THE NORTH CAROLINA RESEARCH CAMPUS
HEALTH-NUTRITION-AGRICULTURE-BIOTECH

7 UNC INSTITUTIONS, PLUS DUKE
RCCC
USDA PRESENCE
INDUSTRY PARTNERS ON SITE & OFF

Mary Ann Lila, NCSU, NCRC
NCRC - National and Global Impact
Leading discovery and delivery of innovative plant-based solutions to advance human health & wellness

1. Whole Foods
2. Functional foods
3. Dietary supplements
4. Medical foods
5. Phytopharmaceuticals
Modified from GD Lewis, R Gerszten et. al. JACC 2008;52;118
Plants & their Bioactive Phytochemicals

“Stressed for Success”
Bioprospecting

**BioExploration, not Bioprospecting**

- Legal framework
- Ethnobotanical leads
- Sustainability

**Screens to Nature**
*(not nature to screens)*
Screens-to-Nature (STN) System

- Portfolio of qualitative field bioassays
- Primary indicators of bioactivity
- Medium-throughput techniques
- Participatory research tool
GIBEX Manual – An Effective Tool for Technology Transfer
Dual Assay for Protease Inhibitors and Proteases Using X-Ray Film

Targets: HIV / AIDS, parasitic diseases, metabolic disorders

1. Squeeze or extract juice
2. Place on surface of x-ray film +/- trypsin
3. Incubate for 15 min,
4. Wash with water

Trypsin - positive control
Protease (source: pineapple juice)
Negative control

Protease inhibitor (source: potato juice with trypsin)
Antimicrobial Assay with Human Saliva

Targets: Bacterial tropical diseases

(C) Saliva or *Staphylococcus aureus* control
(1) Kanamycin
(2) Tobacco extract
(3) Garlic extract applied on the surface
(4) Garlic extract added to the medium
(5) A slice of garlic clove was included in the medium
<table>
<thead>
<tr>
<th>Berry</th>
<th>Ripe/Unripe</th>
<th>Protease Assay</th>
<th>Protease Inhibitor Assay</th>
<th>Amylase Assay</th>
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<th>Antioxidant Assay</th>
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Resources STAY
Knowledge STAYS
IP STAYS
TEK validated;
Youth are engaged
## A-type PACs in wild Alaskan berries

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<th>SD-VO</th>
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- All berries studied contained at least a single A-type PAC.
- Some structures were found to be species-specific (see green highlights)
- Most of these are novel results, having never been described in these berries before.
Visualization of adipocytes after treatment throughout differentiation with 100 µM (epicatechin equivalents), of proanthocyanidin-enriched fraction (PAC) of *V. uliginosum*

Proanthocyanidin-enriched fraction (PAC) of *Vaccinium* (A), negative control (B)
Acute Model for Testing Hypoglycemic Activity

Important Tool for Testing Small Amounts of Material Quickly
Urgent next research priorities: 1) functional food 2) biofortification
Goal: Solve the biggest challenge for the functional foods industry - to deliver an effective daily dose of beneficial dietary bioactives (phytochemicals) in a few servings, while reducing unhealthy compounds.
Nutrasorb™ Process

Sugars + Oils & Fats + Phytonutrients = Nutrasorb™-Enhanced Matrix + Residue Converted To Value Added Products

No Waste Generated!
Example: Nutrasorb Matrix Concentrates

Anthocyanins from Blueberry Juice

Anthocyanins measured by pH differential method

Blueberry concentrate dilution, Matrix concentration

Matrix + ACNs  Matrix
Wheat Bran - Cranberry Nutrasorb

Untreated Wheat Bran

Wheat Bran-Cranberry Nutrasorb

NIH NIDDKD Phase 1 SBIR
USDA Phase 1 SBIR
Nutrasorb Matrix Binds Anti-Bacterial Adhesion Compounds from Cranberry Juice

Compounds eluted from cranberry-Nutrasorb matrix had excellent activity in *E. coli* anti-adhesion assays (UTI model). This activity was comparable to that of chromatographically isolated cranberry flavonoids.

1.5 g of Nutrasorb matrix sorbed proanthocyanidins (main anti-bacterial adhesion compounds) present in one serving of cranberry juice drink (8 oz = 240 mL).
Cranberry Nutrasorb Incorporated into Solid Agar Media Inhibits Bacterial Growth

Staphylococcus aureus
24 h incubation
37 °C
**Nutrasorb Matrix Enhances Efficacy of Sorbed Bioactives**

Example: Polyphenol-Enriched Blueberry-Nutrasorb Matrix Reduces Blood Glucose in Diet-Induced Diabetic Mice

![Graph showing fasting blood glucose levels](image)

- Vehicle
- Matrix Control
- Enhanced Matrix 300 mg/kg
- Enhanced Matrix 600 mg/kg
- Metformin 300 mg/kg

**Graph Details**
- X-axis: Fasting Blood Glucose (mg/dl)
- Y-axis: 0 Hr, 6 Hr

**Statistical Symbols**
- *: p<0.05
- **: p<0.01
- ***: p<0.001

n = 5 ±SD

**Confidential**

YOUR HEALTH IS OUR SCIENCE
From a Functional Food....... to a Biofortification Strategy for the Developing World
Nutrasorb-Zambia
Funded by Bill & Melinda Gates Foundation
Grand Challenges Explorations

Goals of Phase I: Develop and validate an innovative, portable and stable protein-rich food ingredient fortified with bioactives from local fruits

Targeted Population: Children and pregnant and nursing mothers
Close to 45% of Zambian Children Experience Hidden Hunger or Malnutrition
Zambian Infant Mortality Rate is 65/1,000 live births (23/222)

Corn and Seasonal Vegetables Are Staples of Zambian Rural Communities
Ground Nut (Peanut) is the Main Source of Protein
Separation of Fruit Puree by Filtration and Addition of Protein-rich Flour
Mixing, Separation and Drying

Mixing

Separation of flour

Drying of flour

Final Product
... Sharing Nutrasorb Technology
Victoria Falls
Mosi-oa-Tunya (*the Smoke that Thunders*)
*The largest water fall in the world based on the area of falling water*