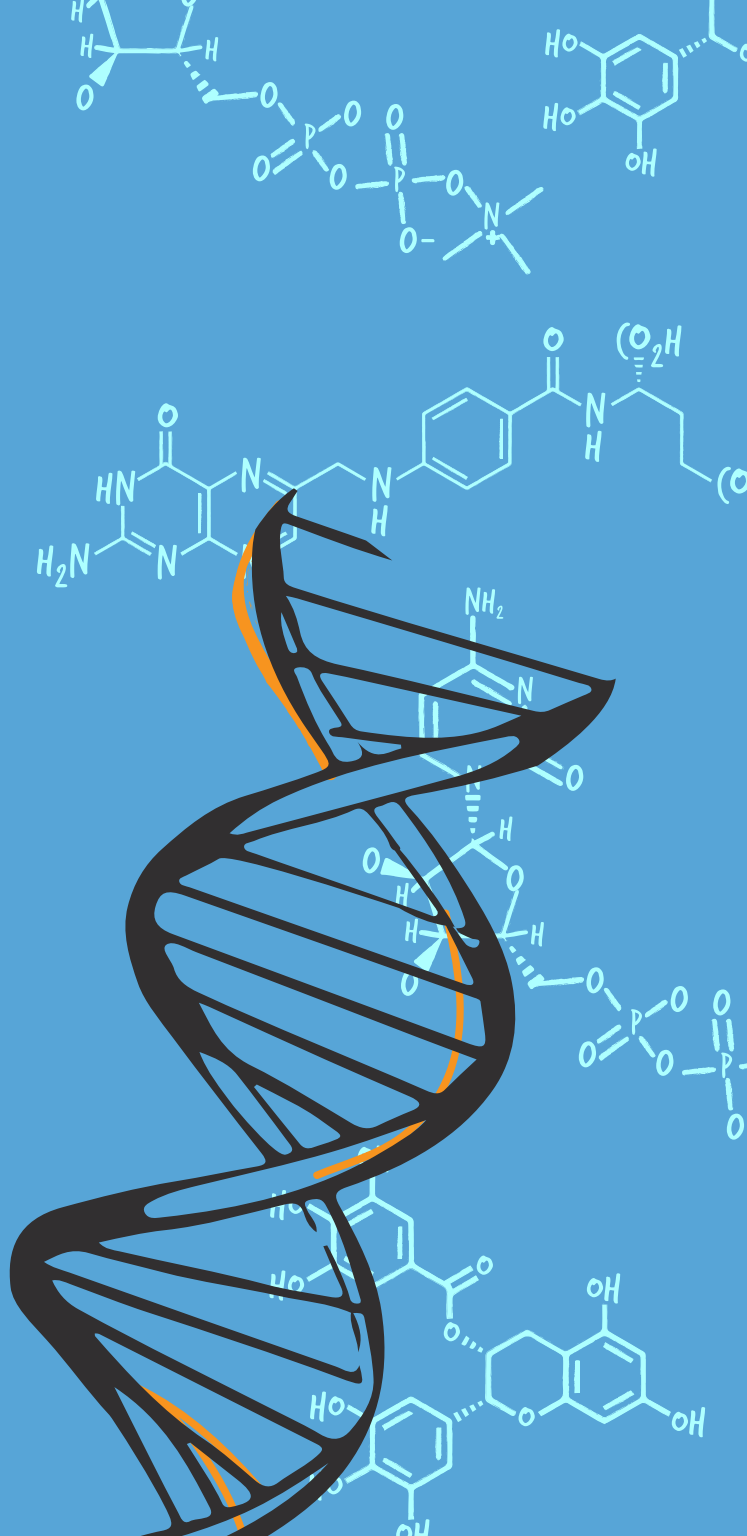
UNC Nutrition Research Institute

IMPACT REPORT 2015–2016



"I am certain that what we are discovering today at the UNC Nutrition Research Institute will dramatically improve our ability to personalize recommendations for better nutrition."

STEVEN H. ZEISEL, M.D., PH.D.
Institute Director

Mission

We are leading research in precision nutrition by understanding how genetics and environment affect an individual's requirements for and responses to nutrients.

Guiding Scientific Premise

Each of us is metabolically unique. The NRI is dedicated to finding out how these differences affect an individual's health so that current one-size-fits-all dietary guidelines can be replaced with customized nutritional recommendations and actions to improve a person's health and quality of life.

