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# ABBASPOURRAD LAB RESEARCH

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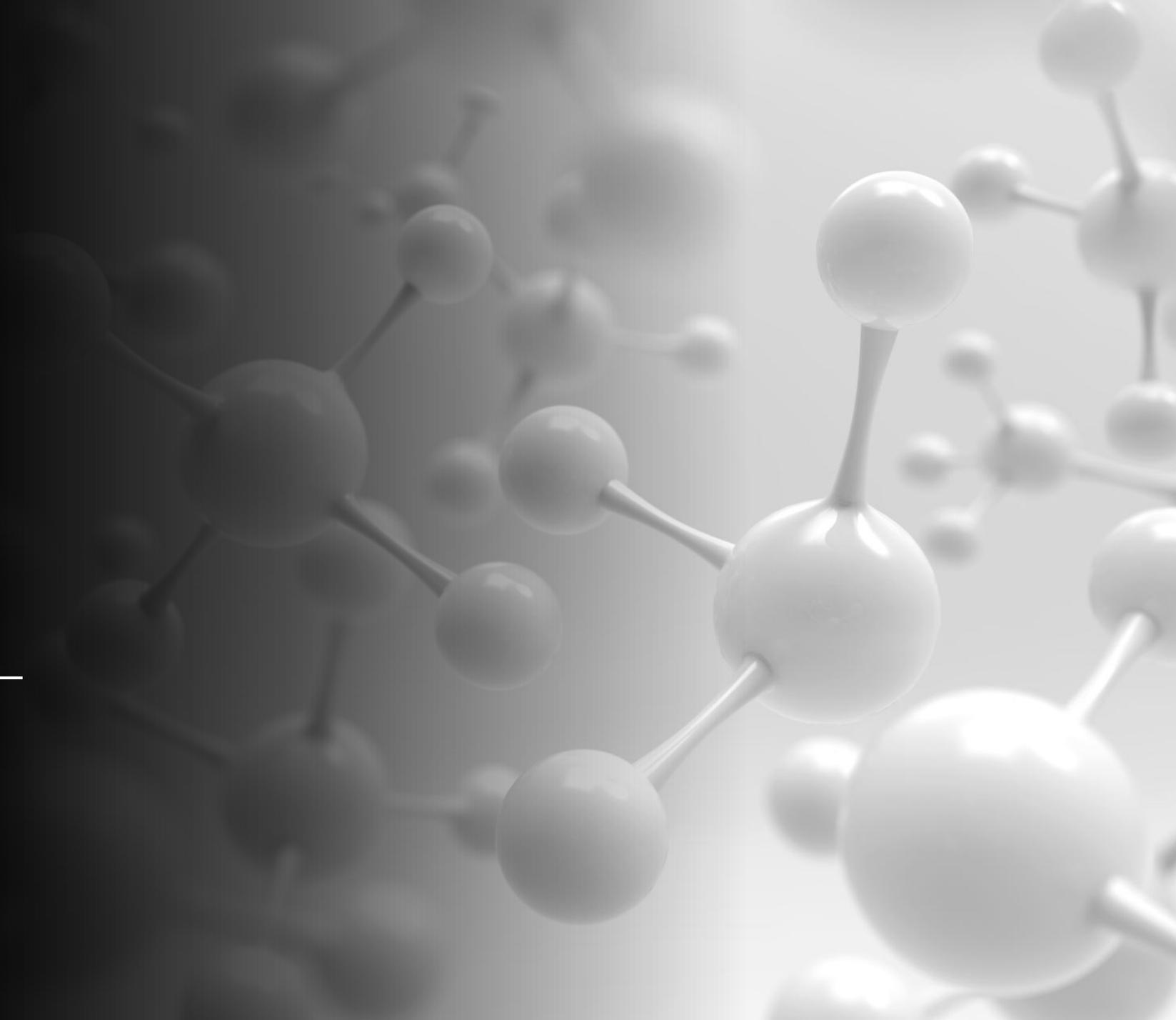
[Google Scholar](#)

