Empowering
Human Health

NORTH CAROLINA RESEARCH CAMPUS

Highlights from our NCRC Campus Partners

2023 Annual Report

NC | RESEARCH CAMPUS

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Welcome to the NORTH CAROLINA RESEARCH CAMPUS

Cory R. Brouwer, PhD

All of us at the North Carolina Research Campus are proud to present our first annual report highlighting the important work of all our partners across academia, business and civic. Our achievements over the past year exemplify the steadfast commitment and innovative mindset that characterize the NC Research Campus.

In 2023, we celebrated our fifteenth year and we felt it was a good time to reflect on our campus history. Our City of Kannapolis Mayor Darrel Hinnant describes the years leading up to the NC Research Campus ribbon cutting and the transformation of the community.

This is a journey that we have taken together. Here collaboration is in our blood and our strength is in how we work together across all academic, business, and civic partners. We include here an article highlighting the power of these collaborations.

We also continue to examine our role in economic development - for both the city of Kannapolis and the state of North Carolina. With partners like the North Carolina Food Innovation Lab transforming the terrain of food science and Coddle Creek Capital investing in early-stage life science developments on campus, the NC Research Campus continues to drive economic growth in our community.

The NCRC is a special place. All of the partners working together at the NC Research Campus are proud to share our first campus wide report, which will become an annual publication. We hope you enjoy learning about our work and its impact.

Sincerely,

Cory R. Brouwer, Ph.D.
Executive Director of Research, North Carolina Research Campus

THE NORTH CAROLINA RESEARCH CAMPUS

CAMPUS METRICS:

71
MD and PHD Level Scientists

261
Scientific Publications

102
University Research Staff

35
University Post Docs

101
University Students (Undergraduate and Graduate)

484
University Partner Employees: **409**

Corporate Partner Employees: **75**

CAMPUS AFFILIATES:

265
(Approx). **Educational Affiliates**

546
Civic Affiliates

300
Community Health Affiliates

1111
Total Campus Affiliate Employees

Total* Federal & Extramural Funding:

$218,301,705.73

** Cumulative since 2008*
** Public University Partners*

132 COMMUNITY EVENTS | 3,000+ Participants

- NCRC Catalyst Symposium
- UNC-Chapel Hill Appetite For Life
- UNC-Chapel Hill Seminar Series
- NCCU Food Security Seminars
- UNC Charlotte Chem101 Speaker Series

57 STEM (educational) **EVENTS** | 6,500+ Participants

- N.C. A&T- Rural Food Forums
- N.C. A&T with USAID Farmer-to-Farmer Program
- NC State Seminars and Workshop Series
- NCFIL International Speaker Presentation
- UNC-Chapel Hill Nutrigenetics, Nutrigenomics and Precision Nutrition Short Course

Welcome to Kannapolis: Home of the North Carolina Research Campus

In 2023, we reflected on 15 years of the North Carolina Research Campus. What started as a handful of buildings with a few occupants grew into a bustling center of scientific innovation. This campus brings leading scientific minds from all over the world to one location dedicated to a central goal: empower human health through nutrition.

Before it was the North Carolina Research Campus, the NCRC was the site of the world's leader in home textile manufacturing: Cannon Mills (later known as Pillowtex). David H. Murdock, businessman and passionate advocate for plant-based eating, owned Cannon Mills in the 80s, but the mill closed in the early 2000s under different ownership. Murdock took that opportunity to return his focus to Kannapolis, developing both the vision and funding for the execution of the NCRC.

City of Kannapolis Mayor, Darrell Hinnant, who was a City Council Member at the time, described the years leading up to the NCRC ribbon cutting being devoted to deciding what exactly the community should be like. "The campus ultimately became the anchor to economic development for the City of Kannapolis," he said. However, the campus opened its doors in 2008 just in time for a global financial crisis. Mayor Hinnant described how the 2008 recession initially slowed recruitment for campus development. "It let the air out of the balloon," he said. "Recruiting businesses during the recession was difficult, but we continued to be amazed at the unwavering commitment by both David Murdock and the university partners to the NCRC's success."

The campus opened in 2008 with the David H. Murdock Research Institute (DHMRI, now

Eremid Genomic Services), North Carolina State University Plants for Human Health Institute (PHHI), and University of North Carolina at Chapel Hill Nutrition Research Institute (NRI). With its trifecta starter pack of research institutes and acronyms, the NCRC began to grow. In 2012, the Cabarrus Health Alliance opened as the community's public health department. And in 2015, the Kannapolis City Hall and Police Headquarters took its place across from the David H. Murdock Core Lab building. In 2024, the campus has eight university partners, four community partners, and nine corporate partners.

Over the years, collaboration between scientists and partnerships between campus partners has been at the heart and soul of the NCRC's ability to prosper. The NRI partners with local businesses to conduct community outreach events like Appetite for Life on topics like beer and honey (and the connection to science, of course). The North Carolina Food Innovation Lab (NC FIL) translates science into something tangible and market-ready. University partners participate in community events like the infamous Kannapolis event Jiggy with the Piggy that transforms the NCRC into a mecca for barbecue enthusiasts. These examples of collaboration provide a business case for why this place and why these organizations and why this mission.

> **"THE CAMPUS ULTIMATELY BECAME THE ANCHOR TO ECONOMIC DEVELOPMENT FOR THE CITY OF KANNAPOLIS."**
>
> — **Darrell Hinnant,** City of Kannapolis Mayor

The NCRC has not only redefined Kannapolis but also charted new territories in the realm of scientific research. As we stand on the cusp of another decade, the journey of discovery, innovation, and transformation at the NCRC is poised to continue and make waves felt far beyond the borders of North Carolina.

NCRC: The Power of Collaboration

Visitors and residents of Kannapolis walking down West Avenue can quickly see what has become a lively, bustling downtown district. And if they keep walking, they happen upon the North Carolina Research Campus, a scientific community comprised of academic and industry partners. Each organization took a different path to end up as a contributing member of the NCRC, but they all play a role in the success of the campus and community. During this 15-year anniversary of the campus, we highlight many reasons why companies have decided to partner with the research campus and we reflect on where these exciting endeavors may one day lead within the world of nutrition and precision health..

ALIGNED VISION

At their core, the institutions and companies that have planted roots at the NCRC are seeking the same goal – to improve human health. The specific words used in the vision and mission of each company may differ and they each utilize their own novel approach, but central to every NCRC partner is the desire to discover and implement new methods and technology to improve human health and our understanding of it.

For example, Eremid Genomic Services, SNP Therapeutics, and Duke Kannapolis all focus on genomic studies and the development of genetic-based tests to drive the next generation of precision nutrition intervention and therapeutics while Bright Path Laboratories, Inc. is focused on the advanced manufacturing of pharmaceutical products. Although they employ different approaches and technologies, together, these companies are driven by their desire to improve human health.

