David M. Barbano Recognition Symposium

11 Introductory remarks on a biographical presentation of our honoree, Professor David Barbano. R. Jimenez-Flores*, The Ohio State University, Columbus, OH.

David Barbano is a professor in the Department of Food Science at Cornell University. Dave received his BS in biology/food science in 1970 at Cornell University and his MS/PhD in food science from Cornell (MS in 1973 and PhD in 1976). He joined the Department of Food Science as an assistant professor in 1980. In 1988, he became the director of the Northeast Dairy Foods Research Center. He is a member of ADSA, IFT, IDFA, AOACI, IAMFES, IDF, and NYS Association of Milk and Food Sanitarians. Dave is past president of the ADSA, and a fellow of ADSA and the Association of Official Analytical Chemists. Dave received the Harvey Wiley award of AOAC in 2010. Dave is on numerous International Dairy Federation committees for milk analysis. The National Cheese Institute (NCI) named him the 2018 NCI Laureate. The award recognizes individuals who have made significant long-term contributions to the development and growth of the cheese industry. The speakers in this special symposium are distinguished former students of Dr. Barbano; each exemplifies a different scientific and technological area of his numerous contributions to dairy science.

12 Milk composition testing: From dairy farmer payment to dairy processor efficiency to dairy farm and animal diagnostics. L. Metzger*, South Dakota State University, Brookings, SD.

A cornerstone of Dr. Barbano’s research program is the development and application of analysis methods for milk and dairy products. A major portion of this work has focused on rapid milk component testing using mid infrared analysis. Mid infrared milk analysis is the critical technology that allowed a transition from producer payment based on milk weight and fat to payment based on multiple components (fat, protein, and other solids). The successful application of mid infrared milk analysis for producer payment as well as dairy herd improvement testing would not have been possible without the detailed and systematically research conducted by Dr. Barbano. The central theme of this research was that mid infrared milk analyzers needed to be accurately calibrated to provide useful information. This research involved numerous facets over a 30-year period including: ensuring accuracy of primary methods, identification of factors influencing mid infrared performance, and development of calibrations standards. The financial implications of this work are enormous and ensure that both producers and processors are fairly compensated for the composition of the milk they buy/sell. Subsequently, Dr Barbano facilitated the application of mid infrared analysis to improve processor efficiency during the manufacture of cheese and concentrated milk products. Finally, in the last several years, Dr. Barbano discovered that some of the factors which influence calibration of mid infrared milk analyzer could be utilized to diagnose rumen health and productivity of dairy cattle. This information has led to a new area of research and has returned him full circle back to the farm.

Key Words: mid infrared milk analyzers, milk composition, analysis methods

13 The Mozzarella/pasta filata years: From pizza cheese to traditional Sicilian Ragusano. J. Yun1 and P. Kindstedt*2, 1Parmlat Canada, Toronto, ON, Canada, 2University of Vermont, Burlington, VT.

In the decades that followed the end of World War II, Mozzarella cheesemaking in the United States grew steadily as the pizza restaurant establishment an ever-expanding footprint across America and beyond. By the 1980s, Mozzarella cheesemaking had attained unprecedented scales of production, yet even as new cheese plants were coming on line across the country and production capacities were reaching dizzying levels, the scientific and technological knowledge base needed to standardize production schedules, control product quality, and maximize cheese yields and efficiency lagged far behind the industry needs. It was within this historical context that David Barbano turned his systematic and meticulous research program toward the needs of the Mozzarella cheese industry during the 1980s. By the early 1990s, Barbano was leading a team of graduate students, post-docs, technical staff, and collaborators in a systematic evaluation of every step in the Mozzarella cheesemaking process. The end product of these studies was nothing less than the transformation of what had been (to an astonishing degree) a poorly understood “black box” process into a precisely controlled make procedure that lent itself to precision tailoring of cheese functionality, tight control over manufacturing schedules and efficiency, and maximization of cheese yields. Barbano’s international collaborators also included research scientists from Italy, where Mozzarella originated. Working with them, Barbano led a systematic evaluation of the scientific and technological aspects of Ragusano cheese, a very traditional PDO pasta filata cheese from Sicily. In the process, Barbano’s team demonstrated a new approach to traditional artisanal practices that merged both the art and science of cheesemaking, in effect combining the best of both worlds, toward the goal of sustaining traditional cheesemakers and the working landscapes that they support. Throughout studies, Barbano’s research led to innovations in cheesemaking technology (such as improved salting methods, preacidification treatments and strategies to improve low-fat Mozzarella functionality), and new analytical methods to evaluate product functionality, that have revolutionized the Mozzarella industry worldwide.

Key Words: Mozzarella, cheese, pasta filata

14 The milk filtration revolution: Pioneering “milk refining.” B. Nelson*, Daisy Brand, Dallas, TX.

David Barbano’s extensive milk separation experience, through both cheesemaking and filtration, contributed to the development of a system that directs components to uses that maximize milk’s value: “milk refining.” During the early years of cross-flow filtration, the dairy industry used reverse osmosis and ultrafiltration (UF) to reduce transportation costs and improve plant throughput. Additionally, capturing proteins from whey was increasing in popularity. Microfiltration (MF) was key to the milk-refining concept because serum proteins no longer went through the cheesemaking process to be separated from casein. To realize the conceivable benefits of filtration, the dairy industry needed to understand changes to product characteristics, how to efficiently operate equipment, economic benefits, changes to analytical measurements, and other dimensions of this burgeoning unit operation. Barbano and his team delivered. They quantified milk component recoveries and cheese yield and determined aging characteristics of cheeses made from retentates. One example of the practical nuggets found throughout Barbano’s research is the change from a pressure-regulating valve with a high pressure drop to a small-diameter pipe that gradually reduces pressure. This pragmatic solution alleviated the destruction of fat globules causing high levels of free fatty acids in cheese made from whole milk retentate.
Additionally, his group found that the coagulant used for cheese making, whey bleaching agents, and adsorbed proteins change UF flux. In the past 20 years, Barbano’s contribution to the body of knowledge of MF cannot be overstated. His research group has determined approaches to increase the efficiency of serum protein removal, determined critical and limiting protein levels and fluxes, compared ceramic and polymeric membrane materials, elucidated foulants, compared channel geometries and diameters, altered analytical methods for accurate measurements of filtration products, and pushed the boundaries of operating conditions. Along the way he used filtration to improve calibration samples for milk testing and showed how to produce products with extended shelf life and diverse attributes. A revolution indeed!

**Key Words:** filtration