



# SOLVING THE BIG CHALLENGES

By Alice Manning Touchette

## **Professor E. Allen Foegeding on Food, Cross-Discipline Research and Mentoring**

How are we going to feed the world in 2050?

That has been on the mind of Professor E. Allen Foegeding for several decades and is one driver of his work in food science. As a specialist in food chemistry and the sensory experience of food texture, Foegeding retired in June 2019 after a 37-year career at NC State in the Department of Food, Bioprocessing and Nutrition Sciences.

"The world population has doubled since 1972," said Foegeding. "We need to think about holistic solutions for food that focus on health, nutrition, sustainability, affordability and cultural adaptation."

Foegeding studies how the senses perceive food structures, important elements when developing new products for consumption.

"We can be sharing the same meal and your brain is saying, 'This is the best meal I've had in my life,' and I'm thinking 'I can't stand this, I don't want another bite,'" said Foegeding. "That's the challenge of food. I try to understand how molecules come together to form the structures of food and what components provide the sensory properties—specifically texture. For example, when you bite into a perfectly crisp apple, what's the food's structure that gives it that quality opposed to the mealy apple that you don't like."

### ***Research that Benefits Society***

To tackle one element of texture, Foegeding worked with the Southeast Dairy Foods Research Center (SDFRC) at NC State — a collection of scientists who work together to study, among other priorities, milk and whey ingredient functionality, thermal and biological processing, sensory properties of cheese and dairy ingredients, dairy food safety, and microbial technologies for starter cultures and probiotics. Funded by Dairy Management Inc. through the National Dairy Council, Foegeding lauds the SDFRC for providing research funds to develop great ideas.

With support from SDFRC, Foegeding studied how to use a by-product of cheese making to generate a functional source of protein.

“Whey proteins are the poster child for sustainability,” said Foegeding. Instead of discarding the whey, Foegeding and his team learned how to utilize it for sports beverages, bars and a range of food applications.

“Whey is a highly nutritious form of protein, and I studied how it could function so that we could significantly increase the protein content of a product and have it remain stable on a shelf without separating or gelling,” he explained.

His expertise in this area led him to work with scientists from around the globe. Following a sabbatical in 1995-96 at New Zealand Dairy Research Institute, he worked with Fonterra, a global dairy company and the world’s largest dairy exporter. Fonterra organized the Transforming the Dairy Value Chain (TDVC) Primary Growth Partnership program, a seven-year, \$170 million investment for innovation. The TDVC combined experts from industry, government and academia “to enable the creation of new dairy products, increase on-farm productivity, reduce environmental impacts, and improve agricultural education.”

For one week in each of the seven years, Foegeding served as an expert in food chemistry to advise on texture and food structure and lead workshops for scientists and researchers.

“Industry, academic, government partnership is always a compromise,” explained Foegeding. “But the overall effort produced a greater output than anyone could have accomplished alone.”

The project resulted in expanded dairy-related technology, and for the academics, providing insight for numerous publications.

“Food scientists want to see our work benefit society, otherwise it’s useless,” said Foegeding.

Toward this ambition, Foegeding authored more than 200 scholarly articles, working with scientists and researchers all

over the world, including Erik van der Linden, professor of physics and physical chemistry of foods at Wageningen University in the Netherlands. The two scientists co-authored a chapter entitled “Gels: Principles, Models and Applications to Proteins” in the book *Modern Biopolymer Science* (Kasapis, Norton and Ubbink, eds. 2009), blending their expertise in physics and food science related to protein gels.

Professor van der Linden also described a visionary article the two published in *Trends in Food Science and Technology* that gave their “systematical approach for addressing the global challenges of agriculture and food systems.” Their work helped enable stakeholders and policymakers to better anticipate and respond to the emerging developments in the world related to food.

“He brought out the best in me and has become one of my best friends over the years,” said van der Linden. “His strength is his sincere interest in connecting to other people.”

That sentiment was echoed by another of Foegeding’s research partners Chis Vinyard, an evolutionary biologist and professor of anatomy at Northwest Ohio Medical University.

In 2019, the two researchers collaborated on a journal article about polysaccharide gels, how they are chewed and their texture.

“With food, we’re making material to fall apart with grace, meaning that it breaks down along a specific path during chewing that produces enjoyment,” explained Foegeding. “I wanted to study oral processing—jaw movement, muscle activity—to understand the process that occurs when people eat foods.”

“I’m an evolutionary biologist that studies feeding—I don’t fit in the food science world—but I had the oral processing and physiology background Allen was interested in,” said Vinyard. “He thinks very broadly trying to understand how the whole system works, not just the one part that he was trained in. The way he looked at how food was processed really moved the field forward.”

“I integrate it all so we understand how to make a food structure deliver certain textural properties to create desirable foods from different material sources,” said Foegeding. This insight is useful

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when applied to making gluten-free products, for example, with the goal of replacing gluten with a food material that provides the same level of quality.

### ***Editor-in-Chief***

Foegeding doesn't just write for scientific journals, he's also editor-in-chief of The Institute of Food Technology's three monthly journals: *Journal of Food Science*, *Comprehensive Reviews in Food Science and Food Safety* and *Journal of Food Science Education*. Holding the position since 2012, Foegeding said editing the peer-reviewed journals, which are accessible behind a paywall, has made him consider the pros and cons of open access.

"When it comes to the debate on how scientific work is going to be made available, I think we need a way to make it accessible, especially when it's vetted by editors and reviewers," said Foegeding.

With the growing number of self-publishers and self-proclaimed experts on the internet, it is vital to have access to current, accurate information and educate consumers how to decipher what information is reliable.

"We're now teaching how to sort through the information to find what's factual. We're educating students about what makes a valid source," said Foegeding.

**"The people I interacted with and influenced — my students and colleagues — are my real legacy. They are my future."**