

Minutes of NC-1023, USDA Multistate Project Meeting
December 3-5
Washington State University
Pullman, WA

Yanyun Zhao (Chair)

Gustavo V. Barbosa-Cánovas (Vice-Chair)

Gail Bornhorst (Secretary)

David Jackson (Administrative Advisor)

Attendees

Akinbode Adedeji, Balunkeswar (Balu) Nayak, David Jackson, Gail Bornhorst, Gustavo V. Barbosa-Cánovas, Kirk Dolan, Pawan Takhar, Roger Ruan, Swamy Anantheswaran, Yanyun Zhao, Mukund V. Karwe, Helen Joyner, Silvana Martini, Rohan Tikekar, Dharmendra Mishra, Jeanne Gleason, Jen-Yi Huang, Gonul Kaltenuc, Bala Balasubramaniam, Bongkosh Vardhanabhuti, Deepti Salvi, Dennis Heldman, Soojin Jun, Fanbin Kong, Ilce Medina Meza, Girish Ganjyal, Pamela Martinez, Kasiviswanathan (Muthu) Muthukumarappan

Sun, Dec 3, 2017

7:00 – 9:00 PM - Mixer/Dinner was held at Sangria Grille, Moscow, ID

Monday, Dec. 4, 2017

8:00 – 9:00 am – Attendees registered at PACCAR building

9:00 am - Laura Lavine, Associate Director of Agri. Research Center from WSU

Welcomed attendees. Encouraged participants to show impacts of the graph (ex: landgrantsimpacts.org) – said she would follow up with Gustavo about how to make sure all project impacts are being recorded. Talked about WSU - ~30,000 students, 12 colleges (just started medical school, previously 11 colleges), \$334 million in total expenditures, and \$3.4 billion in economic impact. Discussed how there are 5 campuses in the WSU system (Pullman is the main campus); opened new campus in Everett with agriculture and engineering. Currently the college is Agricultural, Human, and Natural Resource Sciences. Discussed the importance of agriculture to Washington State. 13% of WA economy is agriculture. Nationwide leader in apples, sweet cherries, pears, hops, carrots, and 5 more commodities. Discussed that there are 4 Research and Extension centers across the state and >10,000 acres of farms across the state. WSU is in the top 6 universities in USDA-NIFA funds in the country. Discussed a new apple variety developed at WSU called Cosmic Crisp. Highlighted the Center of Excellence for Food Safety involved with

the MATS/MAPS in Food Engineering. Thanked Gustavo and organizers for planning meeting; thanked attendees for coming to campus.

9:15 am Dr. Gustavo Barbosa-Cánovas,

Initiated meeting with opening comments. Gustavo thanked attendees for coming to Pullman; said that he has been wanting to host the meeting for many years. Welcomed attendees to campus on behalf of the other food engineering faculty (J. Tang and S. Sablani), who are both out of town. Mentioned that the meeting planning was completed as a team between Yanyun and Gail with himself. Thanked other organizers. Discussed that one objective of the organizing committee was to keep the registration fee low – said that J. Tang will cover the difference if there are extra expenses because they want to offer the best meeting possible. Said that he wanted the meeting to be two full days, to not have attendees only come and leave; this meeting is the only time for food engineers to come together every year (in addition to CoFE, which is typically every 2 years); is hoping that attendees will put this meeting as a top priority so we can all interact as much as possible. Gave some highlights of the program with activities that are planned for attendees. Thanked Todd Vanek from WSU Conference Management and graduate students from WSU for helping with the planning of the meeting.

9:27 am - Dr. Yanyun Zhao

Thank host station (Gustavo, Todd, graduate students). Mentioned 2 attendees that were unable to make it to the meeting (Ashim Datta from Cornell and Ozan Cifci from Nebraska) due to last minute family emergencies. Thanked attendees for coming. Discussed logistics of meeting.

9:30 am - Introductions

All meeting participants gave their names and affiliations

9:40 am - David Jackson, University of Nebraska, NC-1023 advisor gave Washington, DC Update

Dr. Hongda Chen was not able to attend due to participation in another meeting. He advised that members participate in professional societies so that they can leverage their participation when applying for grants. He encouraged members to apply to Dr. Chen's programs at USDA.