**[New York dairy Promotion Advisory Board, September 8<sup>th</sup>, 2020](#)**



# Conversion of Milk Proteins to Clean Label Emulsifiers

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# CLEAN LABEL

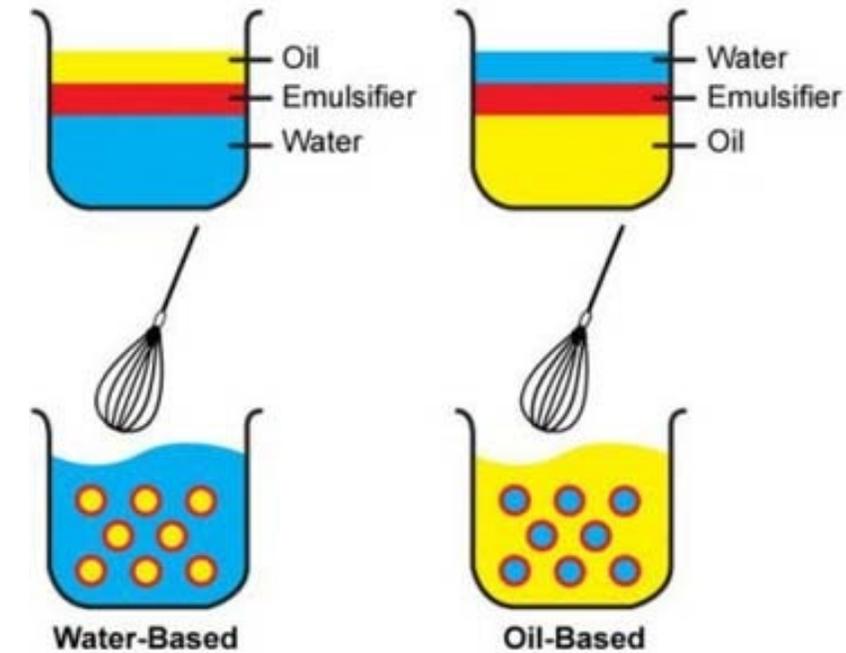


## Background

- The ever-increasing demand for clean label ingredients
- Need for **sustainability** derives the food chain industry from taking a stride towards customer demand

# Emulsifying Agent in Food Industry

- Emulsifying Agent (surfactant) allows us to mix substances of different nature (*e.g.*, water and oil)



## Clean label surfactant (natural sources)

- Maintain stability of the emulsion for the intended shelflife
- Compatible with other ingredients in formula
- Non-toxic
- Little or no odor, no taste or color

Emulsifiers are used for a wide range of processed foods, including ice creams, chocolate, and baked foods to create a smooth texture, prevent separation, and extend shelf life.

