

## FBNS LOCATIONS



Schaub Hall • NC State Campus



Dairy Farm, Museum and Creamery



Plants for Human Health Institute



Center for Marine Sciences and Technology

### Food Safety & Foodborne Disease Prevention

Home to a dominant, integrated (research, education, extension) food safety program, FBNS provides students and stakeholders the capacity to analyze situations, address issues, and provide solutions for preventing contaminants in food that could negatively affect human health.

Facilities include state of the art BSL-2 laboratories for investigations with a range of bacterial and viral foodborne pathogens including Shiga toxin-producing *Escherichia coli*, *Salmonella*, *Listeria*, *Campylobacter* and noroviruses. Laboratories are equipped for characterization of the pathogens at the bacteriological and molecular level.

#### Expertise includes:

- Molecular-based detection of noroviruses in foods
- Sample analysis using reverse transcription qPCR
- Development of processing technologies and hand/surface sanitizers
- Mediating pathogen adherence/growth on fresh produce
- Novel virulence models for bacterial pathogens
- Risk factors for poultry colonization with *Campylobacter*
- Molecular detection and characterization of antimicrobial resistance in foodborne pathogens
- Microbial ecology studies of vegetables and fermentations by high throughput sequencing
- Food safety training programs for students and industry professionals, including FDA inspectors
- Post-harvest treatments such as electrolyzed water application to reduce pathogenic bacteria, off-flavors, and spoilage bacteria in seafood



### Food Manufacturing & Entrepreneurship

FBNS is a leader in providing food manufacturing and entrepreneurship expertise internationally to meet the demand for a safe, nutritious, flavorful and affordable food supply.

Facilities include advanced meat/seafood processing labs, brewing operation, aseptic processing and packaging systems utilizing advanced microwave heating technologies, hot-fill operations, food dehydration via freeze/spray dryer, extrusion system, Grade A dairy facility for fluid and frozen products, rheology/tribology laboratory with sophisticated equipment for analysis of fluid flow behavior, texture and oral processing characteristics.

#### Equipment available for use includes:

- Coastal seafood pilot processing facility
- Food product test kitchen
- Analytical chemistry/microbiology capacity
- Product preparation – choppers, dicers, peelers, mixers, blanchers and steam kettles
- Centrifugal, positive displacement pumps
- Thermal processing – heat exchangers, twin-screw extruder, retort, continuous flow microwave processor, spray dryer, freeze dryer, cabinet dryer
- Nonthermal processing – cold atmospheric plasma, high pressure, and ultraviolet light
- Bioreactors
- Packaging – bag-in-box filler for aseptic processing, bottle filler for hot-filling and vacuum packaging unit for meats/cheeses
- Instruments for characterizing products – rheometers, texture analyzers, network analyzer
- Process validation tools including enzyme-based time-temperature Integrators and microelectronic sensors

### Health & Well-Being

FBNS we identify bioactive, nutritional, microbial, sensorial and structural elements of food related to health and well-being by establishing mechanisms of action, then translating that knowledge into food products and ingredients, interventions, prevention programs, and educational platforms for promoting public health.

#### Expertise includes:

- Anti-inflammatory and anti-oxidant bioassays
- Unique animal model system for the study of metabolic health
- Study of human oral processing in relation to food structure
- Descriptive and consumer sensory analysis
- Functional genomics platform for beneficial microbes
- Advanced analytical instrumentation suite for qualitative/quantitative phytochemical analysis
- Identification and structure elucidation of bioactive compounds including structural characterization
- Volatile compound profiling
- Quantitative analysis of small molecules related to sensory quality and nutrient content

