Plant Protein Innovation Center

Collaboratively growing the landscape of plant-based proteins

B. Pam Ismail
Founder and Director
bismailm@umn.edu

ppic.cfans.umn.edu

CFANS
COLLEGE OF FOOD, AGRICULTURAL AND NATURAL RESOURCE SCIENCES
FOOD SCIENCE AND NUTRITION

UNIVERSITY OF MINNESOTA
Driven to Discover®

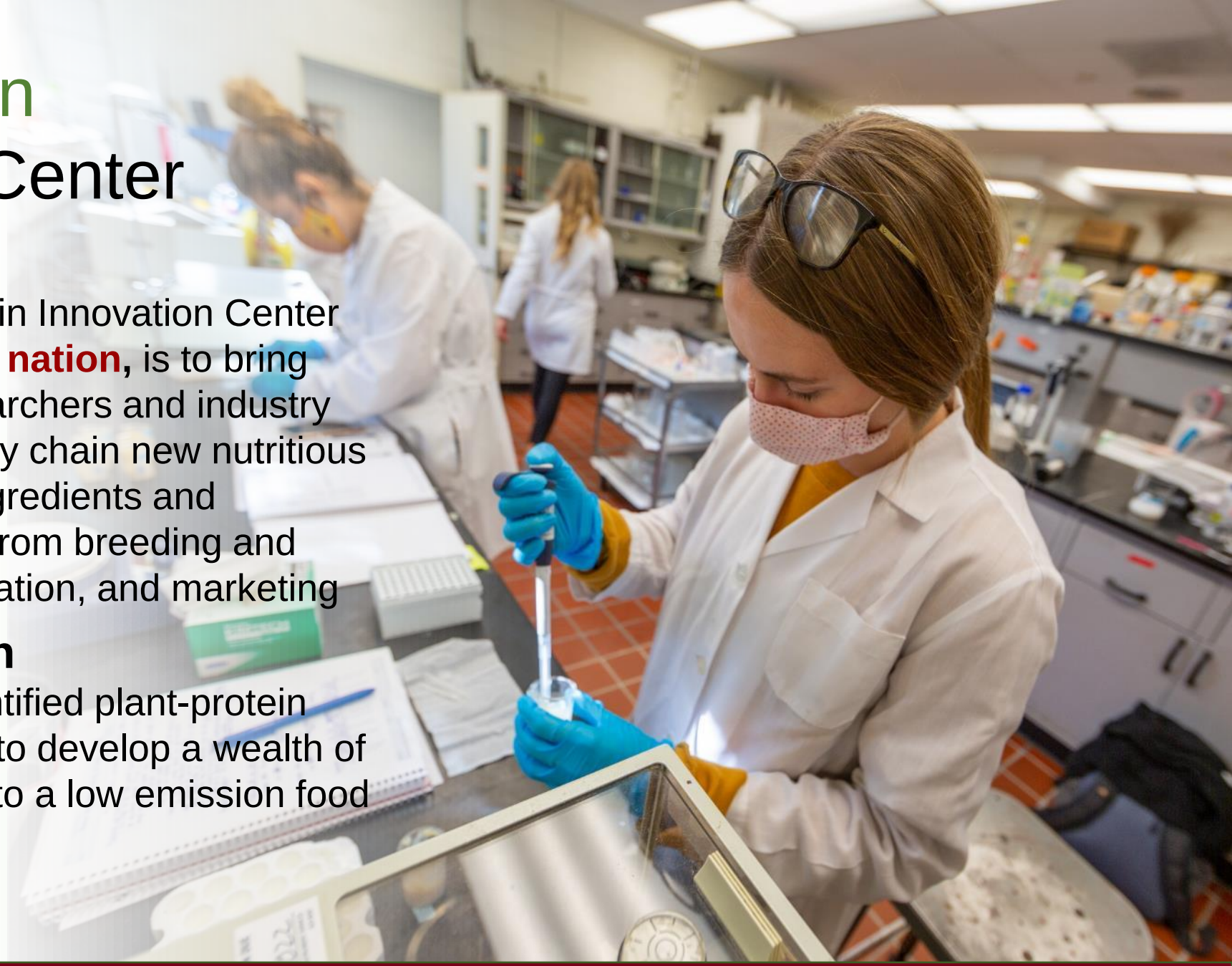
Plant Protein Innovation Center

Mission

- The mission of the Plant Protein Innovation Center (PPIC)**, first of its kind in the nation,** is to bring together interdisciplinary researchers and industry partners to deliver to the supply chain new nutritious and functional plant protein ingredients and products, working all the way from breeding and genetics to processing, formulation, and marketing