Nutrigenomics: A New Science for Healthier Living

Nutrigenomics is the new science that studies how genes and nutrients interact to affect metabolism, playing a critical role in diseases, wellness and healthy development. With nutrigenomic discoveries, physicians will soon be able to create diet and exercise plans customized to your unique needs.

15 FACULTY MEMBERS

10 POSTDOCTORAL FELLOWS

7 GRADUATE STUDENTS

25 RESEARCH STAFF

17 ADMINISTRATIVE STAFF

35 INTERNS

2 FACULTY FELLOWS

1 VISITING SCHOLAR

---

112 NRI PIONEERS

WE STUDY NUTRITION AND

Gene-Environment Interactions

Brian Bennett, Ph.D.
Heart disease

Folami Ideraabdullah, Ph.D.
Role of dietary nutrients in determining disease susceptibility

Martin Kohlmeier, M.D., Ph.D.
Nutrigenetics and nutrigenomics

Saroja Voruganti, Ph.D.
Hyperuricemia, gout, kidney and cardiovascular disease

Obesity and Cancer

Stephen Hursting, Ph.D., M.P.H.
Diet-gene interaction for cancer prevention

Natalia Krupenko, Ph.D.
Role of folate in promoting health and preventing disease

Sergey Krupenko, Ph.D.
Vitamin folate and its role in liver function and cancer

Xiaohu Tang, Ph.D.
Identifying metabolic alterations in cancer

Jomari Torres, M.D.
Human Research Core Medical Director

Manya Warrier, Ph.D.
"Browning" of fat

Brain and Cognitive Development

Carol Cheatham, Ph.D.
Memory and attention abilities

Philip May, Ph.D.
Fetal Alcohol Spectrum Disorders

Susan Smith, Ph.D.
Fetal alcohol exposure and brain development

Natalia Surzenko, Ph.D.
Brain and eye development

Steven Zeisel, M.D., Ph.D.
Choline as an essential nutrient

Obesity-Cancer Connections

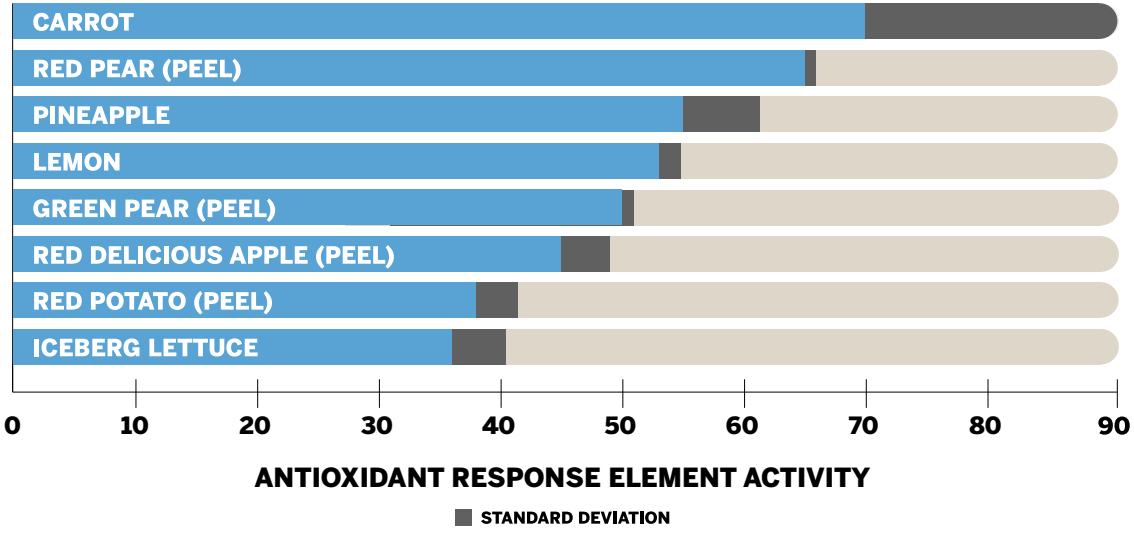
Chronic obesity increases the risk of developing at least 15 kinds of cancer. This is a serious health concern in the United States where more than one-third of adults are obese. Studies from the Hursting lab this year made several promising associations between chronic obesity and cancer. Not only may anti-inflammatory omega-3 fatty acids reduce the risk of developing cancer in the first place, they may be able to reverse the risk, preventing the spread of some types of active cancers. The lab also found that significant weight loss can positively impact response to cancer therapy. Weight loss and fish oil together can be very therapeutic in preventing and reducing the risks of some cancers.