COLLABORATION

Collaboration is key to advancing scientific knowledge. Our partners recognized the inherent collaborative setting of the NCRC and its ability to bring together diverse partners – from academic institutions to public health agencies to pharmaceutical manufacturers. While pursuing their own goals, collaboration is fundamental to efficient and effective research, development, and success. Just look at the over 130 internal and external collaborators that have been critical to the mission of Duke Kannapolis, enabling even more ambitious projects in the future.

The Nutrition Innovation Center, part of Standard Process, is a great example of the extensive collaborations that have developed between members of the NCRC. Their partnership with the North Carolina Food Innovation Lab allows

"Our partnership with Eremid Genomic Services has been instrumental in the development and refinement of our comprehensive prenatal precision nutrition test, Genate™...This ongoing collaboration ensures that we will consistently leverage their cutting-edge services and resources, further advancing our mission to provide innovative and accurate genetic solutions for optimizing health and wellness."

— Dr. Steven Zeisel, MD, PHD, Founder of SNP Therapeutics

"Because of the large amount of activity and presence on the North Carolina Research Campus, it offers an attractive location for advertising and recruitment of participants for advancing nutrition research clinical studies, both within the institutional facilities and local organized public events. A number of scientists employed at Standard Process Inc. have been hired after completing employment or graduate level research on the NCRC campus with other institutions."

— **Gene Ford,** Vice President of Research and Development at Standard Process

them to address challenges in the production of supplements and processing of food ingredients while their clinical research collaborations have provided robust data through the diligent effort of partners at Appalachian State University and the University of North Carolina at Greensboro. They also utilize services of the UNC Charlotte Bioinformatics Services Division for data analysis of some research studies. Together, these collaborations open the door to more research opportunities and future breakthroughs for whole-food health solutions.

Rather than fostering an atmosphere of competition, the NCRC and all of its academic and business partners utilize their skills, equipment, and expertise to support the efforts of one another and the research campus as a whole. Additionally, as the local community has gotten to know and understand the work of multiple partners at the NCRC, trust and cooperation has grown, creating a diverse pool of participants for potential studies, surveys, and other research efforts.

COMMUNITY CONNECTIONS

Transforming a former mill town into an innovative, health-focused research hub was no easy task. It has required countless hours, time, energy by many stakeholders working tirelessly over the years to create what we see today. By joining this campus community, companies are able to be a part of something larger than themselves. Unique viewpoints and goals can be easily shared between campus partners and evolve to create an even stronger network of scientists, researchers, nutritionists, and advocates. Strong connections have also allowed NCRC to give back to the community by creating educational events for tomorrow's scientists. In fact, the NCRC is home to Rowan-Cabarrus Community College's annual STEM Open House through a partnership with the NC Science Festival and several campus partners, bringing STEM education, interactive exhibits and fun to the community.

"The Cabarrus Health Alliance's partnership with the North Carolina Research Campus and active engagement with the NCRC Directors' Advisory has provided an avenue for our leadership team and academic health department committee to stay abreast of local research projects and findings. Additionally, it has presented the space for collaboration opportunities to be shared and celebrated."

— **Erin Shoe, MPH**, Director of Public Health at Cabarrus Health Alliance

NCFIL: Driver of Economic Growth in NC

In 2024, the North Carolina Food Innovation Lab (NCFIL) is at the forefront of pioneering work, reshaping the landscape of food science under the leadership of Executive Director Bill Aimutis. Since its establishment in 2020, NCFIL has been dedicated to driving economic growth in North Carolina.

This year, NCFIL is deeply involved in exploring plant-based foods, with a strong emphasis on reducing reliance on animal products, promoting sustainability, and advocating for ethical treatment of animals. Their projects blend precision fermentation-derived products with plant-based ingredients, showcasing the potential of hybrid food solutions.

Since the inauguration of their expansive 16,000 square-foot facility, NCFIL has seen remarkable technological advancements, particularly in protein extraction and purification. Their cutting-edge bar-producing technology and improved milling/graining capabilities are pushing boundaries in food processing and product innovation.

Bill Aimutis shares insights into NCFIL's diverse projects, highlighting a balanced approach between alternative proteins and creative sauce developments. He envisions a future trend towards hybrid solutions, seamlessly integrating low-protein and dairy-alternative options with unique ingredients and bioactives.

"The fact that we've been focused on human research, nutrition, and health adds credibility to NCFIL," says Aimutis. "When we're out there promoting, we make a point to reference campus partners like the N.C. State Plants for

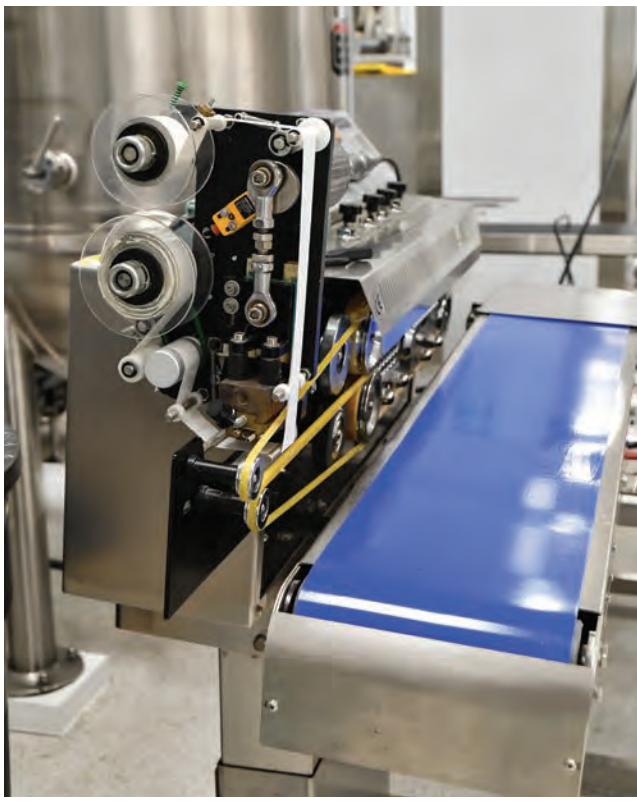
Indeed, collaboration with esteemed entities such as the N.C. State Plants for Human Health Institute bolsters the lab's research and development endeavors, enriching the scientific community and reinforcing its reputation.

— **Bill Aimutis,** Executive Director, NC Food Innovation Lab

Human Health Institute as a vital part of the process – the continuation of R&D." Indeed, collaboration with esteemed entities such as the N.C. State Plants for Human Health Institute bolsters the lab's research and development endeavors, enriching the scientific community and reinforcing its reputation.

Aimutis foresees a continued emphasis on alternative proteins and envisions a broadened NCFIL portfolio, addressing consumer desires for products that harmonize health, affordability, locality, and sustainability. He believes in the transformative power of research and the pivotal role it plays in the evolution of food science.

In conclusion, Aimutis asks: "how do we take research from basic to translational?" NCFIL plays a major role in that answer, acting as a linchpin in transitioning research from its exploratory stages to application, offering a plethora of resources and guidance to budding scientists and startups. It aids in navigating regulatory landscapes and commercializing innovations, contributing significantly to North Carolina's economic landscape. NCFIL is progressively becoming a cornerstone in the food industry, offering transformative solutions and paving the way for a sustainable and innovative future in food science.