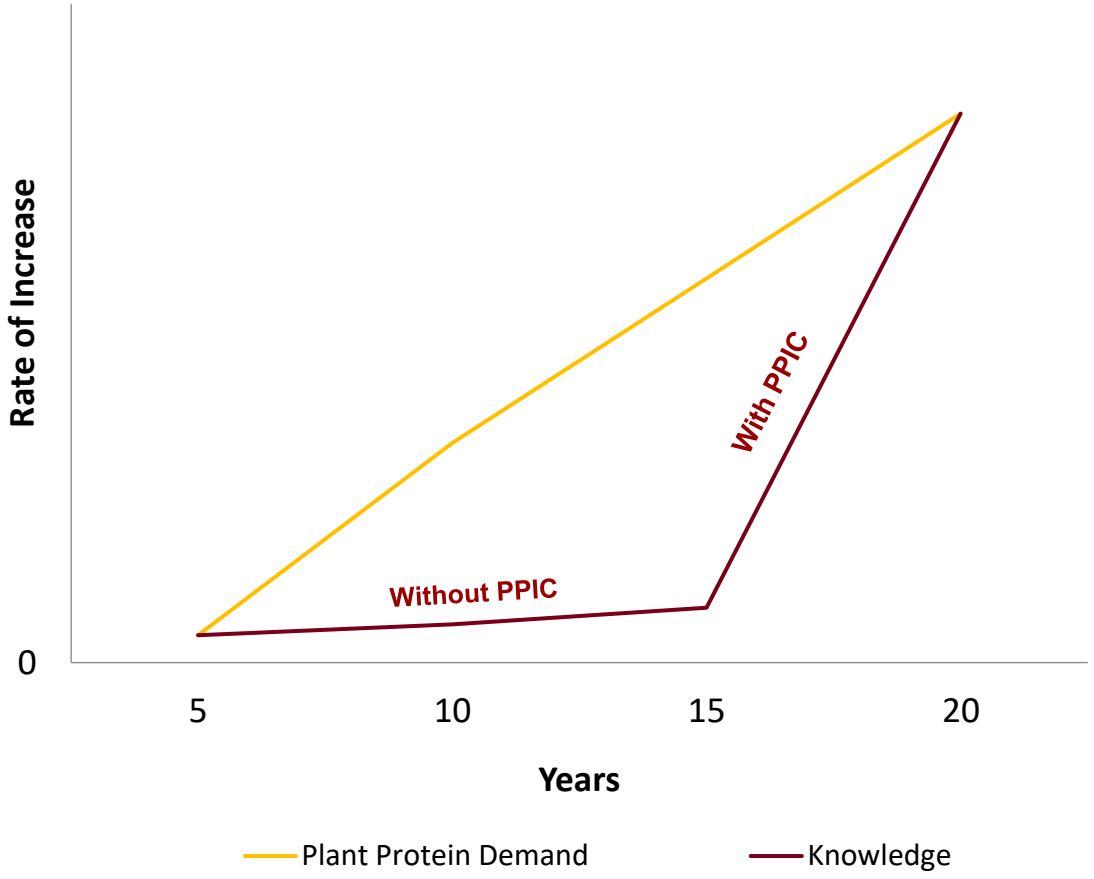
Approach

- PPIC addresses industry-identified plant-protein challenges and opportunities to develop a wealth of fundamental science leading to a low emission food industry



Why PPIC? Why Now?

The PPIC strives to not only bring economic gain to the industry but to also address the consumer desire for nutritious and healthy food, have a positive impact on the environment by seeking and utilizing sustainable crops, provide additional sources of protein for the growing population, and provide revenue to farmers.