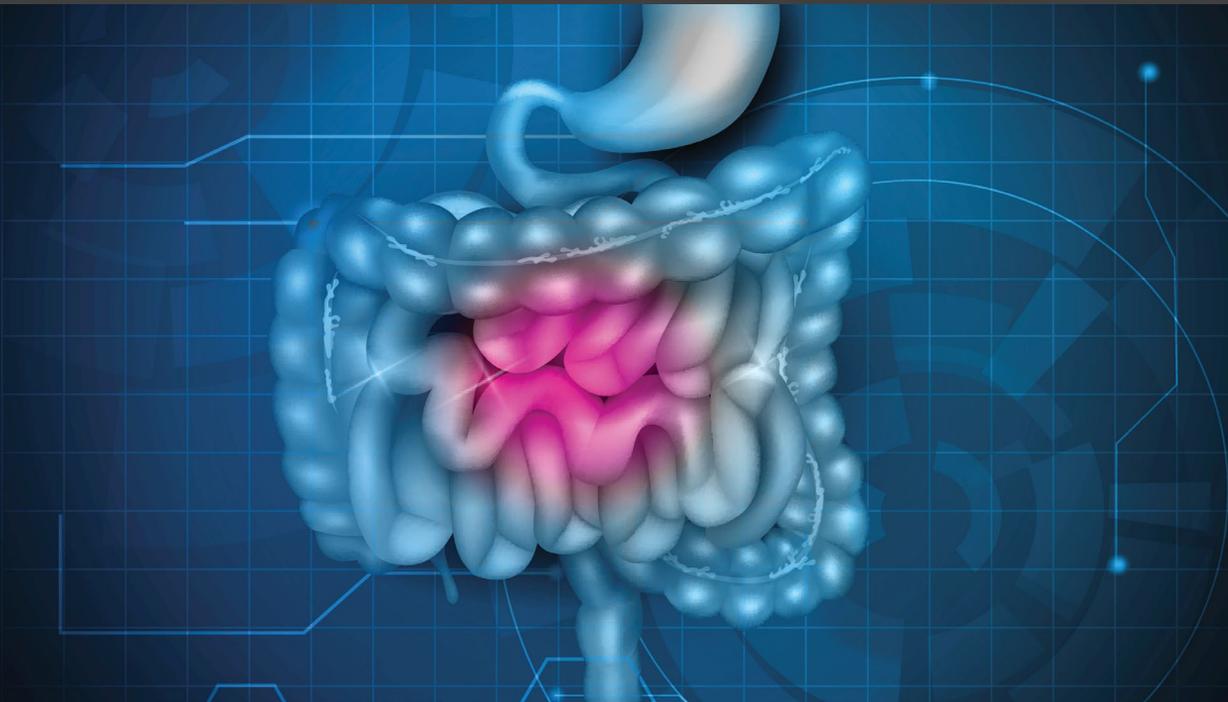




## Challenges:

## Synthetic emulsifiers

- Emulsifiers can harm the gut microbiome, increasing gut permeability—commonly known as "leaky gut."
- A leaky gut lets bacteria move through the gut wall into the bloodstream (inflammatory response)
- Researchers linked emulsifier-induced inflammation to the development of
  - Obesity
  - Type-2 diabetes
  - Cardiovascular
  - Liver disease
  - Inflammatory bowel diseases like Crohn's disease and ulcerative colitis



# Opportunity: Market Size



## List of TOP Manufactures in Synthetic Food Emulsifier Market

- DuPont
- Cargill
- ADM
- Wilmar
- DSM
- Palsgaard
- Belden
- Corbion
- RIKEN VITAMIN
- Mitsubishi Chemical Corporation
- Riken Vitamin
- Abitec Corp
- BASF
- Lonza Group

## Opportunity: Dairy-based Emulsifiers



## Synthetic Food Emulsifier Market by Product Type Segmentation

- **Span**
- **Tween**
- **Glyceryl Monostearate**
- **Sodium stearoyl lactylate (SSL)**
- **Polyglycerol Polyricinoleate (PGPR)**

Food Emulsifier Market size is set to surpass USD 4 billion by 2025 (Global Market Insights)

The overall food emulsifier market from bakery and confectionery application is expected to observe significant gains of 5.5 percent by 2025.

Global food emulsifier market size for dairy & frozen desserts application is projected to exceed USD 330 million by 2025.

# Clean Label Emulsifier

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- Whey has an excellent functional properties!
- Enzymatic hydrolysis of whey protein is a well-known method to improve the nutritional properties!
- Whey protein hydrolysates (WPHs) are considered to be ideal ingredients in the formulation of human milk substitutes!



# Objective

- Convert the whey protein to **high-value-added** and **clean label emulsifiers** with a broad range of functionalities and applications.
- Develop a wide range of emulsifier ingredients (different HLB values) made from **WPH-sugar conjugation**.
- The conjugates will be purified, fractionated, characterized (HLB values), and evaluated in a model emulsion system.