#### Specialized instrumentation includes:

- HPLC systems with photodiode array, fluorescence, and refractive index detectors
- Centrifugal Partition Chromatography (CPC) systems
  - Armen SCPC-2X500-F system with pump injection
  - Dynamic Extraction mid HPLCC for counter current chromatography
- Agilent's 6200 accurate-mass TOF LC/MS and 6530 accurate-mass Q-TOF LC/MS systems
- GC-MS systems for quantitative analysis of targeted metabolites – GC-Olfactometry
- Shimadzu LCMS-IT-TOF (accurate mass determination and structural elucidation)
- Bruker 700 MHz NMR spectrometer
- Leco Pegasus 4D GCxGC-TOF mass spectrometer
- IR Prestige-21 Fourier Transform (near to far)
- Jasco-2000 polarimeter
- J-815 circular dichroism instruments for optical rotation measurement
- SCIEX 6500+ UHPLC MS/MS-QTRAP
- LC-MS Waters Xevo TQD
- Three-stage static gastrointestinal digestion model
- Four-glove anaerobic chamber

### Education Innovation & Effectiveness



At FBNS, we develop and teach approaches to enhance the quality, safety, and nutritive value of our foods that can positively impact the sustainability of the global food supply chain. Through collaboration with industry partners, we establish transformative interventions that become tomorrow's best practices.

We use qualitative research to study the relationship between social environments and eating behaviors in order to develop and evaluate community education programs. This enables us to enhance the knowledge of people in the community that results in positive behaviors and improved health.

Our instructional design team creates and delivers innovative food safety learning modules for the food industry and assesses their impact on enhancing knowledge of the participants and improving food safety outcomes for the organization.

#### Expertise includes:

- Community nutrition needs assessments
- Preschool obesity prevention programs in home and childcare settings
- Process and outcome evaluations of community-based interventions
- Design, implementation, and evaluation of community engagement programming
- Training in qualitative data collection and analysis (e.g. focus groups, in-depth interviews, document analysis)
- Qualitative study design
- Scholarship of teaching and learning research
- Design and implementation of innovative educational pedagogies and technologies in higher education
- Incorporation of virtual reality and 360-degree still image and videos to enhance the learning experience
- Program development, evaluation, and intervention studies on food safety and quality training programs

# FOOD, BIOPROCESSING AND NUTRITION SCIENCES

## RESEARCH PROGRAMS

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## Leaders in Research and Innovation

FBNS faculty researchers work with companies to improve food products, partner with regulatory agencies to assist in the development of appropriate regulations, and conduct independent research that helps improve the health and well-being of our community.

Our students and staff work with faculty to drive research and develop protocols to improve the safety, quality, nutritional value, and desirability of various food products and biopharmaceuticals.

### Food Safety & Foodborne Disease Prevention



#### Fred Breidt\*

*fbreid@ncsu.edu*

Research the safety and microbial ecology of fermented and acidified vegetable products.



#### Alexander Chouljenko

*avchoulj@ncsu.edu*

Investigate post-harvest seafood safety and quality, and develop value-added products and commodities through the utilization of seafood byproducts.



#### Lynnette Johnston

*lmkleman@ncsu.edu*

Work with food processors and fresh produce growers to reduce microbial risks through an education and extension program, with focus on the FSMA regulations.



#### Fernanda Santos

*fbasantos@ncsu.edu*

Research centers on food safety in both pre- and post-harvest sectors with an emphasis on using alternative techniques to control foodborne pathogens in foods.

### Food Manufacturing & Entrepreneurship



#### Dana Hanson

*djhanson@ncsu.edu*

Focus is directed on the safety and quality of meat products as affected by production and processing methods.



#### Marvin Moncada

*mlmoncad@ncsu.edu*

Research alternative and innovative food ingredients technology, designed to create novel food ingredients, beginning with raw materials to development of food products.



#### Ilenys Pérez-Díaz\*

*idiazmu@ncsu.edu*

Development of enhanced and innovative microbiology based technologies and process monitoring for vegetable preservation by acidification and fermentation.



#### Deepti Salvi

*dasalvi@ncsu.edu*

Research food processing techniques: atmospheric pressure plasma, high-pressure, microwaves, ultraviolet light to ensure food safety and quality.



#### K.P. Sandeep

*sandeep@ncsu.edu*

Modeling and validation of continuous flow microwave processing of liquid/particulate foods; Sensor development in validating aseptic processing of multiphase foods.