Omega-3-Acid ethyl esters block the protumorigenic effects of obesity in mouse models of postmenopausal basal-like and claudin-low breast cancer. Ford NA, Rossi EL, Barnett K, Yang P, Bowers LW, Hidaka BH, Kimler BF, Carlson SE, Shureiqi I, deGraffenried LA, Fabian CJ, **Hursting SD** (2015). Cancer Prev Res (Phila). 8:796-806.

A Breakthrough in Understanding Antioxidants

The Zeisel lab this year demonstrated the importance of a new approach to measuring antioxidant potential of foods. Instead of measuring the capacity of nutrients to directly deactivate oxygen radicals and offset their damaging effects, this research tested the ability of food extracts to activate the natural defense systems in our cells. They found numerous fruit and vegetable extracts that are able to activate cellular defense systems, but which do not themselves exhibit strong antioxidant capacity. This study shows that if we rely on traditional measurements of a molecule's antioxidant capacity we may be missing the importance of some nutrients to activate our own antioxidant defenses.

Extracts of fruits and vegetables activate the antioxidant response element in IMR-32 cells. **Orena S**, **Owen J**, Jin F, Fabian M, Gillitt ND, **Zeisel SH** (2015). J Nutr. 145:2006-2011.



Continuing to Build Better Baby Brains

Critical research to understand how maternal nutrition affects infant brain development continued this year with work by a number of NRI scientists. Wang et al. demonstrated a direct link between maternal dietary choline levels and the development of the cortex in their offspring (mouse pups whose mothers were fed a low-choline diet during pregnancy had underdeveloped brain structure). Cheatham et al. extended this finding to humans with their work on the significance of omega-3 fatty acids on cognitive performance in toddlers, while the May lab studied the importance of good maternal nutrition in mitigating the effects of Fetal Alcohol Spectrum Disorders. NRI director Steve Zeisel and colleagues furthered this area of study by moving into clinical trials of choline supplementation in children with FASD.

Maternal dietary intake of choline in mice regulates development of the cerebral cortex in the offspring. **Wang Y**, **Surzenko N**, **Friday WB**, **Zeisel SH** (2016). FASEB J. 30:1566-1578.

Genetic and epigenetic transgenerational implications related to omega-3 fatty acids. Part II: maternal *FADS2* rs174575 genotype and DNA methylation predict toddler cognitive performance. **Cheatham CL**, **Lupu DS**, **Niculescu MD** (2015). Nutr Res. 35:948-955.

Maternal nutritional status as a contributing factor for the risk of fetal alcohol spectrum disorders. **May PA**, Hamrick KJ, **Corbin KD**, **Hasken JM**, Marais AS, Blankenship J, Hoyme HE, Gossage JP (2016). Reprod Toxicol. 59:101-108.

Choline supplementation in children with fetal alcohol spectrum disorders: a randomized, double-blind, placebo-controlled trial. Wozniak JR, Fuglestad AJ, Eckerle JK, Fink BA, Hoecker HL, Boys CJ, Radke JP, Kroupina MG, Miller NC, Brearley AM, **Zeisel SH**, Georgieff MK (2015). Am J Clin Nutr. 102:1113-1125.

