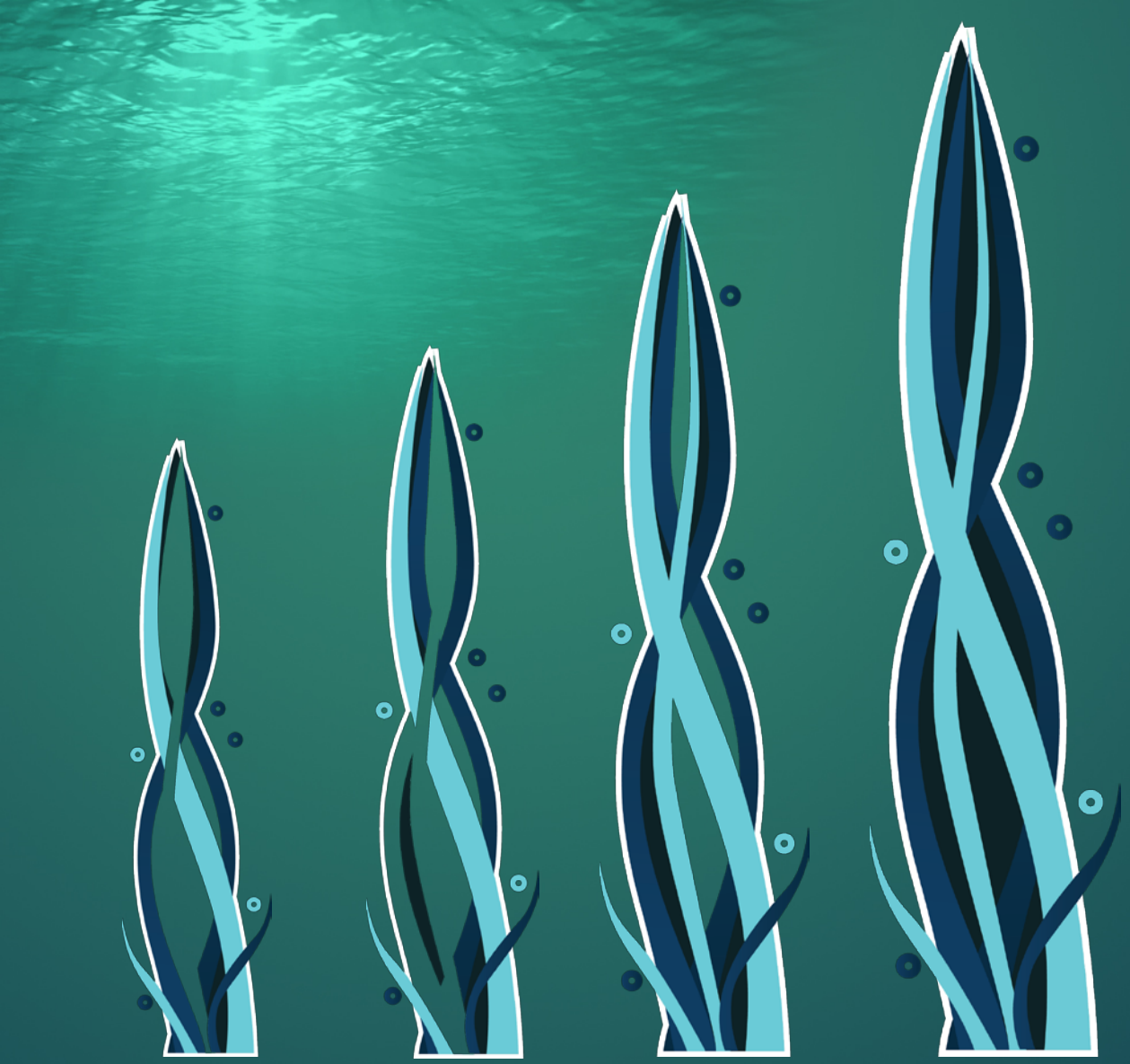
BANTRY MARINE RESEARCH STATION
BMRS

URBAN OFFSETS

FAO
FIAT PANIS

Appendix: II

# PARTNERS & TARGETED CUSTOMERS



Period I
5 farms

Period II
10 farms

Period III
20 farms

Period IV
50 farms

With $1.2 million
over 16 months

Appendix: III

# INVESTMENT

**$3,540**
Annual Operating Cost

**6 months**
Without Credit Sales

**1 months**
With Credit Sales

**1600%**
ROI

**85%**
IRR

Appendix: IV

# PAYBACK PERIOD

- Polysaccharides are biodegradable
- Resistant to microwave radiation
- Less brittle
- Durable
- Water soluble
- Improve global food security
- Increases soil nutrient and water retention

