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FROM THE INTERIM DIRECTOR

Discovery. It is what drives the work of the Jean Mayer USDA Human Nutrition Research Center on Aging.

NASA has its Discovery Program, with a self-described objective to give “scientists the opportunity to dig deep into their imaginations and find innovative ways to unlock the mysteries of the solar system.” Substitute solar system with the human aging system and you have the HNRCA.

Every day more than 200 scientists, research staff and trainees seek to discover novel ways that nutrition influences the aging process and encourages vitality and independent living.

We are proud to be just one of six human nutrition research centers in the U.S. that operate through a cooperative agreement with the USDA’s chief scientific in-house research agency, the Agricultural Research Services.

We are also committed to the discovery of the best among the next generation of scientists. While research is our most visible contribution, developing future leaders is an important part of our enterprise. Our close relationship among the diversity of schools at Tufts University allows us the good fortune to attract so many promising future leaders.
This progress report is a snapshot of our recent discoveries – reaching from within our laboratories to collaborations that stretch from our local community and beyond. Of course, the impact we contribute to the field of healthy and active aging is greater than these pages. I encourage you to stay connected through our website (hnrca.tufts.edu) and other social media for our most current research and community activities.

We will continue to explore new frontiers in nutrition with a shared passion to provide society trusted science that will help the growing – and graying – global population age with greater vitality and independence.

Please enjoy this report in good health,

Sarah Booth, Ph.D.
Interim Center Director
ABOUT THE HNRCA

We promote Healthy and Active Aging, through research, education, and practice. Our work fosters better understanding of the aging process and identifies the best nutrition, physical activity and healthy living choices that encourage vitality.

Laboratories
- Antioxidants
- Bone Metabolism
- Cardiovascular Nutrition
- Energy Metabolism
- Neuroscience and Aging
- Nutrition and Cancer Biology
- Nutritional Epidemiology
- Nutrition, Exercise, Physiology and Sarcopenia
- Nutrition and Genomics
- Nutritional Immunology
- Nutrition and Vision
- Obesity Metabolism
- Vascular Biology
- Vitamins and Carcinogenesis
- Vitamin K
- Vitamin Metabolism

Scientific Cores
- Biostatistics and Data Management
- Comparative Biology
- Dietary Assessment
- Mass Spectrometry
- Metabolic Research
- Nutrition Evaluation

Administrative Cores
- Research Administration
- Physical Plant/Facilities
- Scientific Computing
We are one of six human nutrition research centers in the United States supported by the Agricultural Research Service (ARS), the research arm of the United States Department of Agriculture (USDA). We operate through a cooperative agreement between the USDA and Tufts University which began 40 years ago. Our research follows the mission of the USDA to explore the relationship between nutrition, aging, and health. A majority of our scientists, researchers from Tufts University and the USDA, hold secondary academic appointments within schools at Tufts and other universities.
SUPPORT

85% Government grants and contracts
13% Private grants
2% Other contributions
Looking to policy to tackle health disparities in the age of personalized medicine

Focusing on breast cancer and chronic kidney disease, researchers in the Nutrition and Genomics Lab showed that while genetic knowledge has grown and been used to fight these diseases in the last decade, significant racial and ethnic health disparities persist and hinder universal progress. In a paper published in *Health Affairs*, researchers outlined policy efforts needed to ensure that genetic applications advance in healthcare in ways that reduce existing disparities. Three key areas where their recommendations would make improvements? Incomplete genetic databases, inadequate treatment options, and insufficiently understood disease mechanisms.


Cancer fighting colors in everyday foods

Researchers in our Nutrition and Cancer Biology Lab conduct a lot of research on how carotenoid pigments (red, yellow, orange) fruits and vegetables effect cancer pathways. Last year, they tested the effects of Beta-cryptoxanthin (BCX), a carotenoid pigment compound found in sweet red peppers, on a mouse strain that develops lung tumors when exposed to a carcinogen found in tobacco products and some electronic-cigarette liquids. Mice that were fed BCX developed 50 to 60 percent fewer tumors than mice not fed BCXT.

Regular intake of sugary beverages, but not diet soda, is associated with prediabetes.

A significant body of research has found associations between regular consumption of sugar-sweetened beverages and increased risk of type 2 diabetes. Researchers in the Nutritional Epidemiology Program took it a step further and looked at 1,685 middle-aged adults over a period of 14 years, and found those who drank the highest amounts of sugar-sweetened beverages had a significantly greater risk of developing prediabetes, compared to low or non-consumers. An even more interesting finding from the study; diet soda intake had no statistical associations with risk for either prediabetes or insulin resistance.


