

The Role of Advanced Computation, Predictive Technologies, and Big Data Analytics Related to Food and Nutrition Research: A Workshop

October 10-11, 2023

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Statement of Task

A planning committee of the National Academies of Sciences, Engineering, and Medicine will plan a 2-day public workshop to explore current knowledge and practice related to the application of advanced computation, big data analytics, and high-performance computing to support scientific advances in food and nutrition research. The workshops will feature invited presentations and discussions that will focus on providing guidance to researchers and policy-makers. Topic areas to be considered include:

- Definitions and methodology
 - Clear definitions of artificial intelligence (AI) and related activities such as machine learning (ML), deep learning (DL), etc.
 - Common methods, standards, and protocols
 - Role of AI as a tool for developing study designs

Statement of Task, continued

- Current applications of AI/ML in food and nutrition research
 - Biomarker or bioactive discovery
 - Data collection related to food intake assessment and monitoring methods – tools such as sensors, wearables, smartphone applications
 - Identifying relationship between foods/nutrients and health outcomes
 - Behavioral research – advancing behavior change by teaching personalized health behaviors from personalized data
 - Nutritional quality
 - Food systems
 - Food safety
 - Ways that AI is being applied in other disciplines relevant to food and nutrition
- Considerations for diversity, equity, and inclusion
 - Impact of AI, ML, and DL on underrepresented populations
 - Bias in development of datasets, algorithms, and applications
 - Data privacy

Statement of Task, continued

- Questions and considerations going forward/research gaps
 - What is the greatest limitation to AI now in research and what is the future potential?
 - What is the appropriate use of AI now and in the future?
 - Hypothesis generation? “Evidence” for decision making? Where does it fit on the evidence hierarchy? Classifying subgroups (responders/non-responders)?
 - How can AI be used to increase efficiency (costs) and resiliency in the food system?
 - What is needed to build trust in using advanced computation approaches within the food and nutrition research community?
 - Workforce needs:
 1. Identify experience and skills for successful research teams. Identify training opportunities/exposure to data science methods for food and nutrition researchers

The planning committee will plan and organize the workshop, select and invite speakers and discussants and moderate the discussions. A Proceedings-in-Brief for each workshop and a final workshop proceedings of the presentations and discussions will be prepared by a designated rapporteur in accordance with institutional guidelines.

Study Sponsors

Institute for Advancing Health Through Agriculture Texas A&M University

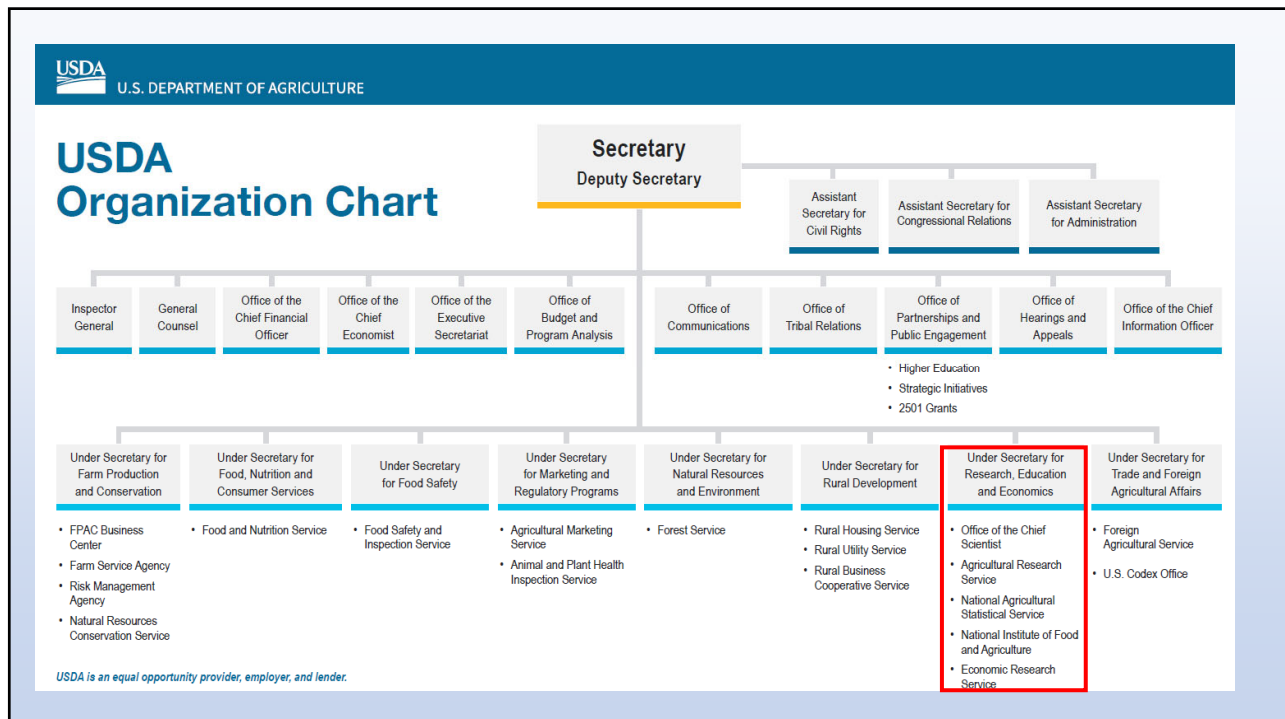
Dr. Amanda MacFarlane

U.S. Department of Agriculture Agricultural Research Service

Dr. Pamela Starke-Reed



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Agricultural Research Service