CODDLE CREEK CAPITAL

Innovators Of Impact

CODDLE CREEK CAPITAL

CODDLE CREEK CAPITAL (CCC) is a boutique venture capital and business consulting firm engaged primarily with privately held, early-stage companies providing organizational design, strategy to market, and capital raising advice with primary focus in Life Sciences Markets. Led by managing partner and founder John Allen, CCC was founded in 2018 with a vision to commercialize early-stage life science developments from the developing biotech hub in North Carolina universities.

John Allen, *General Partner, is a serial entrepreneur and seasoned capital raiser with extensive experience in the early-stage life science sector. In 2002, he co-founded the Open Finance Network (OFN), overseeing its growth from two founders with no assets to managing assets totaling over $23 billion. He co-founded CCC in 2018.*

KEY HIGHLIGHTS FROM LAST YEAR:

1. **Spiral Steroids** – a discovery project with the UNC Nutrition Research Institute (NRI) for the treatment of necrotizing enterocolitis (NEC) and preeclampsia

Necrotizing enterocolitis remains a significant concern in the United States, particularly among premature infants, with considerable morbidity and mortality rates highlighting the need for improved neonatal care practices. Preeclampsia continues to be a leading cause of maternal and fetal morbidity and mortality in the United States, necessitating enhanced surveillance, early detection, and management strategies to mitigate its adverse effects on pregnancy outcomes.

2. **The Genate Test** – a test developed with SNP Therapeutics and Dr. Steven Ziesel that offers precise, DNA-based nutrition recommendations for baby growth and development

Research on baby growth and development is essential for understanding nutritional needs, brain development, and identifying risk factors for health issues and developmental delays. This knowledge informs intervention strategies, empowers parents with caregiving practices, and ensures optimal health and well-being for infants.

3. **Collaboration with Bright Path Laboratories** – building an advanced manufacturing platform for U.S. drug resilience and independence from foreign suppliers for domestic drug supply

The United States has been actively addressing concerns regarding drug resilience and reducing dependence on foreign suppliers for its domestic drug supply. Efforts include increasing domestic manufacturing capacity and enhancing regulatory oversight to ensure the security and reliability of the supply chain.

coddlecap.com

Looking into 2024 and beyond, CCC is involved in numerous plans and collaborative initiatives, including:

- RAIN Scientific, a collaboration with the NRI and R&S Chemical
- Sponsorship of various educational programs at the NCRC
- Exploration of database development around nutrigenomics and various alternative modalities to engage in precision guided nutrition

SNP Therapeutics is one of the first companies formed by and invested in by CCC through a partnership with former UNC NRI director Steven Zeisel, MD, PhD. CCC worked with Dr. Zeisel to bring SNP Therapeutics to commercialization, with capitalization including recruiting SNP therapeutics CEO Jon Kleu in 2019.

Other campus investments CCC has invested in include Bright Path Laboratories and Eremid Genomic Services, formerly the David H. Murdock Research Institute (DHMRI).

CCC seeks forward-thinking individuals, particularly physicians and scientists, who are focused on the overarching concept of longevity and its implications for human health. CCC is particularly interested in companies focused on the relationship between nutrition and gene expression. They are actively recruiting in five key areas: Genomics, Nutrition, Immunology, Oncology, the Microbiome, and Neurology, all with a focus on advancing longevity.

Looking ahead, Allen is committed to bridging the divide between academic research and commercialization efforts. Their aim is to bring the most promising ideas to fruition and amplify the impact of groundbreaking research. They are forging partnerships with scientists at the NCRC to achieve these goals.

Leah Allen, *Managing Partner / Director Community Engagement*

David Helmer, *General Partner*

STANDARD PROCESS INC.

Nutrition Innovation Center

SINCE ITS ESTABLISHMENT IN 2018, the Nutrition Innovation Center (NIC) by Standard Process has been committed to advancing research, testing ingredients, and creating novel products and solutions for healthcare practitioners, veterinarians, patients, and their animal companions. Functioning as a hub for innovation, the NIC champions a holistic approach to nutrition that is grounded in scientific evidence. It serves as a collaborative space where businesses, academic institutions, and healthcare organizations converge to drive transformative advancements in the nexus of human health and nutrition. Activities at the NIC revolve around translational research, leveraging interdisciplinary teams to explore areas such as discovery science, mechanistic studies, plant breeding, agriculture, technology development, clinical research, and educational initiatives.

The NIC occupies a suite on the first floor of the core lab as well as lab space on the fourth floor. Standard Process employs a wide variety of professionals at the NIC, including education specialists, lab technicians, and nutrition scientists – several who completed their doctoral work at the NCRC.

The Standard Process main campus is located in Palmyra, Wisconsin and includes over 800 acres of certified organic farmland used in production for their extensive line of whole food nutrition products. The official definition of "organic" varies slightly depending on the regulatory body and the context. However, in general, organic refers to agricultural products produced using methods that promote ecological balance and conserve biodiversity. These methods typically involve the use of natural fertilizers, pest control methods, and crop rotation. Organic farming also avoids the use of synthetic pesticides, fertilizers, genetically modified organisms (GMOs), and irradiation.

standardprocess.com

KEY RESEARCH FINDINGS AND HIGHLIGHTS FROM 2023

1. **Bovine thymus gland as an oral supplementation to support functional recovery of traumatic brain injury**

Traumatic brain injury poses a significant public health concern in the United States, with approximately 2.8 million TBIs occurring annually. These injuries, often resulting from falls, motor vehicle accidents, or sports-related incidents, can lead to a range of physical, cognitive, and emotional impairments, underscoring the need for comprehensive prevention strategies and rehabilitative care.

2. **Alpha amylase and probiotic supplementation to support digestive health and the balance of the body's fungal community (the "mycobiome")**

The mycobiome, comprising diverse fungal species, plays a crucial role in various ecosystems, including soil, plants, and the human body. Understanding its composition and dynamics is essential for unraveling its impact on ecosystem health, nutrient cycling, and human well-being.

3. **Combining hemp oil, calamari oil, and broccoli in supplementation to address chronic pain and sleep**

Chronic pain affects millions of individuals in the United States, posing a significant burden on public health, quality of life, and healthcare systems nationwide. Sleep habits in the United States vary widely, with many individuals experiencing insufficient sleep duration, irregular sleep schedules, and poor sleep quality, reflecting the diverse lifestyles and societal demands across the country.

Standard Process maintains a collaboration with the North Carolina Food Innovation Lab (NC FIL) to address challenges related to the production of supplements and the processing of food ingredients in innovative formats using NC FIL's pilot plant facility. By partnering with services provided by the David H. Murdock Research Institute (DHMRI), they ensure ongoing analytical support for research endeavors. Current research trials, conducted in partnership with the Appalachian State University Human Performance Lab and the University of North Carolina Greensboro Center for Translational Biomedical Research - both at the NCRC - focus on evaluating the effectiveness of a beet pre-workout supplement in aiding inflammation resolution and metabolic recovery in trained cyclists over a two-week period.