Appendix: V

# SEAWEED AS PLASTIC

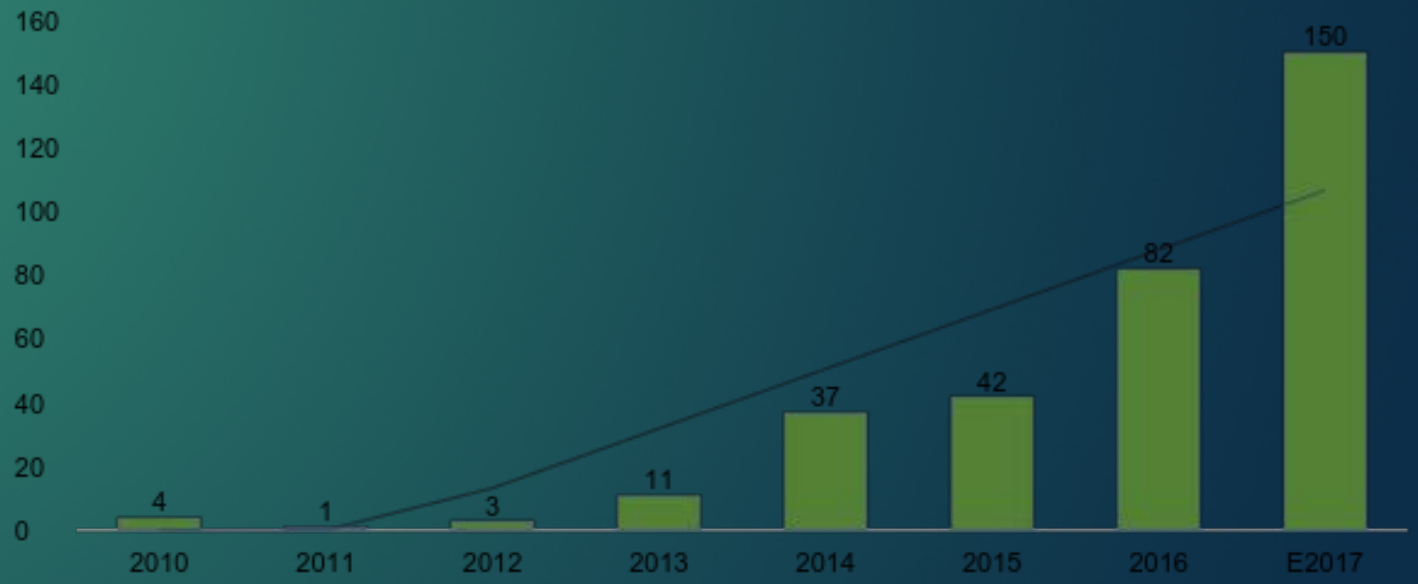
Appendix: VI

# GREEN BOND MARKET

**60%**

**Projected growth between 2017 and 2018**

Green bonds issues since 2010




Source: World Economic Forum 2017

Appendix: VII

# SCALABILITY

**James Morris**
National Oceanic and Atmospheric Administration

**Justin Stone**
Financial Consultant, Certified Public Accountant, entrepreneur

**Melissa Carrier**
Professor of Practice in the Department of Public Policy at the University of North Carolina

**Don Holzworth**
Entrepreneur in residence at UNC Gillings School of Global Public Health

**Laura Fieselman**
Coordinator for UNC Social Innovation Initiative, founder of Raleigh City Farm

**Kurt Ribisl, Ph.D.**
Chair in the Gillings School of Global Public Health - Department of Health Behavior

**Tim Flood, Ph.D.**
Associate Professor of Management and Corporate Communication

Appendix: VIII

# TEAM & BOARD OF ADVISORS

| UNIT PRICE PER KG | |
|---|---|
| Biomass generated per harvest (kg) | 643.5 |
| Number of harvests per year | 3 |
| Total annual biomass (kg) | 1930.5 |
| Rig Lifetime (yr) | 3.5 |
| **REVENUE** | |
| Biomass | 24,420 |
| Credits | 89,836 |
| Total Revenue | 114,256 |
| **COSTS** | |
| Rig structure | 2,782 |
| Labor for Harvesting and Processing | 3,540 |
| Transportation | 89 |
| Bonus per kg | 965 |
| Packaging | 171 |
| Permitting | 100 |
| Total Costs | 7,849 |

| | |
|---|---|
| Profit from biomass | 16,572 |
| Profit from credits | 81,987 |
| Profit per kg seaweed | 8.58 |
| Profit from credits | 46.54 |
| Total Profit per kg with credit | 55.12 |