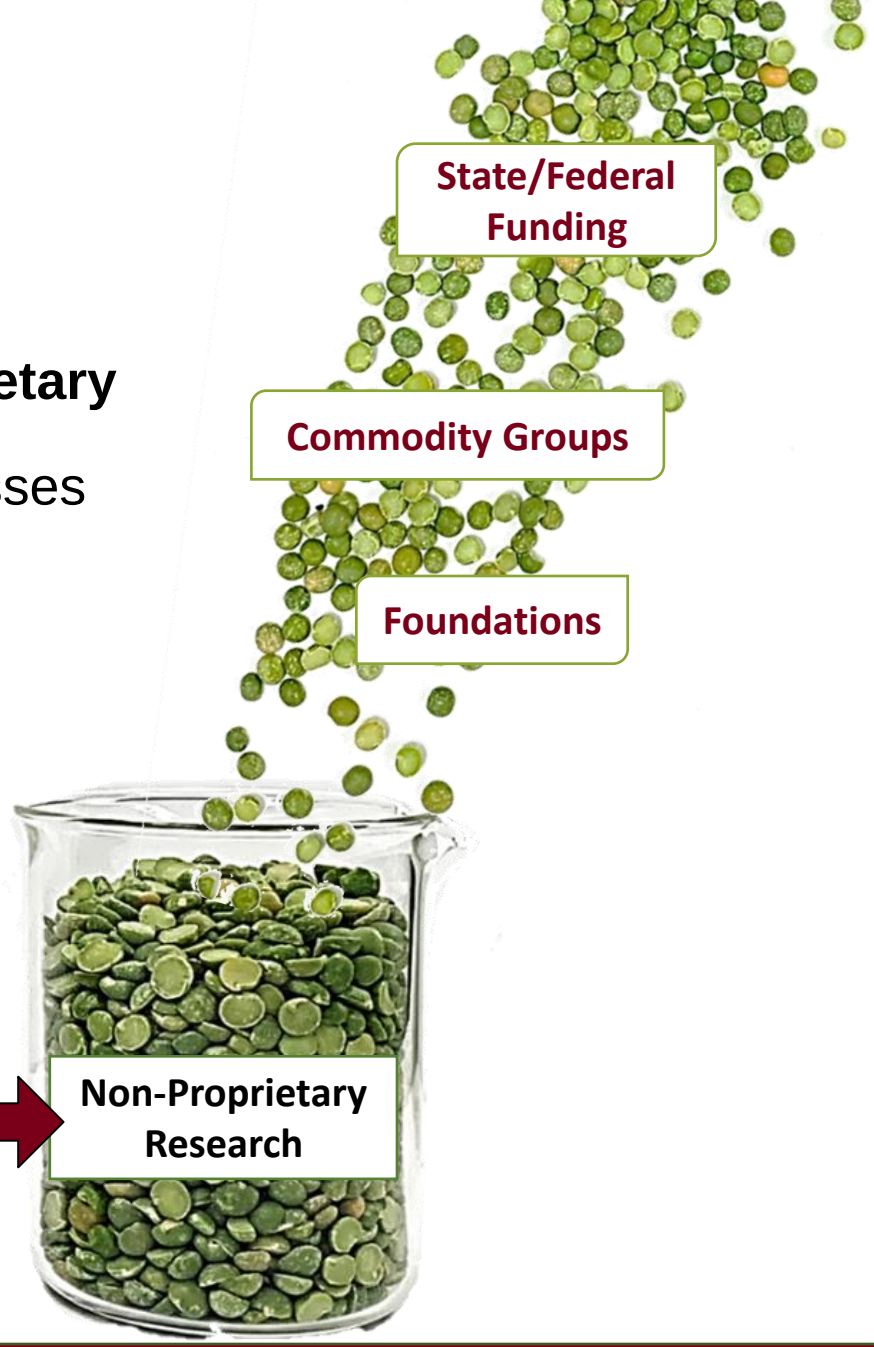


How? The PPIC Model

- Research is mainly **Pre-Competitive** and **Non-Proprietary**
- Research focuses on fundamental science that addresses industry needs and consumers demands