STANDARD PROCESS HAS NAMED GENE FORD ITS NEW VICE PRESIDENT OF RESEARCH & DEVELOPMENT

Gene has been with Standard Process for three years. He brings decades of experience within the food industry and has a well-established background of leading scientific and technical teams. His background includes more than 20 years with Campbell Soup Company, more than 10 years at Nestlé, and a number of high-level R&D leadership roles. He also brings experience in process development, product development, developing technology platforms, and developing R&D strategy. He holds a bachelor's and master's degree in Agricultural Engineering from Michigan State University as well as a master's degree of Technology Management from University of Pennsylvania.

Gene Ford, *Vice President of Research & Development*

EREMID® GENOMIC SERVICES

Advancing Genomic Research and Clinical Testing for North Carolina and Beyond

Eremid® GENOMIC SERVICES

EREMID® GENOMIC SERVICES is a specialty, high-complexity, CLIA-certified, CAP-accredited genomics contract research organization, enabling genomics research and the development of cutting-edge clinical genomic-based Laboratory Developed Tests (LDTs). With a broad range of genomics expertise, Eremid boasts the latest systems from Illumina, PacBio, Oxford Nanopore Technologies, 10X Genomics, ThermoFisher, and NanoString.

Julian Abery MSc.
Chief Business Officer

Julien Curaba PhD.
Chief Scientific Officer

Rapid growth in 2022 saw the opening of the Graham Genomics Training Lab in collaboration with Catawba College and Eremid obtaining Clinical Laboratory Improvement Amendments (CLIA) certification, expanding services to clinical clients. Through 2023, Eremid has seen further transformative developments:

SUBSTANTIAL INVESTMENT ($3.0M)

A multi-million-dollar investment from Coddle Creek Capital has propelled Eremid into a new phase of growth and innovation.

PACBIO REVIO LONG-READ SEQUENCING

As an early adopter of the new PacBio Revio platform, Eremid has built world-leading expertise in long-read sequencing, exemplified by our PacBio Certified Service Provider status.

LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS)

Eremid implemented Semaphore Solutions' Labbit LIMS across its research, clinical, and training labs, streamlining workflows, improving data accessibility and quality, and improving service efficiency and reliability.

CAP ACCREDITATION

Complementing its CLIA certification, Eremid received accreditation from the College of American Pathologists (CAP), cementing Eremid as a trusted partner for end-to-end clinical genomics support.

FUTURE OUTLOOK

Eremid embodies the spirit of innovation and collaboration, contributing to the growth of North Carolina's genomics landscape. We are committed to pushing the boundaries of what is possible in genomics, with a focus on precision, compliance, and technological excellence. 2024 will bring additional expansion as we add GLP compliance to support our Agbiotech and Biotech customers; and welcome some of our clinical clients to the campus as they co-locate to enable closer collaboration with our scientists in the delivery of their genomic tests.

SNP THERAPEUTICS, INC.

Advancing Human Health Through Genetics

A NEW LINE OF NUTRITION PRODUCTS, developed through the research of Dr. Steven Zeisel, MD, PhD, founder of SNP Therapeutics, Inc. provides gene-guided precision nutrition which will advance the value of nutritional therapies to improve human health.

Steven Zeisel, MD, PhD is the past Director of the University of North Carolina's Nutrition Research Institute. Internationally recognized, he is a world-renowned scientist and a Kenan Distinguished University Professor in Nutrition and Pediatrics. Dr. Zeisel has proven that humans require choline and that this nutrient is critical for normal brain development, and for liver and muscle function. Based on his research, the US Institute of Medicine set a dietary requirement for choline in 1998. Having authored more than 350 scientific publications, Dr. Zeisel has won numerous awards including the prestigious National Institute of Environmental Health Sciences' Falk Award, the American Society for Nutrition's Osborne and Mendel Award, the American College of Nutrition's Award.

According to Jon Kleu, CEO, SNP Therapeutics, Inc., has developed the first comprehensive prenatal precision nutrition test. The test evaluates over 325 genetic markers that have a important role in the metabolism of key nutrients critical to optimal fetal development.

Steve Zeisel, MD, PhD, *Founder, SNP Therapeutics*

Jon Kleu, *CEO, SNP Therapeutics*

This at-home test kit, the **Genate Prenatal Precision Nutrition Test,** is lab processed and evaluated with the company's proprietary algorithm and produces for the patient a genetic report, shared with their Health Care provider. The GenateTM report shares recommendations for nutrition solutions to help patients make decisions allowing for nutrition optimization. The company has also recently launched a new prenatal nutrition line and offers maternal health counseling through their own Certified Dieticians to assist as women develop their nutrition plans.

In response to a need for improved identification and treatment of individuals with genetic causes of **Male Infertility,** SNP Therapeutics has also developed a patented genetic test and targeted nutrition treatment for males with a specific sperm function disorder. The company is currently conducting a clinical study with Boston IVF which will entail a two phase study on the prevalence and treatment for males with the genetic signature for male factor infertility. By determining each person's genetic signature with the test and algorithmic process that examines hundreds of related SNPs, men can be screened and identified for the company's proprietary nutrition formulation to treat this specific sperm function disorder.

Future plans have been developed to conduct additional clinical studies in the areas of **NAFLD** (non-alcoholic Fatty Liver Disease) and **Muscle Wasting – Sarcopenia.** The company's Precision Nutrition approach will be utilized to develop genetic tests and nutritional interventions for these disease states.

SNPTherapeutics

BRIGHT PATH LABORATORIES, INC.

Transforming America's Access to Essential Medicines

BRIGHT PATH LABORATORIES is a pharmaceutical company committed to changing the way American medicine is sourced and manufactured. Bright Path's network of advanced manufacturing facilities is based entirely in the United States. Using a continuous flow platform and our patented Spinning-Tube-in-Tube (STT) Reactor™, our process produces large quantities of medicine in less time, at less cost, and with higher quality than our competitors. Our commitment to sustainable Green Chemistry decreases process steps, generates less waste, and uses fewer resources than traditional techniques. With Bright Path, a greener, cleaner, and faster approach to making medicine has finally arrived.

Tony Quinones, *Co-Founder and Chief Executive Officer*

BRIGHT PATH LABS ADDRESSES CANCER DRUG SHORTAGES WITH U.S. MANUFACTURING

Bright Path Labs is Solving Drug Shortages with Domestic Development and Manufacturing of Cancer Medicines Kannapolis, North Carolina–December 12, 2023, Bright Path Laboratories, a US-based advanced drug development and manufacturing company is proud to announce their contribution to solving drug shortages for the domestic development and manufacturing of two critical cancer drugs: Carboplatin and Cisplatin.

Both cancer drugs are used in chemotherapy treatment protocols to treat patients with various forms of cancer and, because of the shortage many patients have been forced to have their treatment delayed or significantly modified. The issue of domestic drug shortages has reached historic levels and concerns continue to grow as treatments for many significant health issues are having a serious impact on patient care. Bright Path is using its patented continuous flow advanced manufacturing platform to domestically manufacture these drugs at its state-of-the-art North Carolina research and development manufacturing facility.