Selected Published Papers

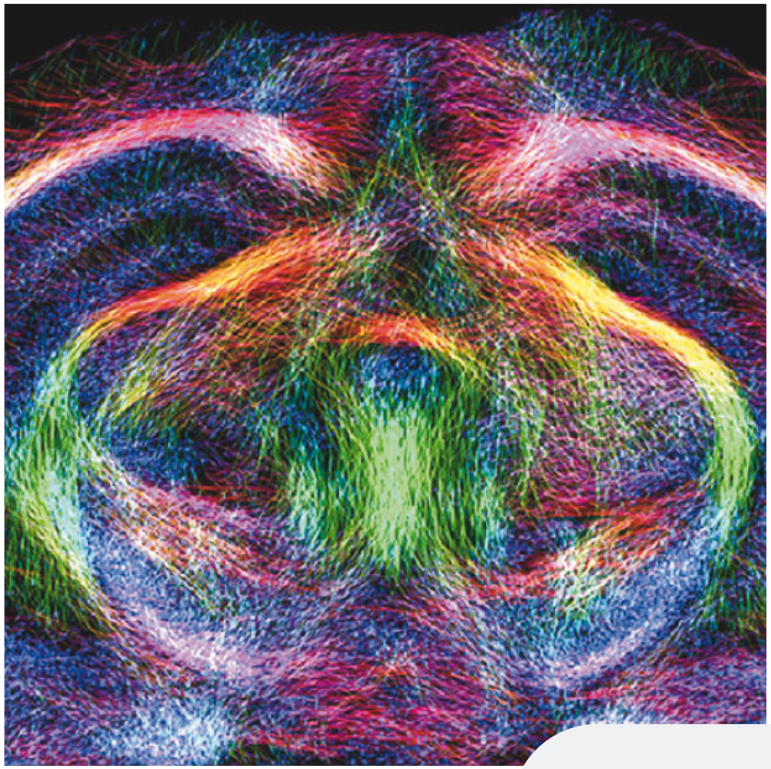
An assessment of molecular pathways of obesity susceptible to nutrient, toxicant and genetically induced epigenetic perturbation. **Xue J**, **Ideraabdullah FY** (2016). J Nutr Biochem. 30:1-13.

Choline metabolites: gene by diet interactions. **Smallwood T**, Allayee H, **Bennett BJ** (2016). Curr Opin Lipidol. 27:33-39.

Obesity and cancer: mechanistic insights from transdisciplinary studies. Allott EH, **Hursting SD** (2015). Endocr Relat Cancer. 22:R365-R386.

Assessment of cardiovascular disease risk factors in a genetically homogenous population of Parsi Zoroastrians in the United States: A pilot study. **Vazquez-Vidal I**, **Chittoor G**, Laston S, Puppala S, Kayani Z, Mody K, Comuzzie AG, Cole SA, **Voruganti VS** (2016). Am J Hum Biol. 28:440-443.

Plasma 1-carbon metabolites and academic achievement in 15-yr-old adolescents. Nilsson TK, Hurtig-Wennlöf A, Sjöström M, Herrmann W, Obeid R, **Owen JR**, **Zeisel S** (2016). FASEB J. 30:1683-1688.



A VIEW OF FETAL BRAIN DEVELOPMENT.

Newborn neurons migrate long distances to reach their final locations. As they migrate, they sample the environment and change their trajectory. Once they reach final locations, they stop and begin establishing connections with other neurons.

"Whether a mother is not consuming the right nutrients, like choline and omega-3 fatty acids, or she is consuming alcohol that negates the impact of beneficial nutrients, the negative influence on a baby's brain and other development can be substantial."

PHILIP A. MAY, PH.D.
Research Professor, Nutrition

Appetite for Life

While it takes years to move from hypothesis through scientific testing to application of findings, we believe that our community members should be kept abreast of nutrition-related research as it unfolds. This year the NRI reached more than 700 people through free Appetite for Life programs covering such topics as plant phytochemicals and antioxidants, brain stem cell rejuvenation, bioinformatics for understanding personal nutritional requirements, and a superorganism known as our gut microbiome.

JOHNSON & WALES, APRIL 2016

ON THE MENU:

Farro Risotto
Spinach and Flaxseed Pesto
Sous Vide Salmon
Dark Chocolate Tofu Mousse with a Nut Crust

"We value our community and embrace our responsibility to share relevant research and the impact these findings have on human health."

FOLAMI IDERAABDULLAH, PH.D.
Assistant Professor, Genetics

Partnerships

At **Johnson & Wales University** in Charlotte we presented three Appetite for Life programs pairing our registered dietitians with their master chefs.

With our campus partners **Dole Foods** and **NC State University** we presented a series of free mini-classes in cooking and nutrition for campus staff and the public.

Dr. Steve Zeisel talked about NRI science to nearly 300 members of the **Queens University Senior Scholars**; 60 members then visited the NRI in Kannapolis.