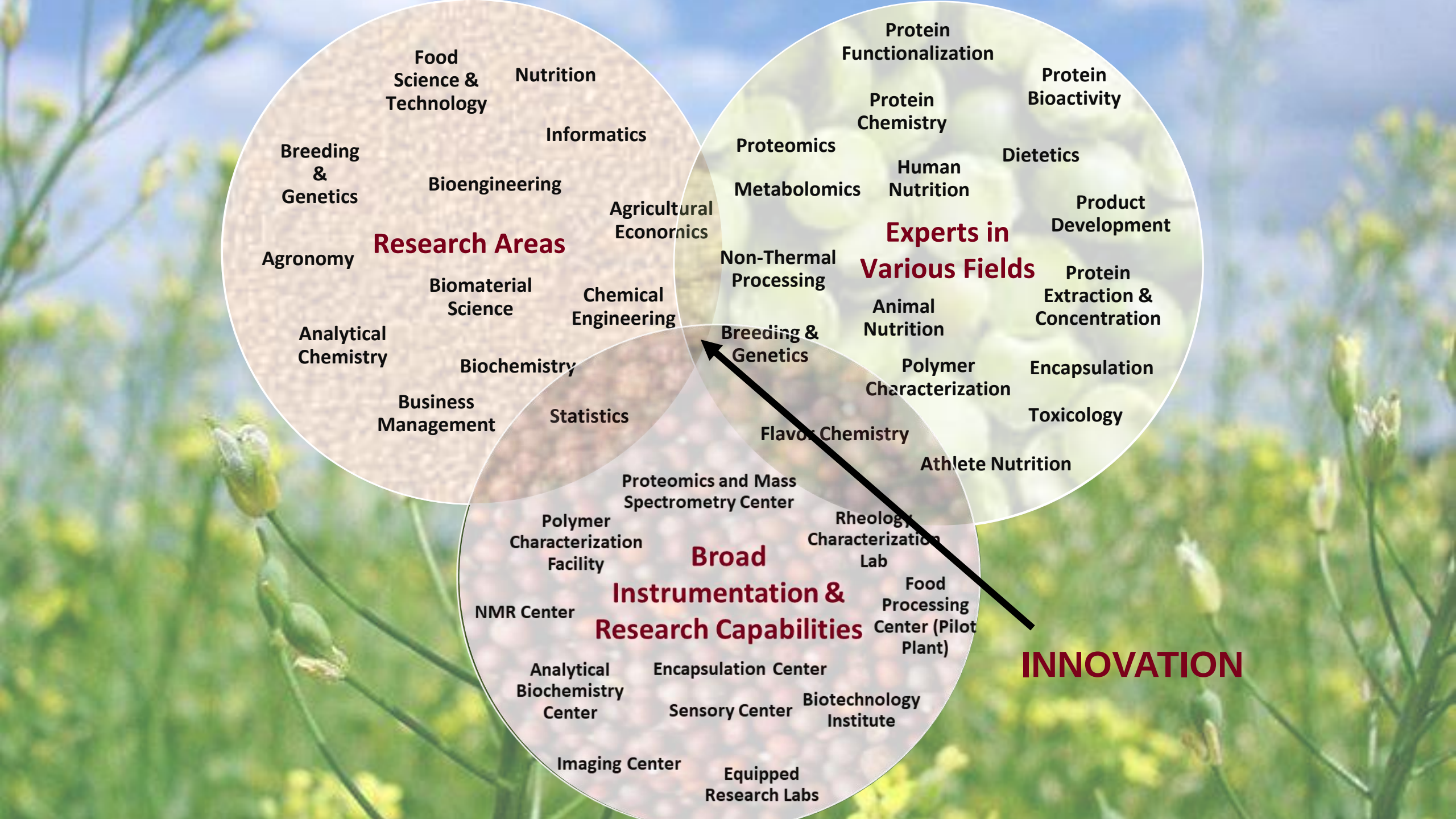
Industry Contributions/Memberships

Total funds acquired: over $6,000,000



The PPIC Model:

Coming Together to Grow Research


Research Areas
Food Science & Technology
Nutrition
Informatics
Breeding & Genetics
Bioengineering
Agricultural Economics
Agronomy
Biomaterial Science
Chemical Engineering
Analytical Chemistry
Biochemistry
Business Management
Statistics
Experts in Various Fields
Protein Functionalization
Protein Bioactivity
Protein Chemistry
Proteomics
Dietetics
Human Nutrition
Metabolomics
Product Development
Non-Thermal Processing
Protein Extraction & Concentration
Animal Nutrition
Breeding & Genetics
Polymer Characterization
Encapsulation
Toxicology
Flavor Chemistry
Athlete Nutrition
Broad Instrumentation & Research Capabilities
Proteomics and Mass Spectrometry Center
Polymer Characterization Facility
Rheology Characterization Lab
NMR Center
Food Processing Center (Pilot Plant)
Analytical Biochemistry Center
Encapsulation Center
Sensory Center
Biotechnology Institute
Imaging Center
Equipped Research Labs
INNOVATION

Areas to be Addressed

- Understand how novel proteins can replace or be combined with traditional protein ingredients in various food products to deliver optimal nutrition, functionality, and flavor
- Unveil unique characteristics and applications for each protein source
- Determine viable (cost effective) extraction (wet and dry) and processing technologies for producing functional protein ingredient from novel sources
- Develop prediction models to link protein structure to function
- Investigate crop diversity and breed for protein quality traits
- Secure abundant and sustainable supply

Identified Research Priorities

Production

Primary research focus areas related to breeding, sustainability of the supply, and crop diversity

Processing & Formulation

Primary research focus areas related to extraction methods, unique processing, co-products, food systems, high value end use

Application

Primary research focus areas related to flavor, functionality, and nutrition

https://ppic.cfans.umn.edu/research/research-priorities

Research Advances

PPIC Funded Research

- Four successful RFPs resulting in nine projects, submitted by PPIC researchers, funded for up to $50,000 per year
- *Link to research summaries*

Research Advances

Examples of PPIC Grant Proposals

(**Over one million dollars**)

- Proposal funded through Good Food Institute (GFI) (2020)
  - Title: *Characterizing and texturizing proteins from pulses to form fibers with textures that mimic chicken*
  - Three interdisciplinary PPIC researchers
  - Funds granted: **$250,000**

- Proposal funded through Foundation for Food & Agricultural Research (FFAR) (2020)
  - Plant Protein Enhancement Project
  - Title: *Legumes of the future: Developing methodologies and germplasm to enhance the functionality and nutritional quality of pea protein*
  - Five interdisciplinary researchers
  - Funds requested: **$800,000**

Who?