Rethinking an important nutrition benchmark

The glycemic index (GI) of a given food is a value that aims to indicate the food’s effect on a person’s blood glucose (also called blood sugar) level. Developed as a way to help diabetic individuals control their blood sugar, GI is intended to represent the effects a food has on blood sugar levels. GI has also served as the basis for several popular diets. Researchers in our Cardiovascular Nutrition Lab discovered that glucose response varies among individuals, hence, it should be used with caution on an individual level. It is one of many parameters that go into defining a healthy diet.

Promoting successful active aging in minority populations through community settings

AARP research has found that 97% of Chinese Americans desire to stay physically fit as they age. The Healthy Habits Program (HHP) was implemented in Boston to provide a community-based physical activity and education for Chinese older adults in the area. Researchers in our Nutrition, Exercise, Physiology and Sarcopenia Lab did a collaborative evaluation of the program to see if the outcomes of the program were in fact beneficial to the older Chinese community involved. After 6 months in the program, meaningful improvements were seen in the mobility and cognition as well as executive function, depression and perceived disability. Knowing that promoting successful aging in minority populations through community settings works, we are equipped with a powerful tool to reduce ethnic health disparities in the US.

“It is never too late to make smart changes in your diet. Shifting towards healthier food choices can improve symptoms or decrease risk for developing chronic diseases such as type 2 diabetes, hypertension and heart disease - all of which are more common in older than younger adults.”

- Alice H. Lichtenstein, D.Sc., senior scientist and director of the Cardiovascular Nutrition Laboratory
Reaching beyond the Center’s 16 labs and applying proven research is an important part of our work. It also allows us to make valuable connections to people – young and old.

**In your home**
The research, knowledge and leadership we provided to the national Dietary Guidelines for Americans has been translated to the most practical level: your plate. Our “MyPlate for Older Adults” is an easy-to-use graphic guide to foods that fit into a healthy well-balanced diet. As part of this collaboration with the AARP Foundation, we’ve created an engaging video that will inspire everyone to adopt a healthy diet – check it out on our website and share it with others.

**In the community**
Working with Age Friendly Boston and the new Boston Public Market, the HNRCA organizes events that combine the importance of physical activity and sound nutrition. Using Boston’s beautiful urban park and harbor systems, we offer guided walks and nutrition education through lectures and cooking demonstrations. We also provide dozens of lectures to the Boston community that feature renowned nutrition researchers such as Drs. David Ludwig, Leonard P. Guarente, Frank Hu and Caroline Apovian. Our annual Drs. Joan and Peter Cohn and Family Lecture featured distinguished neurologist and best-selling author Dr. Rudolph Tanzi and distinguished researchers Drs. Gene Bowman and Brent Reynolds.
In Washington

Dr. Alice Lichtenstein, head of our Cardiovascular Lab, served as vice-chair of the 2015 Dietary Guidelines Advisory Committee. Dr. Lichtenstein led our efforts to transfer that knowledge to our MyPlate for Older Adults. To showcase this achievement, the HNRCA and AARP Foundation were invited by the Congressional Hunger Caucus to present its findings on Capitol Hill.
Internationally
Our scientists partner with researchers and nutrition experts around the world. Last year we invited a special collaborator, world-renowned Spanish chef and nutrition advocate Andoni Luis Aduriz of the 2-star Michelin restaurant Magaritz to come the HNRCA to share novel ways he incorporates the principles of sound nutrition science into his menu. Highlights of the trip included an interactive dinner with HNRCA supporters and a powerful dialogue session with students.

“As future nutrition research scientists, it is now a priority to cultivate our relationship with food and culinary food science in the kitchen as well as the laboratory to better serve our community, clients, patients, and friends and family.”
- Stephanie Harshman, PhD student

“As I continue to research the biological side of nutrition, I will recall this session as a reminder that I am not working to improve the health of biological black boxes, but rather the experience of living, feeling humans.”
- Kenny Westerman, PhD student
The community comes to the HNRCA

Our human research studies would not be possible without the contributions of so many people in the Greater Boston area. Each year our scientists conduct about two dozen studies – from the effect of fish oil on heart disease to benefits of berries for cognition to value of exercise in building muscle strength – that require people from all walks of life to actively engage in the research. Their contribution to nutrition science is huge and our appreciation is captured in a video you can find on our website.
**Alternative food sources**
The Vitamins and Carcinogenesis Lab, led by Dr. Joel Mason, is exploring edible insects as an alternative source of protein and other valuable nutrients. Finding healthy food alternatives that also promote sustainable agriculture practices is a vision we share with the USDA’s Agricultural Research Services. While still in the early discovery phase for this initiative, we have established a North America-based multi-sector collaboration representing the leading experts from academia, government and industry that we expect will provide a strong foundation for this research.