"The necessity to reshore America's pharmaceutical manufacturing has never been greater and Bright Path is honored to be part of this process," said Tony Quinones, Co-Founder and Chief Executive Officer of Bright Path Laboratories. "Our transformative technology is changing the way America manufactures medicine, reducing our dependence on foreign pharmaceutical products and ultimately delivering to patients the medicine they need."

ABOUT BRIGHT PATH LABORATORIES

Bright Path Laboratories, Inc. brings its AI-enabled, advanced continuous manufacturing technology to the pharmaceutical industry where its novel chemical production techniques can have a significant impact in solving some of today's biggest challenges: reestablishing and improving the resiliency of pharmaceutical domestic supply chains, and accessibility and affordability of medicine. The Company uses its proprietary and patented STT® reactor for continuous and on-demand production of specialty chemicals, key starting materials (KSMs) intermediates, and active pharmaceutical ingredients (APIs) in North America with an emphasis on sustainable green, clean chemistry.

www.brightpathlabs.com

CABARRUS HEALTH ALLIANCE

CHA'S MISSION is to achieve the Highest Level of Individual and Community Health through Collaborative Action. We envision a thriving community where people make healthy choices in healthy environments. CHA works to improve community health and eliminate health disparities through traditional public health services such as environmental health protection, immunizations, disease surveillance and prevention; clinical services including maternity, dental, and pediatric primary care and behavioral health treatment; and community programming focused on prevention, case management, and connecting those with the greatest health needs to care.

FOOD IS MEDICINE

Through collaborative efforts with community partners, Cabarrus Health Alliance contributes to the advancement of human health by implementing lifestyle medicine and the "Food is Medicine" initiative within the community. "Food is Medicine" emphasizes diet and nutrition as the focus of preventing and treating chronic disease. Within the last year, Cabarrus Health Alliance has delivered and facilitated eight "Food is Medicine"-focused cooking classes with 80% of those classes being at capacity (twelve participants per class). Of those who attended a class, 100% of patients felt "extremely confident" in trying the recipes at home to make a change in their health.

CULINARY INNOVATIONS AND HEALTHY FOOD RETAIL

Culinary Innovations allows people to come together and encourages them to try healthier foods options. It gives people confidence in their cooking skills and demonstrates how to cook vegetables and other foods in healthier ways. In 2023, we offered 14 adult classes, including the family series, and had a total of 146 attendees. For the kids, we offered 10 classes and had a total of 48 attendees. We held two kids camps where we had a total of 20 participants. 98% of the attendees reported that they have learned something new.

WIC INDIVIDUALIZED COUNSELING

In the 2023 calendar year WIC nutritionists provided 9,383 one-on-one counseling opportunities (participants are seen multiple times per year, number includes duplication). One nutritionist was also able to provide education to multiple preschool classrooms with Save the Children Head Start Program in

PARTICIPANTS AS PARTNERS IN RESEARCH

Duke University

DUKE KANNAPOLIS: A part of the Duke Clinical and Translational Science Institute (CTSI) and Center for Precision Health (CPH), Duke Kannapolis functions as an engine to accelerate precision genomics and population health research, featuring a diverse community of engaged research participants.

Svati H. Shah, MD, MHS, *Ursula Geller Distinguished Professor of Research in Cardiovascular Disease, Associate Dean for Translational Research, Director of the Center for Precision Health (CPH) within the Clinical and Translational Science Institute (CTSI) and Duke Kannapolis*

Duke Kannapolis manages a wide variety of research projects focusing on the exploration, discovery, and validation of biomarkers that inform a deeper understanding of health and disease. Founded in 2007, Duke Kannapolis has enrolled over 15,000 participants using a successful community-engaged research model. Duke Kannapolis offers a wide range of assets and full-scope capabilities for investigators.

Launched in 2023, the CPH will harness the power of genomic, biomarker, and health data to transform patient care and population health. The center aims to expand clinical genetics, conduct clinically relevant translational research, perform cutting-edge implementation science, engage with and build trust in the community, and educate the workforce of tomorrow. The OneDukeGen genomic sequencing study, led by Duke Kannapolis, is a key foundational project in the CPH.

By partnering with Duke Kannapolis and the CPH, researchers in 2023 discovered an early marker of heart failure, more evidence that a key metabolic pathway may hold promise for the prevention and treatment of Alzheimer's disease, and new markers of fracture risk among older adults with type 2 diabetes.

ROWAN-CABARRUS COMMUNITY COLLEGE UPDATE

DR. CAROL S. SPALDING ADVANCED TECHNOLOGY CENTER: The newest building at the North Carolina Research Campus honors the achievements of Dr. Carol S. Spalding, including the founding of OpenCampus which focuses on non-traditional delivery for military and online education.

Carol Spalding, EdD,
President of Rowan Cabarrus Community College

BIOWORK PROGRAM

This new certificate program is a state-of-the-art development designed to equip students with the knowledge and skills required to compete for jobs at new biopharmaceutical manufacturing facilities that are currently planned in our area. Training students today will enable a ready, specialized workforce on day one of the new facility and demonstrates dedication to meeting the needs of companies seeking to invest in our community.

EXPANDED NURSING PROGRAM

Rowan-Cabarrus Community College (RCCC) is equipping more nursing students to go into our community and meet the ever-growing healthcare needs of this area. The college has recently expanded its nursing programs by 50 percent, including offering four nursing education programs on the research campus.

ENGINEERING

Advancing the field of human health and scientific research involves many types of jobs. RCCC strives to enhance employability and educational attainment of students beyond the bench by investing in programs such as engineering. Through this program, they prepare students with required skills and harness innovative technology in both engineering and advanced manufacturing.

GLOBAL WORKFORCE PROVIDERS

RCCC's Advanced Technology Center at the NCRC was selected as the home of the western hemisphere global training provider for Okuma, a trailblazer in computer numerical control (CNC) machining as well as RJG Inc., a global leader in injection molding. These collaborations allow for state-of the-art training programs and equip our community's students to lead the charge in future technologies.

APPALACHIAN STATE UNIVERSITY

HUMAN PERFORMANCE LAB:
The mission of the Human Performance Laboratory (HPL) is to investigate unique nutritional products as countermeasures to exercise- and obesity-induced immune dysfunction, inflammation, illness, and oxidative stress.

Dr. David C. Nieman, DrPH, FACSM

Professor & Director, Appalachian State University Human Performance Lab

KEY FINDINGS

In a collaborative study funded by the Almond Board of California with NC State and UNC Greensboro, we showed that **four weeks of intake of almonds (57 g/day) supported positive effects in improving mood state, retaining strength, decreasing muscle damage, increasing the generation of gut-derived phenolic metabolites, and altering the plasma oxylipin DiHOME response to unaccustomed eccentric exercise in untrained adults.** The elevated post-exercise plasma levels of 12,13-DiHOME with almond intake supported positive metabolic outcomes for adults engaging in unaccustomed eccentric exercise bouts.