Industry Members

PPIC Partners

ADM

AFS APPLIED FOOD SCIENCES

AMANO Amano Enzyme

Cargill™

CONAGRA BRANDS

DANONE ONE PLANET. ONE HEALTH

FERRERO

GREEN BOY GROUP

General Mills

iff

Ingredion

Microsoft

ROQUETTE Offering the best of nature™

TATE & LYLE

TharProcess™ Sustainable Trust

Who?

Industry Members

Associate Members

BAYER

EDLONG
Everything Dairy Can Be.

THE ish FOOD COMPANY

THE LAND INSTITUTE

MATTSON
WE MAKE FOOD HAPPEN

MEATI FOODS

motif FOODWORKS

NATURE'S Fynd

NEOM نيوم

NotCo

PULSE CANADA

Schreiber

Who?

Industry Members

Affiliate Members

Catapult

NuCicer

Who?

Supporters & Collaborators

Agricultural Utilization Research Institute auri

BRIDGE2FOOD

Canada Consulate General Consulat général

CROWN EST. 1878

DIL

ExAlt R&D, LLC

Forever Green

THE FUTURE OF Protein PRODUCTION

gfi Good Food Institute

hartman GROUP

IMPROVE

Luke NATURAL RESOURCES INSTITUTE FINLAND

Naturally MINNESOTA

Protein Highway Network for plant-based protein innovation

PLANT BASED FOODS ASSOCIATION

SCHWAN'S COMPANY SCHWAN'S CORPORATE GIVING FOUNDATION

UNIVERSITY OF MANITOBA

VTT

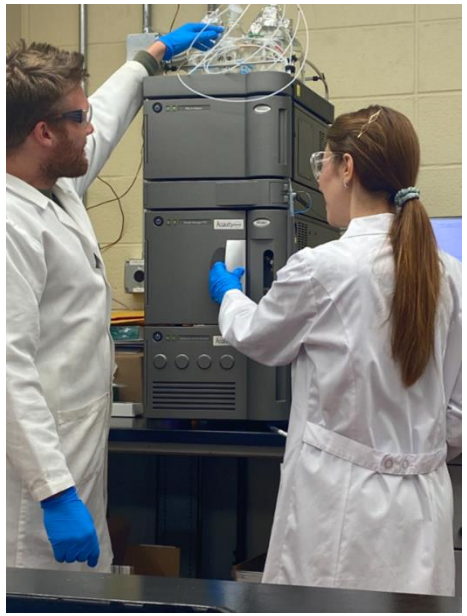
WAGENINGEN UNIVERSITY & RESEARCH

Who?

Researchers

- 38 interdisciplinary researchers across the University of Minnesota and from external institutions!

https://ppic.cfans.umn.edu/expertise/researchers



Senior Scientists, Postdocs, and Students

Become a Member of the PPIC!

With investment and collaborative effort between industry and researchers, we can innovate!

Affiliate

- Companies with an annual revenue of less than $2 million
- A yearly membership fee of $3,000/year for 3 years
- (Sponsorship available through application)