**Linking the microbiome and muscle strength**
Our Nutrition, Exercise, Physiology and Sarcopenia lab is examining the link between gut bacteria and muscle mass and physical functioning among older adults. Led by Dr. Michael Lustgarten, the work is focused on the chronic effects of specific dietary protein and amino acids on physical activity and could lead to diet-specific measures that help people maintain muscle mass and reduce the incidence of injury and hospitalization that results from decreased mobility as people age. This is one of many research projects that is focusing on unlocking the mystery of the human microbiome and its impact on human health.
Vitamin K may be good for your brain
Vitamin K, well known for its contribution to strong bones and a healthy circulatory system, may also provide essential benefits to our brain. Vitamin K Lab Director Sarah Booth is researching the possible role of vitamins K and D in Alzheimer’s Disease. This ground-breaking work is using data from the NIH-funded Memory and Aging Project (MAP) that allows the team to examine levels of metabolites from these two vitamins in the cortical and subcortical regions of brain and link to the cognitive function and neurological condition of the MAP subjects. This research may lead to the adoption of healthy eating habits that mitigate cognitive impairment.

Fruits and vegetables build strong bones
Dr. Bess Dawson-Hughes, head of our Bone Metabolism lab and one of the world’s foremost experts on bone health, is continuing her work on the benefits that fruits and vegetables have on building bone density and muscle mass. Her work has shown the average American diet (high grain/low fruits and vegetables) produces an acid level harmful to bone health. Her current research seeks to determine whether adding dried fruit to your diet lowers the rates of bone loss in older adults with acid-producing diets.
**Future Leaders**

**Nutritional data analysis as a change agent**
Kat Rancaño, a doctoral candidate in the Nutritional Epidemiology at the Friedman School of Nutrition Science and Policy at Tufts University, was drawn to the field of nutrition because she wanted to understand health disparities and work to eliminate barriers to health. Working with researchers in our Nutritional Epidemiology Program, she helped create an evidence map for dietary fiber and bone health outcomes and assisted with a study on beef consumption and frailty among older populations in the United States. Both projects generated knowledge that could directly impact the burden of disease and improve the quality of life among older populations. Kat plans to use epidemiological studies to promote changes in communities experiencing a disproportionate burden of chronic disease.

**Frequency of dietary fiber exposures categorized by physiological function**
The aging brain

Approximately one in seven adults over the age of 65 experiences moderate to severe cognitive impairments. Jirayu Tanprasertsuk (Boo Boo), a PhD candidate in Biochemical and Molecular Nutrition program at the Friedman School of Nutrition Science and Policy at Tufts University, who also works in the Antioxidant Research Lab at the HNRCA, is working to lower those numbers through nutrition. “We are looking at brain tissue samples from 47 centenarians. Before these folks died, multiple cognitive tests had been performed annually. And from these brain tissue samples, we will measure the levels of fat soluble vitamins (vitamin A, D, E, K), carotenoids, and different fatty acids in the brain and measuring all metabolites present in the brain. From these data, I will look at associations among nutrient levels, metabolomics, and pre-mortem cognition.” Boo Boo anticipates that higher levels of metabolites will relate to anti-inflammatory and anti-oxidative pathways. Human studies thus far have only measured dietary intake or serum levels as measurement, this study is looking at multiple nutrients measured directly in the brain.
Eating for eyesight

Age-related macular degeneration (AMD) is the leading cause of blindness in the United States. Sheldon Rowan, PhD, a scientist in the Nutrition and Vision Lab, and Assistant Professor at Tufts University School of Medicine, works to understand the events that lead to AMD and the role diet plays in it. “There is a strong association between diets containing excessive refined carbohydrates (high glycemic index) and AMD. I found that feeding aging mice with high glycemic index diets led to development of an AMD-like disease, whereas mice fed low glycemic index diets showed healthy normal eyes. Changing the diet from high glycemic to low glycemic index diets in the middle of the study completely prevented formation of AMD, indicating that disease progression can be halted or maybe even reversed with a healthy diet.” reports Dr. Rowan. He is now looking at the role that the gut microbiome plays in the onset of AMD.
Behind the scenes of nutrition research
Dr. Kathryn Barger took her interests in food, nutrition and statistics and found a home at the HNRCA after working in the pharmaceutical industry. In her position as statistician, she collaborates with PhD students and principal investigators, to develop study designs and implement data analysis. Dr. Barger helps her fellow researchers at the HNRCA to answer questions like: How many subjects do I need to include in my study? What statistical test should I use to answer my research question? What data do I need to collect in order to get the best information from my experiment? Dr. Barger loves to promote good science through good statistics. Barger states, “I study methods to analyze multi-modal data, often 2 or 3 types of big data, such as metabolomics, dietary assessment data, and microbiome data. The data are the ingredients, and I identify the best preparation method needed to yield the most informative results.”.