#### John Sheppard

*jdsheppa@ncsu.edu*

Research the process optimization of yeast-based bioprocesses, including fuel-ethanol and yeast-bacteria co-cultures.



#### Josip Simunovic

*simun@ncsu.edu*

Microwave-assisted aseptic processing, emerging technologies for cooling, particle flow monitoring, and process validation for production of new, shelf-stable foods.



#### Minliang Yang

*myang26@ncsu.edu*

Explore system-level strategies to improve food sustainability by assessing both the life-cycle environmental footprint and economic feasibility of the food system.

### Health & Well-Being



#### Jon Allen

*jallen@ncsu.edu*

Research vitamin/mineral fortification in foods; Identification and stability of food components that impact chronic disease risk; Sustainable food production applied to developing countries globally.



#### Rodolphe Barrangou

*rbarran@ncsu.edu*

Focus on the biology and genetics of CRISPR-Cas immune systems in bacteria; Building phage resistance in probiotic strains and starter cultures used in foods.



#### Lisa Dean\*

*lloehrl@ncsu.edu*

Determine phytochemicals, nutritional components, and flavor aspects of peanuts and peanut plant parts as related to genotype, production practices, and processing.



#### MaryAnne Drake

*m Drake@ncsu.edu*

Identify chemical components responsible for flavors in cheese and whey ingredients as affected by formulation and processing.



#### Keith Harris

*gkharris@ncsu.edu*

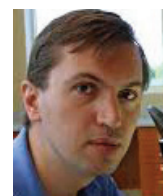
Use food chemistry and nutrition principles to study the effects of processing and storage on health and functional properties of plant food products.



#### Suzanne Johanningsmeier\*

*sdjohann@ncsu.edu*

Determine chemical/biochemical basis for improved production/utilization of fermented and acidified vegetables to reduce waste and produce high quality, healthful products.



#### Slavko Komarnytsky

*skomarn@ncsu.edu*

Research the role of diet/nutrition in preventing chronic metabolic diseases and inflammation; Pathological mechanisms of insulin resistance and muscle loss; Botanicals and healthy aging.



#### Mary Ann Lila

*mlila@ncsu.edu*

Work on discovery, characterization, and clinical analyses of health-protective plant compounds; Develop protein-polyphenol colloids for functional foods/allergy attenuation.



#### Andrew Neilson

*aneilso@ncsu.edu*

Interactions between phytochemicals and the gut microbiome; personalized nutrition (dependence of phytochemical bioactivities on sex and genetics).



#### Ondulla Toomer\*

*otfoye@ncsu.edu*

Identify chemical constituents and health benefits of raw and processed peanuts and tree nuts; investigate peanut by-products for use as alternative feed ingredients.



#### Haotian Zheng

*hzheng23@ncsu.edu*

Study dairy ingredients manufacturing and application, food structure and texture design (stability, physiological functionality, mouthfeel), food rheology and tribology.

### Education Innovation & Effectiveness



#### Natalie Cooke

*nkcooke@ncsu.edu*

Develop and evaluate innovative teaching techniques and technologies and community engagement programs to improve college students' self-efficacy in nutrition-related skills.



#### April Fogleman

*adpierce@ncsu.edu*

Improve maternal/infant health care with evidence-based research to inform health care practices regarding nutritional/bioactive components in human milk.



#### Suzie Goodell

*lsgoodel@ncsu.edu*

Formative behavioral research to develop nutrition education programs focused on obesity prevention in preschool children from low-income, low-resource families.



#### Nicola Singletary

*nsingle@ncsu.edu*

Improve clinical lactation care in global settings, nutrition education pedagogy in higher education, and breastfeeding education at the secondary school level.



#### Clint Stevenson

*cdsteve3@ncsu.edu*

Develop novel e-learning strategies for improving skills/behaviors among the food industry workforce (virtual reality, case studies, interactive videos).

\*USDA-ARS scientists with special faculty appointments in FBNS

**NC STATE UNIVERSITY**

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For a complete list of all faculty, professional staff and program interests, visit our website:

**[fbns.ncsu.edu](http://fbns.ncsu.edu)**