Associate

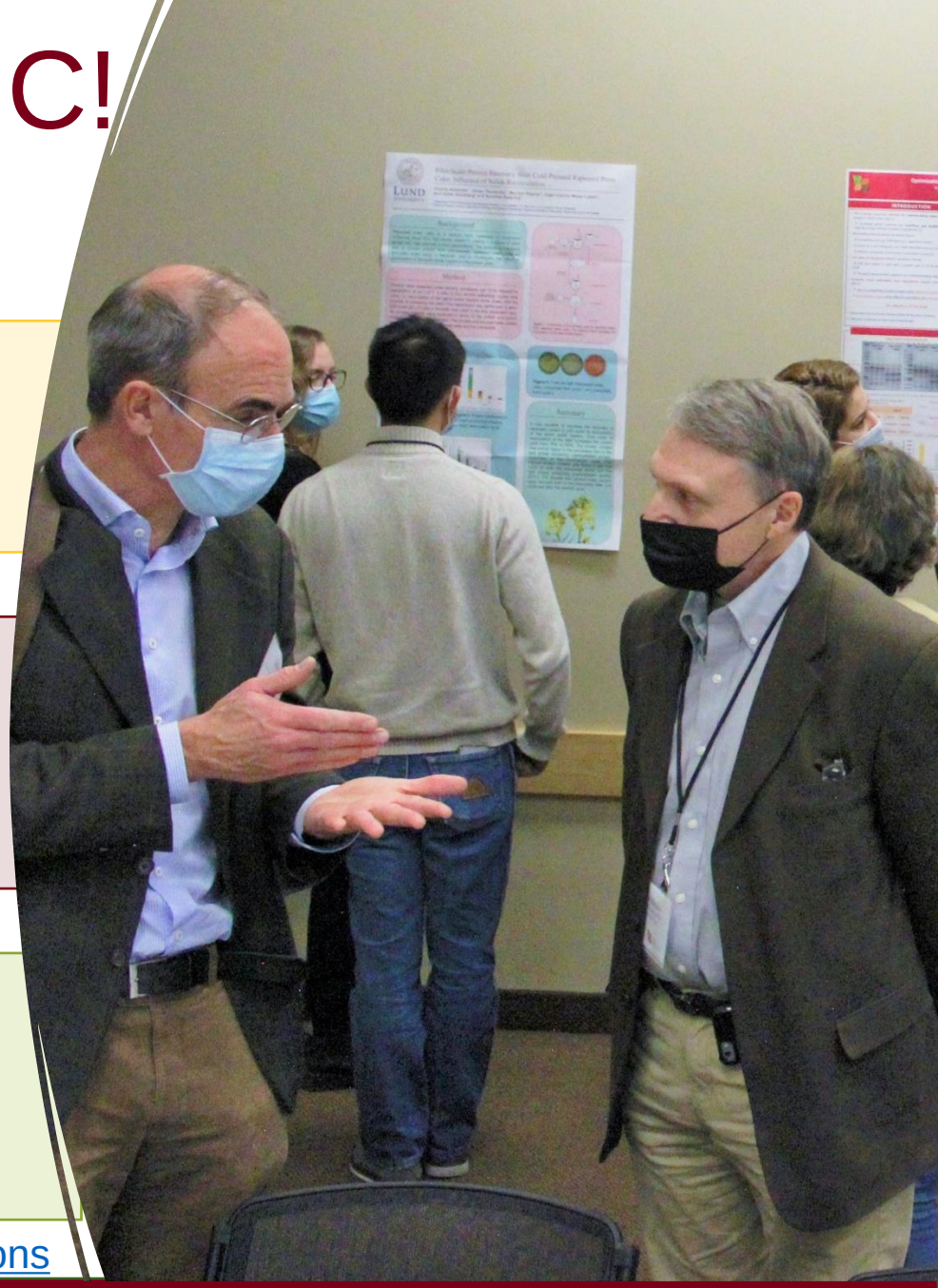
- Companies with an annual revenue between $2 and 5 million* and for organizations
- A yearly membership fee of $6,000/year for 3 years

**A company that makes more than $5 million annual revenue may join at an associate level for a one-year trial period, non-renewable, for $10,000 one-time membership fee.*

Partner

- A yearly membership of $20,000 for 3 years for companies that have $5-100 million annual revenue;
- A yearly membership of $40,000 for 3 years for companies with more than $100 million in annual revenue

https://ppic.cfans.umn.edu/members-supporters/membership-options



Benefits to Members

https://ppic.cfans.umn.edu/members-supporters/membership-benefits

For **All Members** PPIC offers:

- Visibility on our website and networking opportunities
- Waived registrations to PPIC events*
- Opportunity to host booths at annual meetings at no additional cost
- Expert advice and support for troubleshooting processing/product development challenges
- Facilitated collaboration with other PPIC member companies

For **Associate & Partner** members PPIC also offers:

- A Welcome package** that offers a complimentary project custom designed to meet your research needs
- A 20% discount on any subsequent projects to continue reaching research goals
- High-priority project timelines
- Customized hands-on training on various analytical techniques
- Support with setting up new R&D labs for protein research

For **Partner** members PPIC also offers:

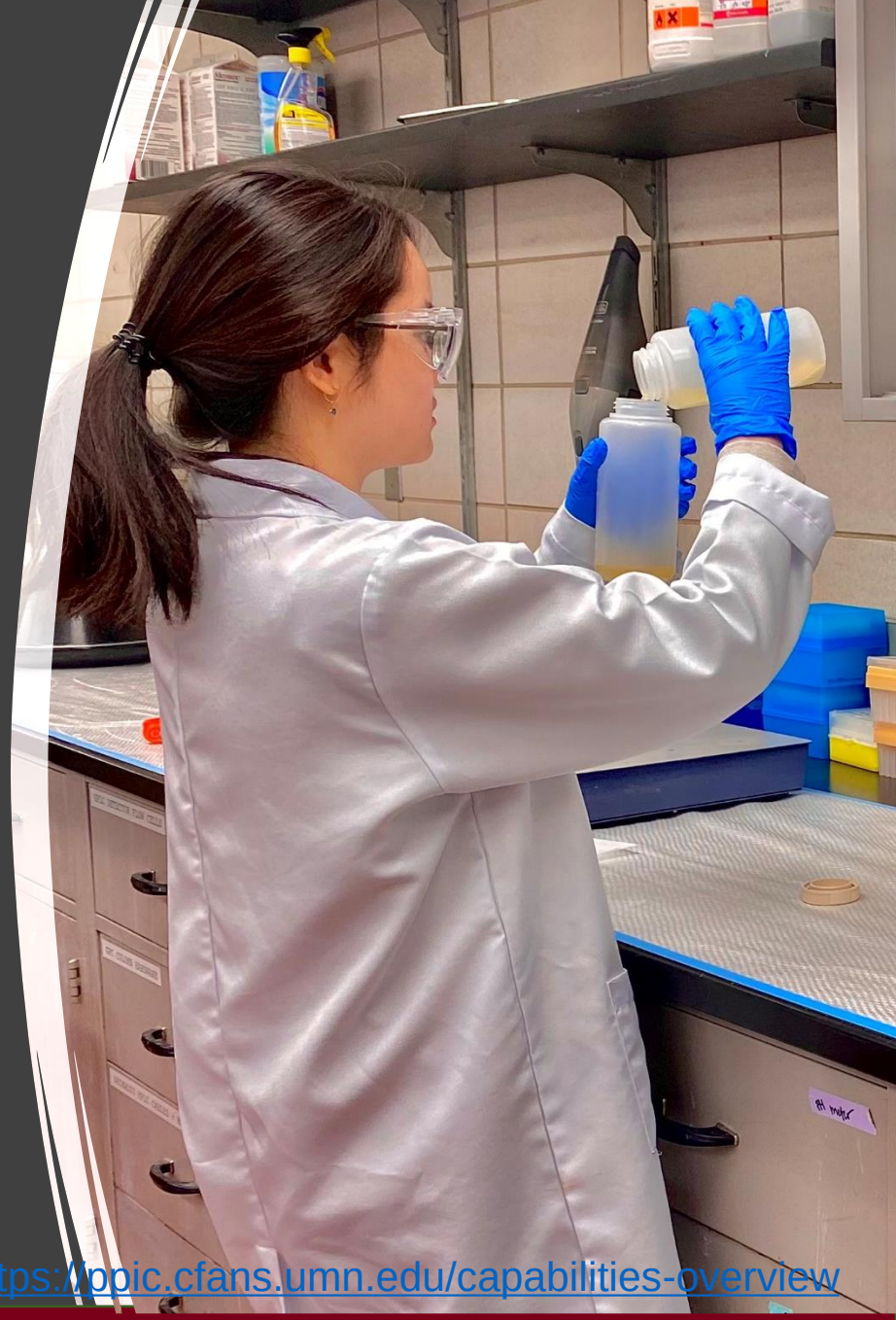
- Having an R&D scientist on the Technical Committee
- Contribution to and development of the center Research Priorities
- Receiving quarterly updates on PPIC Funded projects
- Involvement in decision making to fund research proposals

Waived Event Registrations
Partners: Three waived registrations to PPIC annual meetings, two waived registrations to PPIC short course; a total value of $5,000 - $7,000/annually;
Associate Members: Two waived registrations to PPIC annual meetings, one waived registration to PPIC short course; a total value of $3,000 – $4,500/annually;
Affiliate Members/ Supporters: Two waived registrations to PPIC annual meetings; a total value of $1,500 - $3,000/annually
*****Welcome package***
Partners: A welcome package of $8,000 value is offered for a complimentary project;
Associate Members: A welcome package of $4,000 value is offered for a complimentary project

PPIC Capabilities

Check out our webpage for a full list of capabilities

Sample Preparation	Compositional Analysis	Protein Extraction
Structural & Functional Characterization	Nutritional Analysis	Flavor Extraction Techniques
Analytical Measurement of Flavor Compounds	Application Techniques	Access to University Facilities



https://ppic.cfans.umn.edu/capabilities-overview

Research Outputs

Since 2021 PPIC has produced:

Several publications from both PPC and externally funded sources

- **Enhancement of Pea Protein Solubility and Thermal Stability for Acidic Beverage Applications via Endogenous Maillard-Induced Glycation and Chromatography Purification**.