**Deliverable: The production of clean label emulsifiers from whey only promotes sustainability in the dairy industry but also introducing a new clean label ingredient in the market.**

# **Project: Conversion of Milk Proteins to Clean Label Emulsifiers**

## **Objective:**

The objective of this study is to develop a wide range of emulsifier ingredients made from whey protein hydrolysate-sugar conjugation. The conjugates will be purified, characterized, and evaluated in a model emulsion system.

**PI:** Alireza Abbaspourrad

**Time:** January 1, 2021 - December 31, 2021 (Year 1 of 2 Years)

**Requested Budget (Post-doc and technician salary):** \$96,760



**Sequestration of Bovine Milk Oligosaccharide:**

**A Novel Value-Added Food Ingredient**

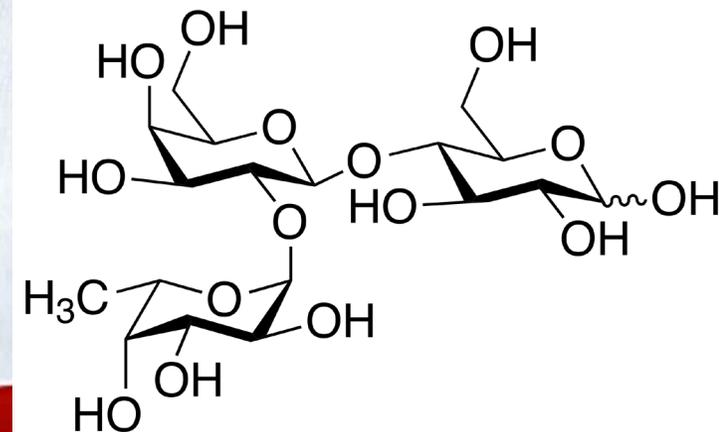
# Background

- Human milk oligosaccharides (HMOs) that exist in breast milk are shown as a key ingredient for cognitive growth and boosting the immune system of infants.
- HMOs are complex molecules that are significantly challenging to be synthesized.
- 2.5 oz. of HMO costs ~\$30 (Source: Amazon).

# Human Milk Oligosaccharide 2'-FL (Fucosyllactose)

## Prebiotic Found In Mothers' Milk

✓ GUT HEALTH ✓ IMMUNE HEALTH ✓ COGNITIVE HEALTH



# Cont'd...

- **Limited sources of HMOs and production challenges.**
- **Bovine colostrum has been explored as a rich source of bovine milk oligosaccharides (BMOs): (1g/L)**
- **A potential substitute, as there is a similarity between molecules exist in HMOs and BMOs**
- **As BMOs are mainly made of 3–10 monomers, they pass through the ultrafiltration membrane and end in the whey permeate.**





## Challenge and Opportunity

- **Sustainability** challenges in the dairy industry
- **Wide availability of BMOs in dairy whey permeate**
- Current need for infant formula and supplements with **BMO-like functionalities**
- Recovery of BMOs from whey permeate
- Current techniques: Membrane filtration and bioprocess to isolate BMOs both suffer from a lack of **separation efficiency**

# Objective

- ❖ Develop a novel and **cost-effective technique** to **extract and isolate bovine milk oligosaccharides (BMOs)** from **whey permeate** using specially **molecularly imprinted polymeric (MIP) resin**.

This research has a **remarkable potential** to not only extend the contribution of the dairy industry into the food and supplement market but also help the dairy industry to further **promote sustainability**.



# **Project: Sequestration of Bovine Milk Oligosaccharide: A Novel Value-Added Food Ingredient**

## **Objective:**

The objective of this study is to develop a novel and cost-effective technique to extract and isolate bovine milk oligosaccharides (BMOs) from whey permeate using specially molecularly imprinted polymeric (MIP) resin.

**PI:** Alireza Abbaspourrad

**Time:** January 1, 2021 - December 31, 2021 (Year 1 of 2 Years)

**Requested Budget (Ph.D. student and technician salary):** \$109,740



**Thank you**

