2023 Short Course Program

Tuesday, October 3, 2023

Time	Event/Speaker	Description	Location
7:45 - 8:25am	Check-in	Coffee, tea, and muffins available	Stewart Center 307
8:25 – 8:30 am	Conference Opening	Opening remarks: Bruce Hamaker - Director, Whistler Center for Carbohydrate Research	Stewart Center 306
8:30 – 9:45 am	Yuan Yao	*Introduction to carbohydrates: Basic concepts - monosaccharides, oligosaccharides, and polysaccharides*	Stewart Center 306
9:45 – 10:00 am	Break	Refreshments available	Stewart Center 307
10:00 – 11:30 am	Jozef Kokini	*Basic principles of rheology and viscoelasticity and applications in the world of cereal products*	Stewart Center 306
11:30- 11:40 am	Break	Refreshments available	Stewart Center 307
11:40 – 12:50 pm	Yuan Yao	*Modifications of starch and other polysaccharides*	Stewart Center 306
12:50 – 2:00 pm	Lunch	On your own	PMU
2:00 – 3:30 pm	Senay Simsek	*Starch granule structure and properties*	Stewart Center 306
3:30 – 3:40 pm	Break	Refreshments available	Stewart Center 307
3:40 – 4:25 pm	Yuan Yao	*Polyols and high-intensity sweeteners*	Stewart Center 306
4:25 – 5:15 pm	Bruce Hamaker	*Carbohydrate nutrition and labeling*	Stewart Center 306
5:15 – 7:00 pm	Faculty/Student & Attendee Networking	Beverages and hors d'oeuvres available	Anniversary Drawing Room/Room 304 Purdue Memorial Union
Zoom Link for all courses on Tuesday, October 3, 2023: https://purdue-edu.zoom.us/j/94970419952			

Wednesday, October 4, 2023

Time	Event/Speaker	Description	Location
7:45 - 8:25am	Check-in	Coffee, tea, and muffins available	Stewart Center 307
Breakout Session 1			
8:30 – 9:30 am	Mario Martinez	*Formulating plant-based semisolid foods*	Stewart Center 306 https://purdue-edu.zoom.us/j/91232364608
8:30 – 10:00 am	John Keller	*Part I: Hydrocolloids and functionality*	Stewart Center 302 https://purdue-edu.zoom.us/j/98515593862
10:00 – 10:30 am	Break	Refreshments available	Stewart Center 307
Breakout Session 2			
10:30 – 12:00 pm	Lisa Mauer	*Starch material properties*	Stewart Center 306 https://purdue-edu.zoom.us/j/91232364608
10:30 – 12:00 pm	John Keller	*Part II: Hydrocolloids and functionality*	Stewart Center 302 https://purdue-edu.zoom.us/j/98515593862
12:00 – 1:00 pm	Lunch	On your own	PMU
Breakout Session 3			
1:00 – 2:30 pm	Steve Lindemann, Clay Swackhamer and Dane Deemer	*Computational approaches to big data in gut microbiome studies*	Stewart Center 306 https://purdue-edu.zoom.us/j/91232364608
	Brad Reuhs	*Complex carbohydrate structure analysis (non-starch)*	Stewart Center 302 https://purdue-edu.zoom.us/j/98515593862
2:30 – 3:00 pm	Break	Refreshments available	Stewart Center 307
Breakout Session 4			
3:00 – 4:30 pm	Lavanya Reddivari	*Dietary polysaccharide and phenolic interactions in gut health*	Stewart Center 306 https://purdue-edu.zoom.us/j/91232364608
	Eun Joong Oh	*Enhancing carbohydrate profiles: the power of microbial fermentation*	Stewart Center 302 https://purdue-edu.zoom.us/j/98515593862

Thursday, October 5, 2023

Time	Event/Speaker	Description	Location
7:45 - 8:25am	Check-in	Coffee, tea, and muffins available	Stewart Center 307
Breakout Session 5			
8:30 – 10:00 am	Owen Jones	*Polysaccharide phase separation – coacervation and incompatibility*	Stewart Center 306 https://purdue-edu.zoom.us/j/94152415722
	Ganesan Narsimhan	*Predictive modeling of multiphase systems*	Stewart Center 302 https://purdue-edu.zoom.us/j/97270903867
10:00 – 10:30 am	Break	Refreshments available	Stewart Center 307
Breakout Session 6			
10:30 – 12:00 pm	Senay Simsek and Yuan Yao	*Modification of starch for enhancement of functional and nutritional properties*	Stewart Center 306 https://purdue-edu.zoom.us/j/94152415722
	Bruce Hamaker	*Can dietary carbohydrates create an Ozempic-like weight loss effect?*	Stewart Center 302 https://purdue-edu.zoom.us/j/97270903867

Advanced course descriptions:

Formulating plant-based semisolid foods (Mario Martinez)

- Starchy flours, cell wall materials and protein-rich fractions are complex systems that could represent a versatile platform of building blocks for novel semisolid foods.
- Knowledge across nutrients (e.g., cell walls, flavonoids) and hierarchical structures (e.g., food supramolecular structuring) will be in focus.
- The structuring synergies among endogenous proteins and non-proteinaceous components (e.g., polysaccharides and minerals) in the molten state will be discussed.