USDA's principal intramural scientific research agency

-  2,000 scientists and post docs
-  6,000 support employees
-  \$1.6 billion annual budget
-  660 research projects
-  90+ research locations

 United States Department of Agriculture
Agricultural Research Service



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USDA/ARS Human Nutrition Program

Mission: to
throughout
research

Vision: we
on scientific



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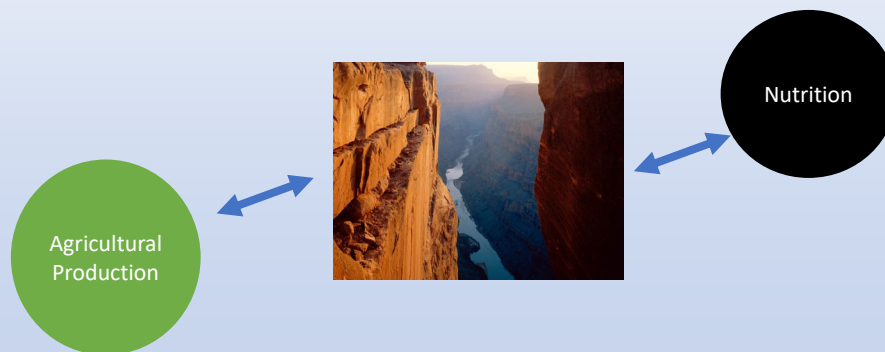
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USDA/ARS Human Nutrition Priorities (2024-2029)

Component 1: Bridging the Gap between Food Production and Human Health

- Determine Agriculture Practices that Influence the Nutritional Quality and Composition of Food
- Conduct Multiple-disciplinary Research to understand the Complex Interactions within the Food System and their Impacts on Human Health

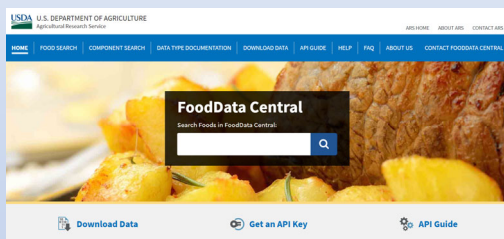


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USDA/ARS Human Nutrition Priorities (2024-2029)

Component 2: Monitoring Food Composition and Nutrient Intake of the Nation

- Provide Food Composition Data
- Determine Food Consumption and Dietary Patterns of Americans
- Develop New and Improved Methods to Analyze Foods and Determine Food and Nutrient Intake



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USDA/ARS Human Nutrition Priorities (2024-2029)



Component 3: Scientific Basis for Dietary Guidance

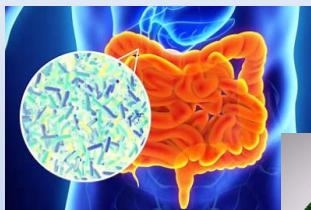
- Improve the Scientific Basis for Updating National Dietary Standards and Guidelines
- Identify Mechanisms Whereby Food, Food Components, and Physical Activity Promote Health
- Utilize Advanced Technology to Develop and Integrate Multiple Data Sources to More Precisely Inform Nutritional Requirements

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USDA/ARS Human Nutrition Priorities (2024-2029)

Component 4: Prevention of Diet-Related Chronic Diseases

- Identify Mechanisms Whereby Food, Food Components, and Physical Activity Help Prevent Diet-Related Chronic Diseases such as Obesity, Diabetes, Cardiovascular Disease, and Cancer
- Develop and Evaluate Diet and Physical Activity Strategies to Prevent Chronic Diseases



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USDA/ARS Human Nutrition Priorities (2024-2029)