Schneider A., Bu, F., Ismail, B. 2023. *Current Research in Food Science,* 2023;6:100452-63

- **Investigation of Novel Cold Atmospheric Plasma Sources and their Impact on the Structural and Functional Characteristics of Pea Protein.**

Bu, F., Feyzi, S., Nayak, G., Mao, Q., Kondeti, V.S., Bruggeman, P., Chen, C., Ismail, B. 2022. *Innovative Food Science and Emerging Technologies*, 83, 103248.

- **Structure-Function Guided Extraction and Scale-up of Pea Protein Isolate Production.**

Hansen, L., Bu, F., Ismail, B. 2022. *Foods,* 11, 3773.

- More can be found on our website: https://ppic.cfans.umn.edu/research-outputs

A patent on Method for Producing Functional Pea Protein

- Alissa Schneider, B. Pam Ismail, 2020. **Method for Producing Functional Pea Protein.** Provisional Patent Filed Oct 30th 2020, Application number: 63/107,797, developed at the University of Minnesota

Several literature reviews on novel plant protein sources

PPIC Outreach

Annual PPIC events include:

- Research Spotlight Meeting
- Protein short courses and hands on experiences
- Workshops on
  - Commercialization
  - Process Scale Up
  - Abundance of supply challenges

Outreach will allow for the exchange of knowledge between the public and private sphere

What PPIC Offers the Community

- Networking opportunities during events with companies across the value chain (Ingredient suppliers, processors, and CPG companies)
- Interaction with scientists from various disciplines
- Research advancement and innovation
- Development of new and successful protein ingredients and applications
- Post-farm processing technologies that add value along the entire value chain
- Scaling plant protein from regenerative Agriculture
- Development of environmentally sustainable protein crops
- Securing supply chain
- Training the next generation of plant protein scientists

Thank You to Our: Technical Committee

Elizabeth Nguyen
Senior Scientist
Alternative Proteins
Archer Daniels Midland Company

Kazuhiro Furukawa
Business Development
Amano Enzymes

Chris Fields
Chief Science Officer
Applied Food Science

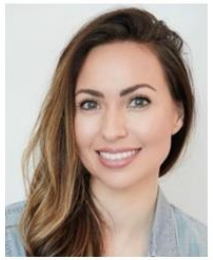
Nathan Knutson
Nutrition Center of Expertise & PPD Leader for the Americas, Cargill

TBD
Conagra Brands

Jonathan Gray
Vice President, R&D
Danone North America

Katie Whalen
Agritech & Biotech Science Manager - Open Innovation
Soremartec S.A., Ferrero

Sara Rosene
Associate Principal Scientist, Nutrition & Technology Solutions, Protein Program
General Mills



Vanessa Valdes
Lead Food Scientist/ R&D Lab Manager
Green Boy Group

Der-Chyan Hwang
Global R&D Nourish - Protein Solutions Leader
International Flavors & Fragrances

Nagul Naguleswaran
Protein Chemistry Lead
Global Research
Ingredion Incorporated

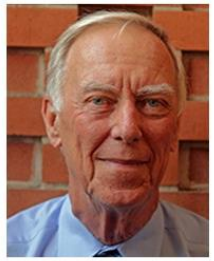
Ranveer Chandra
CTO Agri-Food, and Managing Director, Research for Industry
Microsoft

Jennifer Kimmel
Head of R&D Americas
Roquette America, Inc.

Zheng You
Principal Scientist, Health & Wellness R&D
Tate & Lyle

Jason Lupoi
Director of Laboratory Operations
Thar Process

Lolly Occhino
Senior Food Scientist
Agricultural Utilization Research Institute



Gary Reineccius
Professor Emeritus, Food Science & Nutrition Department
University of Minnesota

Thank You to Our: Executive Board

Laurice Pouvreau
Expertise Leader Protein Technology Wageningen University & Research (The Netherlands)

Denis Chéreau
CEO, IMPROVE (France)

Greg Cuomo
Associate Dean for Research & Graduate Programs, Utah State University

Sergiy Smetana
Head of Food Data Group, German Institute of Food Technologies (DIL e.V.) (Germany)

Julie Simonson
VP R&D Product Innovation, Schwan's Company

Jason Robinson
Director – Business Development, Food, Agricultural Utilization Research Institute

Christina Connelly
Trade Commissioner, Consulate General of Canada

PPIC

Partner with us today to change the landscape of plant-based protein tomorrow!

Plant Protein Innovation Center

ppic.cfans.umn.edu

CFANS
COLLEGE OF FOOD, AGRICULTURAL AND NATURAL RESOURCE SCIENCES

FOOD SCIENCE AND NUTRITION

UNIVERSITY OF MINNESOTA
Driven to Discover®