- *Nieman DC, Omar AM, Kay CD, Kasote DM, Sakaguchi CA, Lkhagva A, Weldemariam MM, Zhang Q. Almond intake alters the acute plasma dihydroxy-octadecenoic acid (DiHOME) response to eccentric exercise. Front. Nutr.2023;9:1042719.*

Astaxanthin is a dark red keto-carotenoid found in aquatic animals such as salmon, shrimp, and algae. This collaborative study funded by Lycored (Israel) with NC State and UNC Greensboro showed that **4-weeks of astaxanthin versus placebo supplementation was linked to normalization of post-exercise plasma levels of numerous immune-related proteins including immunoglobulins within 24h.** Short-term astaxanthin supplementation (8 mg/d during a 4-week period) provided immune support for runners engaging in a vigorous 2.25h running bout and uniquely countered decreases in plasma immunoglobulin levels.

- *Nieman DC, Woo J, Sakaguchi CA, Omar AM, Tang Y, Davis K, Pecorelli A, Valacchi G, Zhang Q. Astaxanthin supplementation counters exercise-induced decreases in immune-related plasma proteins. Front. Nutr. 2023;10:1143385.*

NORTH CAROLINA A&T STATE UNIVERSITY

CENTER FOR EXCELLENCE IN POST-HARVEST TECHNOLOGIES: The Center focuses on discovering better ways to preserve or process fruits and vegetables to prevent disease, enhance health, and increase value of North Carolina agriculture by finding better ways to retain freshness, preserve health-promoting compounds and nutrients, and make food safer for consumption.

KEY FINDINGS

USING TARGETED AND UNTARGETED METABOLOMICS TO IDENTIFY NOVEL DIETARY BIOMARKERS

Nutritional epidemiology research needs more reliable and quantitative methods for measuring dietary intake of specific foods. From the perspective of intake, there are inherent weaknesses of food frequency questionnaires and 24-hour food recall, the two major methods used in epidemiological studies to assess dietary intake. In order to better understand the beneficial health effects of functional foods, biomarkers for their exposure and effects are needed. Dr. Shengmin Sang's lab at N.C. A&T has developed targeted and untargeted metabolomic approaches to study food biomarkers. Supported by several ongoing NIH and USDA funded grants, Dr. Sang's lab is building in-house dietary library and has identified numerous novel biomarkers for whole grains, ginger, and flavonoids using the combination of targeted and untargeted metabolomic approaches.

Leonard Williams, Ph.D., MBA

Director, Lead Scientist for Food Safety and Microbiology and Professor of Food Sciences

- *Wang, W.; Zhu, Y.; Sang, S. Barley phenolamides effectively scavenge harmful methylglyoxal in vitro and in mice. Mol Nutr Food Res. 2023, 67, e2200709.*
- *Esquivel-Alvarado, D.; Zhang, S.; Hu, C.; Zhao, Y.; Sang, S. Using metabolomics to identify the exposure and functional biomarkers of ginger. J Agric Food Chem 2022, 70, 12029-12040*

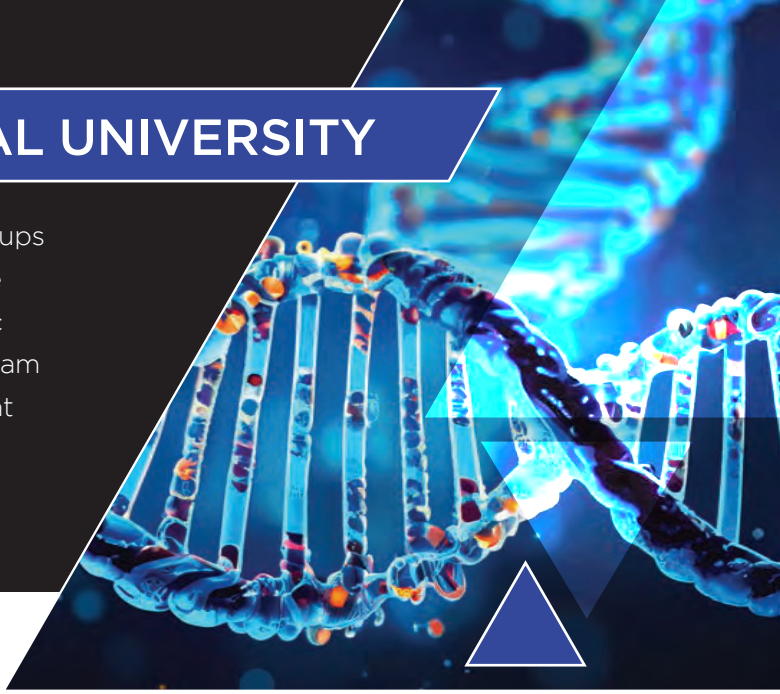
DESIGNING NANOCARRIERS TO CONTROL FOODBORNE PATHOGENS

Currently, there is a need for the development of environmentally friendly and valued-added antimicrobials to reduce antimicrobial-resistant foodborne pathogens and increase food safety. Because most foodborne bacterial pathogens can acquire resistance to most antimicrobial agents, Dr. Williams' research team is exploring the role of functional nano-carriers to increase the effectiveness of antimicrobials against foodborne pathogens through targeted delivery. Dr. Williams' group is conducting a comprehensive study to detect and isolate pathogenic foodborne pathogens from various food products (e.g., produce, meat, dairy, etc.) commonly consumed.

- *Bahrami, A., Delshadi, R., Cacciotti, I., Esfanjani, A., Rezaei, A., Tarhan, O., Lee, C., Assadpour, E. Tomas, M., Vahapoglu, B., Capanoglu, E., Williams, L.L. and Jafari, S. (2022). Targeting foodborne pathogens via surface-functionalized nano-antimicrobials. Adv Colloid and Interface Sci. 302(2):102622.*

NORTH CAROLINA CENTRAL UNIVERSITY

NUTRITION RESEARCH PROGRAM: The research groups in NCCU/Kannapolis have established unique expertise in zebrafish and mouse models to study hematopoietic disease and cancer biology. Our unique research program facilitates collaborations with researchers from different universities on the NCRC as well as among different university campuses of the UNC System.



KEY FINDINGS

To study the effect of in utero exposure to alcohol on the breast cancer risk later in life using mouse models, we found that **mother exposure to alcohol between gestation day 10 and day 20 resulted in modified mammary development, as indicated proliferative morphogenesis and alterations in mammary epithelial cell repopulation**, in female offspring. The underlying mechanism involves activation of signaling in estrogen receptor pathway and receptor tyrosine kinase pathways. Our findings underscore the potential impact of maternal exposure to alcohol on daughters' mammary development and tumor risk.