Appendix: IX

# UNIT ECONOMICS

# Appendix: X FIVE YEAR PROJECTIONS

| BUSINESS MODEL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
| Number of rigs | 1 | 10 | 20 | 40 | 60 | 80 | 90 | 100 |
| Total quantity of biomass (kg) | 644 | 12,870 | 25,740 | 77,220 | 115,830 | 154,440 | 173,745 | 193,050 |
| **Revenue** | | | | | | | | |
| Animal Feed | - | - | 6,950 | 20,849 | 41,699 | 62,548 | 83,398 | 104,247 |
| Bioplastics | 483 | 4,826 | 9,653 | 28,958 | 57,915 | 86,873 | 115,830 | 144,788 |
| Cosmetics | 7,658 | 76,577 | 153,153 | 459,459 | 918,918 | 1,378,377 | 1,837,836 | 2,297,295 |
| Credits | 29,945 | 598,907 | 1,197,814 | 3,593,443 | 5,390,164 | 7,186,886 | 8,085,246 | 8,983,607 |
| Total Revenue | 138,086 | 980,310 | 1,367,570 | 4,102,709 | 6,408,696 | 8,714,683 | 10,122,310 | 11,529,937 |
| **Costs** | | | | | | | | |
| Structure and Processing | 12,037 | 56,071 | 92,968 | 232,980 | 446,777 | 620,827 | 834,625 | 1,008,674 |
| Operations | 5,502 | 20,974 | 40,249 | 105,347 | 208,493 | 311,640 | 414,787 | 517,933 |
| Management | 60,000 | 100,000 | 150,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 |
| Total | 77,540 | 177,045 | 283,217 | 538,326 | 855,270 | 1,132,467 | 1,449,411 | 1,726,608 |
| **Profit** | **5,755** | **497,602** | **1,038,078** | **3,318,058** | **5,012,276** | **6,746,242** | **7,542,100** | **8,377,705** |
| Profit Margin | 77% | 81% | 79% | 82% | 79% | 78% | 75% | 74% |

Food Products Animal Feed

Hygiene Products Fertilizer

Food Products Gelling Agent

Dietary Supplements

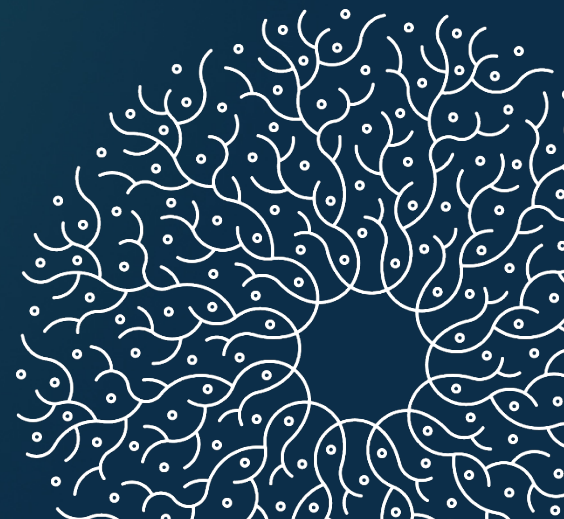
Animal Feed Food Products

Fertilizer Animal Feed

Gelling Agent

Appendix: XII

# SEAWEED REIMAGINED




Appendix: XIII

# POTENTIAL APPLICATIONS

| Market Segments | Value per kg (USD) |
|---|---|
| Bioplastics | 2.50 |
| Personal Hygiene | 20.41 |
| Vitamin Supplements | 8.18 |
| Food | 16.56 |
| Feed & Protein | 1.43 |
| Gelling Agent | 1.05 |
| Fertilizer | 0.55 |
| Carbon Credit | 0.02 |
| Nitrogen | 40.00 |
| Phosphorus | 41,000.00 |

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Appendix: XIV

# BIBLIOGRAPHY

# PARTNERS & **CUSTOMERS**

DuPont Tate & Lyle BioProducts

BANTRY MARINE RESEARCH STATION

## Seaweed Buyers

NEWTRIENT

BSAG Baltic Sea Action Group

URBAN OFFSETS

## Credit Buyers

dk

FAO FIAT PANIS

## Partners

Seaweed Buyers

Credit Buyers

Partners

Future Customers

Appendix: II

# PARTNERS & TARGETED CUSTOMERS