***Part I and II: Hydrocolloids and functionality (*John Keller)**

A practical and thorough overview of that specialized branch of "Carbohydrate Science" covering classification, sources, structure, rheology, properties, and utilization in food, pharmaceutical & industrial systems. Emphasis is placed on the relationship of structure to unique properties for solving specific application problems and functionality.

***Starch material properties (*Lisa Mauer)**
This segment will cover common analytical techniques used to characterize starch material properties and the effects of co-formulated molecules thereon.

***Computational approaches to big data in gut microbiome studies* (Steve Lindemann, Clay Swackhamer and Dane Deemer)**

Clay Swackhamer: *Understanding the concepts of machine learning and modeling*

- Defining Artificial Intelligence (AI), machine learning, and deep learning
- Case study 1: Classifying microbiomes by disease phenotype using machine learning
    - This is based on two manuscripts: Miad's manuscript/collaboration with Rush University (under review) and this paper: https://www.nature.com/articles/s41598-022-04773-3
- Case study 2: Classifying pathogens by microcoloy morphology using deep learning
    - This is a food safety application but it still involves microbiology, it uses deep learning and it nicely transitions to case study 3. It is based on this paper: https://journals.asm.org/doi/10.1128/aem.01828-22.
- Case study 3: Can deep learning find the mystery artist?
    - This is where I used a deep CNN to classify the "Jackson Pollocks" produced by Hamaker lab members. It uses the same modeling approach as case study 2, and if people want, they can submit their own artwork for classification since the model takes about 5 min to train.
- Technical imitations, ethical considerations, and outlook
    - AI safety/ethics is so hyper-salient right now I think we should include this

Dane Deemer: *Computational approaches and data analysis*

- Why we utilize high-powered compute clusters for microbiome analyses
    - Case study: Exponential scalability of metagenomic samples
- Introduction to the platforms we use to analyze microbiome data
- Stringing together software solutions for complete analytics
    - Pipeline creation, automation
- Introduction to common tools and "tool types" for analysis of gut microbiome data
    - qqime, mothur, assemblers, binners, annotation tools, etc.
- How we validate the tools we use for microbiome data science
- Custom analytics: providing your own software solutions

***Complex carbohydrate structure analysis (non-starch) (*Brad Reuhs)**
In this course, you will learn about instrumentation and technology for structural analysis of complex polysaccharides**.**

***Dietary polysaccharide and phenolic interactions in gut health (*Lavanya Reddivari)**
In this course, we are going to look at the structure and function of different polysaccharides and polyphenols and how the interaction between these two components influences physiological function.

***Enhancing Carbohydrate Profiles: The Power of Microbial Fermentation* (Eun Joong Oh)**
Synthetic biology is increasingly being recognized as an efficacious method to engineer microbes for the synthesis of carbohydrates in food. Concurrently, microbial fermentation presents a potential avenue for the minimization of unwanted carbohydrates throughout the bioprocessing stages. This course will discuss the latest achievements, trends, and key challenges in microbial fermentation for carbohydrate conversion.

***Polysaccharide phase separation – coacervation and incompatibility* (Owen Jones)**
Polysaccharides are macromolecules, many of which are marginally soluble in water and have a blend of colligative and colloidal attributes. This course describes general conditions in which mixtures of polysaccharides and proteins can repel or associate with one another, facilitating transition to a liquid-in-liquid dispersion with associated textural and visual attributes.

Predictive modeling of multiphase systems (Ganesan Narsimhan)

- Formation and stability of emulsions
- Formation, syneresis and stability of foams
- Viscosity
- Characterization of flow behavior of Non-Newtonian fluids
- Rheology of dispersions
- Intrinsic viscosity of macromolecular solution
- Gelation of proteins
- Baking of leavened food
- Swelling and pasting of starch suspensions

Modification of starch for enhancement of functional and nutritional properties
(Senay Simsek and Yuan Yao)
Starch modification methods alter the functional and nutritional properties of native starches. This section will cover strategies for starch modification, preparations of resistant starch, and their impacts on starch functionality with regard to their application in food systems and digestibility characteristics.

***Can dietary carbohydrates create an Ozempic-like weight loss effect?* (Bruce Hamaker)**

- What is the gut-brain axis and review of gut hormones related to appetite and postprandial glycemia?
- Action of current weight loss drugs related to glucagon-like peptide-1 (GLP-1) (e.g., Ozempic, Wegovy, Monjaro)
- Concept of slow digestion of dietary carbohydrates and small intestine locational digestion
- How carbohydrates can activate the gut-brain axis and ileal brake mechanisms
    - Evidence that carbohydrates can be designed for satiety and weight management
- Dietary carbohydrates with potential to activate the gut-brain axis
    - Starch and other glycemic carbohydrate structures
        - Chemical properties
        - Physical properties
    - Digestive enzymes
        - α-Amylases
        - α-Glucosidases
    - Relationship between carbohydrate structures and digestion
        - Fast versus slow digestion
        - Branching patterns
        - Food matrix effect
        - Other α-glucan structures
- What is the state of the science, and possible applications in products?