Nikia A. Laurie,
Interim Director, North Carolina Central University

We also studied the role of LSR, a lipid metabolism regulator, in triple negative breast cancer (TNBC). LSR was reported to be overexpressed in TNBC, which is more frequently in African American women suggesting its potential correlation with health disparity. **Our findings demonstrated overexpression of LSR induces resistance to chemotherapy drugs through upregulation of Multidrug Resistance 1 (MDR1). Our results suggest an association between LSR overexpression and therapeutic resistance, which may have impact on clinical breast cancer treatment.**

Glutamine is a non-essential amino acid but plays a critical role in many cellular processes. **We find that glutamine regulates blood vessel endothelial cell aging which is a natural process but associated with age-related diseases such as cancer, cardiovascular and degenerative diseases.** Our finding is consistent to recent studies that glutamine plays an important role in adult zebrafish heart regeneration. Therefore understanding the role of glutamine in aging and regeneration may provide insight to promote cardiovascular function and healthy aging.

U.S. agricultural production and food supply chain is vulnerable to accidental or intentional disruption caused by plant pests and diseases, including non-native species, bacteria, fungi, and viruses from U.S. territory. **We are developing tools for analytical platform for border protection and plant pest and disease risk assessment. This platform evaluates open-source data to monitor global plant biothreat events.** These include metadata of phytosanitary information, climatic patterns, near real-time air, marine, and land cargo movement. In addition, we will use genomic data to address the challenges posed by emerging biothreats and present this information into CBP operational contexts and potential countermeasures.

NORTH CAROLINA STATE UNIVERSITY

Mary Ann Lila, Ph.D.,

Distinguished Professor and Director, NC State Plants for Human Health Institute

PLANTS FOR HUMAN HEALTH INSTITUTE: The NC State Plants for Human Health Institute uses a transdisciplinary approach to drive its research efforts toward the discovery and translation of the links between plant compounds, disease prevention, and health maintenance. NC State Extension provides a bridge to the community through K-12 STEM education and healthcare-focused outreach.

KEY FINDINGS

The Iorizzo team uncovered the genetic mechanisms controlling health-related bioactive accumulation in blueberry and carrot. Across three blueberry studies, genetic mechanisms responsible for anthocyanin acylation and glycosylation, total anthocyanin and chlorogenic acid accumulation, were identified.3,4,6 In carrot, a putative DNA sequence that enhances anthocyanin accumulation was identified, and total anthocyanin concentration was associated with antioxidant capacity.1,2 Also, the mechanisms that underlie the synthesis of apigenin, a carrot specific bioactive were uncovered.5 This research contributes to major advances in health-related bioactive genetics establishing the foundation to develop DNA-based strategies to select for desired bioactive content in these crops. This research will ultimately facilitate the selection of new and improved cultivars of fruit and vegetables with improved quality and health-promoting characteristics.

- *Albert N.W., et al. 2023. Vaccinium as a comparative system for understanding of complex flavonoid accumulation profiles and regulation in fruit. Plant Physiology.*
- *Mengist M.F., et al. 2022. Dissecting the genetic basis of bioactive metabolites and fruit quality traits in blueberries (Vaccinium corymbosum L). Frontiers in Plant Science.*

The Arabidopsis DEMETER (DME) demethylates the central cell genome before fertilization. This epigenetic reconfiguration is essential for seed viability. DME demethylates ~10% of the methylated sequences, but how DME is recruited remains unknown. Histone H1 facilitates chromatin higher-order compaction and restricts access of chromatin modifying enzymes. H1 loss affects methylation and expression of certain imprinted genes in plants and mammals. The Hsieh Lab showed that H1 and DME physically interact and H1 variants are co-expressed with DME in the central cell. Without H1, DME demethylation is substantially enhanced. We conclude that H1 is required to maintain methylation homeostasis in the Arabidopsis endosperm.

- *Hsieh, T.-F., et al. (2022) Loss of Linker Histone H1 in the Maternal Genome Influences DEMETER-Mediated Demethylation and Affects the Endosperm DNA Methylation Landscape. Front. Plant Sci., 22 December 2022, Sec. Plant Development and EvoDevo, (DOI:10.3389/fpls.2022.1070397)*

Fruit from over 60 species of Rubus (blackberry, raspberry, black raspberry) were screened for anthocyanin profiles. Many of these previously had no information available on the amount or type of anthocyanin. Most of the anthocyanin pigments were cyanidins, attached to glucose, rhamnose, xylose, and di and tri-saccharides of these sugars. Phenotypes (e.g., black or red or purple) did not always have the expected anthocyanins. For instance, some blackberry hybrids had anthocyanins more commonly associated with raspberry. Results will be used to help determine species relatedness in Rubus. The lab of Penelope Perkins-Veazies completed this work in collaboration with Pairwise, NC State University Plant Sciences Initiative, and five public institutions.

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

NUTRITION RESEARCH INSTITUTE: The Nutrition Research Institute is committed to conducting innovative basic and translational science studying precision nutrition, how individual differences in requirements and responses to diet affect our individual nutritional needs. We believe that our advances in nutrition science are leading to successes in preventing or mitigating the negative effects of chronic diseases and aging, and in improving human development, even prior to conception.

Deborah Tate, PhD
Interim Director

KEY FINDINGS

Triple-negative breast cancer (TNBC) has high recurrence and mortality rates. Research from the NRI seeks to facilitate development of new, effective treatments. The Hursting laboratory (Smith et al., 2022) found that **aging and obesity increase risk via similar mechanisms, suggesting potential targets for future treatments and highlighting the need to account for age and obesity when treating TNBC**. The Rushing and Sumner laboratories (Rushing et al., 2023) used a metabolomics approach to study how polyphenols and omega-3 polyunsaturated fatty acids impact chemosensitivity. This could aid development of TNBC treatments with fewer side effects.

- *Smith et al. (2022). Front Oncol 12: 1031174*
- *Rushing et al. (2023). Int J Mol Sci 24: 4406*

Drinking alcohol during pregnancy has negative health effects on the developing fetus, but exactly how alcohol exerts these effects is less clear. In a collaborative effort of the May, Mooney, and Smith laboratories, Hasken et al. (2022) analyzed how alcohol consumption-associated maternal metabolites related to certain alcohol-affected birth outcomes. They found that **a metabolomic signature consistent with increased maternal amino and fatty acid metabolism correlated with decreased infant weight, length, and head circumference,** consistent with the hypothesis that maternal alcohol consumption puts metabolic stressors on the mother that can ne
developing fetus.

- *Hasken, et al. (2022). Nutrients 14: 5367.*

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

BIOINFORMATICS RESEARCH AND SERVICES: Researchers from UNC Charlotte's Bioinformatics Services Division and the Department of Bioinformatics and Genomics work at the intersection of computer science and biology to develop the tools and resources necessary for analyzing large, complex datasets in order to answer critical biological questions.

Cory Brouwer, Ph.D.