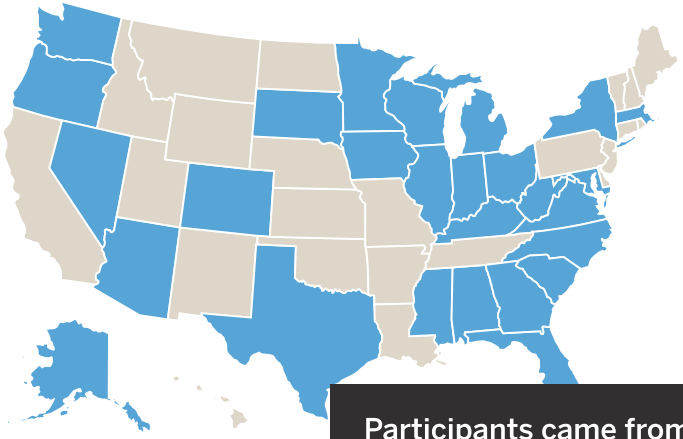
On our home campus in Chapel Hill, Dr. Summer Goodson and Dr. Sergey Krupenko were guest speakers at the **Carolina Science Café**, an all-topics science program for the public.

FY16 Community Outreach impacted more than 1,200 people.

Nutrigenetics, Nutrigenomics and Precision Nutrition Workshop

The Nutrition Research Institute held its first Nutrigenetics, Nutrigenomics and Precision Nutrition workshop, May 23-26, 2016. It featured 16 expert-led presentations on an array of topics including, "Nutrition and Epigenetics" and "MicroRNA and Metabolic Profiling." In hands-on sessions participants learned to analyze and interpret genetic data using PLINK, Harvard's open-source, whole-genome association analysis toolset.

"We know that nutrition has the most important life-long behavioral impact on human health," says Dr. Steven H. Zeisel, Institute Director, "but we are only now beginning to understand human variability in requirements and responses to diet. Understanding these diet-genome interactions is critical if we are going to make progress towards effective prevention and treatment of chronic diseases like diabetes, heart disease, and certain cancers."



Participants came from Brazil, China Egypt, Mexico, Spain, Taiwan and 28 states in the U.S.

25 FACULTY
46 GRADUATE STUDENTS
5 INDUSTRY PROFESSIONALS
10 POSTDOCTORAL FELLOWS
7 RESEARCH & CLINICAL STAFF

93 ATTENDEES

Presenters included NRI principal investigators and professors of Nutrition, Psychology and Genetics at UNC Chapel Hill. Sample classes:

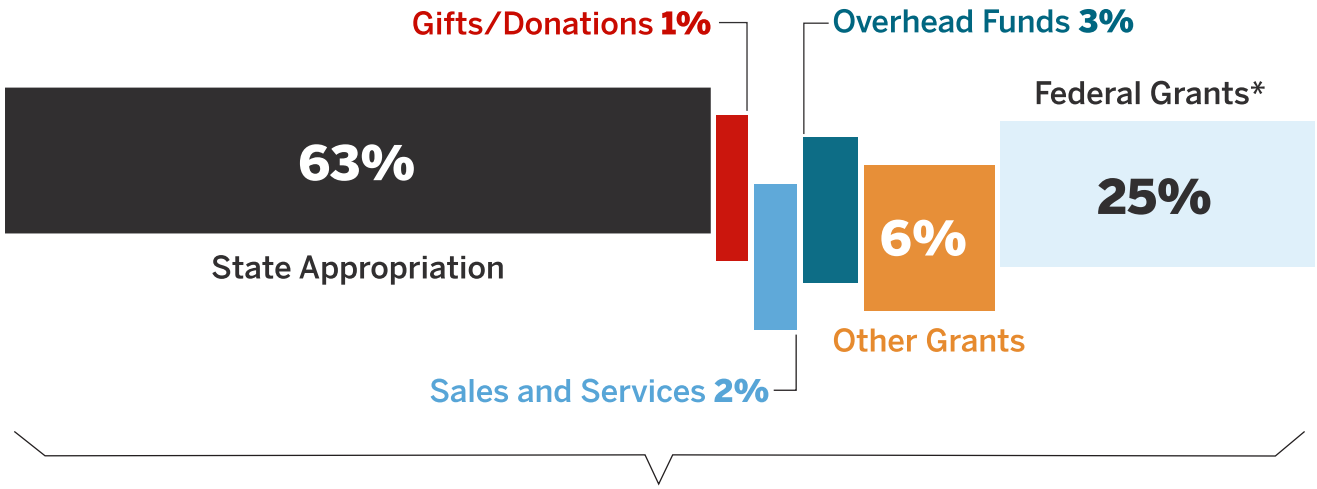
Genetics Primer for Nutrition Researchers
Brian Bennett, Ph.D.