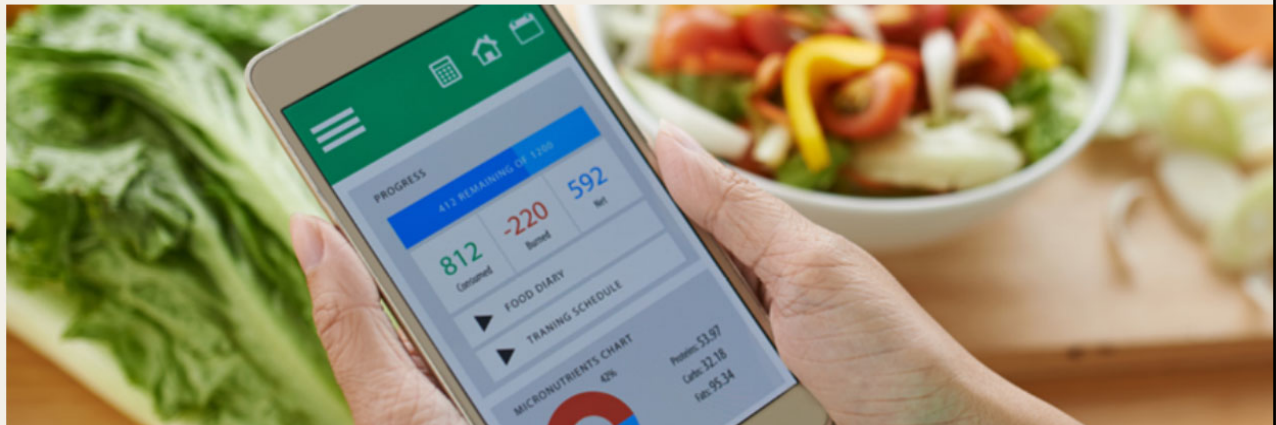
Component 5: Life Stage Nutrition and Metabolism

- Identify Dietary and Related Lifestyle Impacts for healthy Development and Function from Conception to Old Age
- Understand the Role of Diet and Physical Activity on Metabolic Programming



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Workshop Goals

- Explore opportunities and challenges related to the application of advanced computation, big data analytics, and high-performance computing to support advances in food systems and nutrition research.
- Discuss the appropriate use of evidence generated through advanced computation, big data analytics, and high-performance computing to inform food- and nutrition-related programs and policies.

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Workshop Goals

- Consider ethical considerations associated with advanced computation, big data analytics, and high-performance computing and strategies to mitigate ethical concerns and avoid bias.
- Identify opportunities and challenges related to capacity building and training to support robust and ethical application of advanced computation, big data analytics, and high-performance computing in food and nutrition research.

Agenda

DAY 1: TUESDAY, OCTOBER 10, 2023

Introductory Remarks

- Patrick Stover, Institute for Advancing Health through Agriculture at Texas A&M University
- Cindy Davis, U.S. Department of Agriculture, Agricultural Research Service
- Jennifer Tiller, Deputy Staff Director, U.S. House Committee on Agriculture
- Sharon Kirkpatrick, University of Waterloo; Planning Committee Co-Chair

SESSION I: Setting the Stage

The Current State of Advanced Computation, Big Data Analytics, and High-Performance Computing - Faisal Mahmood, Harvard Medical School

Ethics, Privacy, Bias, and Trust in the Application of AI - Judy Gichoya, Emory University

AI in Nutrition and Food Sciences: Promises and Challenges - Benoît Lamarche, Université Laval

Moderated Discussion

Agenda

SESSION 2: Applications and Lessons Learned, Part 1

Wearables - Edward Sazonov, University of Alabama

Microbiome - Rob Knight, University of California, San Diego (virtual)

Metabolomics - Susan McRitchie, University of North Carolina at Chapel Hill

Discussant: Holly Nicastro, NIH Office of Nutrition Research

Moderated Discussion

SESSION 3: Capacity Building

NIH Supported Training Program in Artificial Intelligence and Precision Nutrition at Cornell: Plans and the Road Ahead- Saurabh Mehta, Cornell University (virtual)

Inclusive Teams for Food and Nutrition Research - Angela Odoms-Young, Cornell University

Moderated Discussion

Agenda

DAY 2: WEDNESDAY, OCTOBER 11, 2023

Key Themes from Day 1 and Issues that Warrant Further Discussion - Diana Thomas, U.S. Military Academy at West Point; Planning Committee Member

SESSION 4: Applications and Lessons Learned, Part 2

Applications of AI in Food and Nutrition Research - Benoît Lamarche, Université Laval

Designing Nutrition Studies for AI Data Analysis - Sai Das, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University

Farmers Trust in AI - Aaron Smith, University of California, Davis

Application of AI: Supply Chains - Christopher Mejía Argueta, MIT Center for Transportation and Logistics (virtual)

Discussant: Elenna Dugundji, MIT Center for Transportation and Logistics

Discussant: Becca Jablonski, Colorado State University; Planning Committee Member

Moderated Discussion

Agenda

SESSION 5: Potential Applications of AI to Large-Scale Food and Nutrition Initiatives

Bridge to AI, Nutrition for Precision Health - Chris Hartshorn, NIH National Center for Advancing Translational Sciences (virtual)

Considerations for Ethics and Diverse Populations - Janie Hipp, Native Agriculture Financial Services (virtual)

Moderated Discussion

SESSION 6: Final Discussion and Synthesis

Panel Discussion