Director, UNC Charlotte Bioinformatic Services and Professor of Bioinformatics and Genomics

KEY FINDINGS

In humans, every trait we see today—from heart disease to height—is a result of our evolutionary history. We can better understand these traits by asking how did we (evolutionarily) get here? A record of our evolution is chronicled in our DNA and can be extracted by comparing genomes between individuals. Dr. Abbe LaBella co-led a recent project to characterize the evolutionary forces associated with >900 human. Her lab **uncovered a mosaic of evolutionary forces associated with these diverse traits. This not only provides insight into the complexities of human evolution, but offers important evolutionary context for specific trait-associated genes.**

- *LaBella et al. "Mosaic patterns of selection in genomic regions associated with diverse human traits." PLoS Genetics 18.11 (2022) https://doi.org/10.1371/journal.pgen.1010494*

Nitrogen remains a severely limiting nutrient for biofuel production, which has massive energy requirements to produce fertilizer (~2% global energy). Switchgrass represents a biofuel that could displace ~30% of the US petroleum consumption. Marginal lands contain limited nitrogen, but are excellent to grow switchgrass for bioenergy. Nitrogen fertilization often increases biomass; however, in switchgrass on marginal lands it offers limited benefit. **Our study examined the microbial impact in these ecosystems using metagenomics. We resolved Janthinobacterium sp. which could be providing fixed nitrogen (as ammonium) to switchgrass.** Dr. Richard A. White III's lab is leading research for soil health and bioenergy in North Carolina at NCRC Charlotte.

- *White III RA, et al. Genome-resolved metagenomics of nitrogen transformations in the switchgrass rhizosphere microbiome on marginal lands. Agronomy 2023. 13 (5), 1294. https://doi.org/10.3390/agronomy13051294*

The human genome is still full of mysteries. Despite extensive progress in completing the human genome, there still remain very difficult regions to sequence, let alone understand their function. To help unveil what these challenging regions of our DNA do, we turn to other animal genomes for comparison. There are many animals that have certain adaptations that humans lack, and therefore these regions of the genome are lesser understood in humans and better understood in different animals. **Turning to animals like fish that have genes for underwater chemical communication or bats that have exceptional immune receptors, Dr. Laurel Yohe's lab argues that using their genomes is essential to understanding our own.**

- *Yohe, L.R., et al. (2022) Placing human gene families into their evolutionary context. Human Genomics, 16(1): 56. https://doi.org/10.1186/s40246-022-00429-5*

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CENTER FOR TRANSLATIONAL BIOMEDICAL RESEARCH: The UNC Greensboro Center for Translational Biomedical Research conducts basic and translational research in the area of liver diseases and diabetes. Our research is primarily focusing on the mechanisms and development of therapeutic approaches for treatment of alcohol-induced liver disease. We also focus on developing bioanalytical tools for systemic biological investigation of diabetes and early biomarkers of diabetic complications.

Qibin Zhang, Ph.D.

Co-director and Professor, UNC Greensboro Center for Translational Biomedical Research

Zhanxiang Zhou, Ph.D.

Co-director and Professor of Nutrition, UNC Greensboro Center for Translational Biomedical Research

KEY FINDINGS

Alcohol consumption disrupts lipid homeostasis in the development of alcohol-associated liver disease (ALD). Long-chain acyl-CoA synthetase 1 (ACSL1) regulates hepatic lipid homeostasis by channeling fatty acids to lipid metabolic pathways. We observed ACSL1 levels decreased after alcohol consumption in both human and mice and deletion of this enzyme in the liver of mice exacerbated alcohol-induced liver damage. The study suggests that ACSL1 deficiency mediates alcohol-induced lipotoxicity and cell death in the pathogenesis of ALD.

- *Dong H, Zhong W, Zhang W, Hao L, Guo W, Yue R, Sun X, Sun Z, Bataller R, Zhou Z. Loss of long-chain acyl-CoA synthetase 1 promotes hepatocyte death in alcohol-induced steatohepatitis.* **Metabolism**. *2023 Jan; 138:155334. PMID: 36349655. PMCID: PMC10245388.*

Blood proteins are used as biomarkers for clinical diagnosis, prognosis, and personalized medicine, but oftentimes they can only be measured one at a time clinically. We developed a platform that can measure over 600 proteins in blood plasma at 60 samples per day, with 57 FDA-approved biomarkers consistently measured from human plasma. The balance achieved between proteome coverage, throughput, and reproducibility of this protein platform makes it promising in clinical settings, where many samples are to be measured quickly and reliably to support various needs of clinical medicine.

- *Woo J, Zhang Q. A Streamlined High-Throughput Plasma Proteomics Platform for Clinical Proteomics with Improved Proteome Coverage, Reproducibility, and Robustness.* **J Am Soc Mass Spectrom**. *2023;34(4):754-62.*

Accurate diagnosis and better understanding of the disease progress relies on knowing the molecular changes within a specific cell type in tissues. Using laser capture microscopy and mass spectrometry, we developed a workflow to selectively isolate specific cell types and profile the proteins within these cells: 900 proteins can be identified from less than 1000 Paneth cells in the crypt region of the intestine. This work enables profiling of cell specific pathological changes at the proteome level directly from biopsies.

- *Woo J, Schoenfeld M, Sun X, Iraguha T, Zhou Z, Zhang Q. Mouse Paneth Cell-Enriched Proteome Enabled by Laser Capture Microdissection.* **J Proteome Res.** *2022;21(10):2435-42.*

NC Food Innovation Lab

The plant-based food industry faced serious challenges in late 2022 and early 2023. Product offerings had exceeded demand, and many of the products were not meeting consumer expectations. Those challenges and higher food prices caused consumers to buy plant-based products at a diminished pace compared to previous years.

Bill Aimutus, *Executive Director, NC Food Innovation Lab*

Though the lab is managed by NC State University, it's a professional organization—not a student teaching facility.

Consumers staled on more plant-based burgers or "chicken" nuggets and were seeking more sophisticated plant-based offerings like bowls and main courses, but even those saw consumers not repeat buying, and several plant-based companies have exited the business.

Nonetheless, consumers are still expressing interest in clean label food products that are better for them from a nutritional perspective as well as being better for the environment. Plant-based foods that meet these requirements are more sought after by the consumer. These types of entrepreneurs have sought the assistance of NCFIL the past six months.

NCFIL has expanded its capabilities this year with several new pieces of food processing equipment. We have further developed our expertise in protein extraction and added a nutritional bar manufacturing line for small scale production runs.

NCFIL FY22 BY THE NUMBERS

NCFIL had a successful year by landing larger, more sophisticated projects often as part of a partnership and through repeat customers. There were also opportunities to assist several entrepreneurs that were listening to the voice of the consumer and trying to meet their needs.

Through our pilot plant capabilities and suite of other services, we work with established food companies and growth-phase entrepreneurs to research, develop and market their plant-based food concepts.

- 64 Facility tours, 105 Clients since inception;
- Interacted with 72 new North Carolina companies and with 80 new national or international companies
- Engagement with EDPNC led to the creation of 800 new jobs
- Patent applications filed with NCFIL as inventors; 2 patents issued

40 YRS North Carolina Biotechnology Center®

Greater Charlotte Region

The Greater Charlotte office of NCBiotech sits at the center of regional life sciences technology-based economic development. As we mark 40 years since the creation of NCBiotech, we are excited to continue growing the life sciences sector in our community.

- Supporting life sciences growth of industry and academia
- Championing our entrepreneurial ecosystem
- Collaborating on workforce development

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