Nutrition Epidemiology in the Genomic Age
Saroja Voruganti, Ph.D.

Experimental Approaches in Nutrigenetics
Martin Kohlmeier, M.D., Ph.D.

NGx for Study of Metabolic Diseases – Cancer
Stephen Hursting, Ph.D., M.P.H.

FUNDING



$18,450,000

2015-2016 Components of Support

** Federal grants make up a quarter of our funding, primarily from the National Institutes of Health, which is experiencing historically low levels of success, award and funding rates. Only the top 10-15% of proposals are awarded.*

DONOR RECOGNITION 2015-2016

Corporate and Foundation

Harris Teeter

THE DICKSON FOUNDATION, INC.

PCRM Physicians Committee for Responsible Medicine

Tattoo Projects

Castle and Cooke
Catawba College
David H. Murdock Research Institute
Farmers and Merchants Bank
GenoVive
Michigan State University
Microsoft
Prime Pain Institute
Xavier University School of Medicine

DONOR RECOGNITION 2015-2016

Visionary

$10,000 and more

Gregory and Melissa Alcorn
Byron Bullard
Jeffery Hughes and Jana Harrison
Fred and Alice Stanback
Steven and Susan Zeisel

Futurist

$5,000 - $9,999

John Fennebresque, Jr.
Erika Gantt
Karen Harper
David H. Murdock
Tom E. Smith

Innovator

$1,000 - $4,999

Kenneth and Patricia Argo
Fred and Laura Brown
William and Ann Cannon
Chris Cope
Arthur Gallagher
Jason and Laura Holt
Douglas Kelling
Charles Kinsey
Diane Laval
Jane Liles
James and Dorothy Martin
Philip and Doreen May
Julia Mills
Hugh and Mary Margaret Morrison
Robert and Julie Steele
Jo Anna Stephens
Phyllis Wingate
James Woodward

"The goals of the NRI hit home for me because of what I've learned that might have helped my brother live longer after his diagnosis. I'm pleased to give the NRI my financial support as encouragement to continue researching targeted nutrition."

DIANE LAVAL
Donor, 2016

"Visiting NRI is always uplifting. Every time we visit or read about the research, there's a valuable tip for better living. We invest in these programs because they embody hope and optimism for a better life."

GREGORY AND MISSIE ALCORN
Donors, 2015

Supporters

Up to $999

Nethra Ankam
James Bowman
Donald Cameron
Walden Cash
Carol L. Cheatham
Suzanne Dane
Robert Dawson
Joann Dervay
Iris B. Elliott
Suzette Garofano
Brooke Giles
Celine Gisbert
Douglas Glasgow
Iris Granek
Amit K. Hiteshi
Shirley Huang
Linda P. Johnson
Julie Kaull
Stewart Kerr
Nicole Leong
Nancy LeQuire
Brien and Laura Lewis
William MacDonald
Ofelia E. Marin
J.P. and Karen McBryde
Helen Morrison
Roy Metzger
Shalonda M. Newcomb
Cecilia Nwankwo
Elizabeth Paisley
Amy Price-Neff
Mara Pulcheri
James Rutledge
Alan Sacks
Jason A. Sadolfsky
Darlene Sanchez
Thomas Sanctis
Lauren K. Schwartz
Kirby Sheridan
Bruce Silverstein
Dana Simpler
Sandra Thomas
Ricardo J. Vasquez
Richard and Judy Vinroot
Saroja Voruganti
Jeanne K. Wagner
Kerstyn C. Zalesin

ISIS TRUJILLO, PH.D.

Postdoctoral Fellow
Zeisel Lab

MANYA WARRIER, PH.D.

Research Assistant Professor

THANKS!

Thank you for giving. Your gifts directly impact our research staff, postdoctoral fellows and faculty, allowing us to continue ground-breaking research in the field of nutrition.

JODY ALBRIGHT

Research Technician
Bennett Lab

UNC NUTRITION RESEARCH INSTITUTE

500 LAUREATE WAY
KANNAPOLIS, NC 28081

WWW.UNCNRI.ORG
704-250-5000