David gave the NC-1023 Administrator Update

We are already in our 3rd year of the project – this is the mid-term review year, which he needs to write by 12/15/17. Discussed the review criteria, which include: “Describe result ssince the project was last approved; compare actual accomplishments with the objectives in the project outline; reasons should be given if project objectives were not met; is there evidence of the interdependence among project participants and with other projects/agencies? List relevant examples. How well is the technical committee working together? Document any linkages. Is there evidence of delivering accomplishments to peer groups, stakeholders, clientele, and other multistate activities? Rate this project on linkages. Has outside funding been obtained from other federal and state agencies or the private sector by the technical committee to support project activities? Rate this project on its accomplishments.” It is *crucial* that the stations work together and articulate the accomplishments of the group. It is not as important to have individual accomplishments, but it is important that we describe them as how we are working together. We need to synthesize all of the accomplishments of the group and how they work to meet the objectives. Some examples may be related to multimedia, teaching, and others. Stated outputs that we described in the project:

- New analytical technical and a platform and arrangements for instrument and data sharing among collaborative researchers
- Novel and sustainable processing and preservation technologies
- New mathematical models for transport processes
- Educational activities

9:50 am - Yanyun opened the floor for questions to David Jackson

- Denny suggested that reports from Ad Hoc committees could be used to show collaborative synergy between members
- David Jackson recommended that the group look at each goal from the project and synthesize information as to what the members have done to achieve the project goals (not focusing on individual station achievements)
- Bala commented that Dr. Hongda Chen wanted to convey that Food Manufacturing Technologies is a new program in USDA (focusing on Food Engineering related topics). Dr. Chen encouraged all members of the committee to actively submit proposals to this topical area.

- Balu asked what to do if the chair of your committee isn't present? Suggestion by Gustavo that each subcommittee should have a co-chair in case the chair is not present.

9:55 am - Steering Committee Report

Lester Wilson cannot attend the meeting. He sent a message to emphasize collaboration in all reports. Pawan said he does not have any additional comments. Denny emphasized the same points as Lester, and mentioned it would be a good idea to re-vitalize the steering committee and select new members. Stressed the importance of Ad hoc Committees – as this is where quite a bit of actual collaboration happens. Told members that they should expect that they actually need to contribute to the ad hoc committees. Encouraged members who have been involved for >5 years to get involved with the steering committee.

9:59 am – Yanyun Zhao asked members to review minutes from 2016 (they received by email the previous week)

Swamy moves for the minutes (pending spell check) be approved

Mukund seconded the motion

Soojin asked whether all of the discussion needed to be included in the minutes.

Swamy said that the administrative committee could decide how much detail to include in the minutes, and it was ok to have more details than less.

Yanyun said that there were no specific formatting requirements.

Girish said that although he was not at the meeting, the details were helpful and made it seem like he was at the meeting.

Balu appreciated the level of detail.

Bala suggested that we send out the minutes as soon as possible to the group to help facilitate collaboration and to get timely feedback.

Jeanne suggested using a google document.

Minutes were approved after discussion.

10:10 – 10:25 Coffee Break

10:30 Meeting Reconvened

Station Reports

It was agreed that each report should be 15 minutes/station. The reports will be presented with newer members going first. The members that it is their first time were given first priority, the members that were here for their second year were given second priority (order of 7 station reports).

It was agreed that the station reports should be shared with the members. Gail will set up a Google Drive to share the files.

10:35 am - Girish Ganjyal (Gustavo V. Barbosa-Cánovas), Washington State University Station

First time member to the meeting. Discussed some of his background and part of his extension program (assistance with broader industry issues, assistance to individual companies, and training program). For research, he said that they look at physicochemical changes in raw materials, processing technologies (extrusion, frying, and direct steam injection), and microstructure analysis (micro-CT and x-ray density profiling). Swamy asked for an example of some projects. Girish discussed that they are looking at both proteins and wood fiber so they are more accessible to enzymes. Focused on his extrusion program – have twin-screw extruder in the lab (with subcritical CO₂ injection) – they work on pulses, pomace, waxy wheat, quinoa, wood fiber, textured vegetable protein. They started doing short courses in 2015, and provide assistance to industry and commodity groups (mainly pulses and wheat), as well as national and international groups. Mentioned that they have several different types of extruders in the lab, many of which were donated by industry.

Jeanne Gleason asked about how information is disseminated to the industry, and whether the food processing industry looks to extension to solve problems.

Girish discussed a bit about extension history, and noted that the industry does come to extension specialists for help with specific needs and issues.

10:50 am - Bongkosh (Jeab) Vardhanabhuti, University of Missouri

Discussed some information about Univ. of Missouri (6 core faculty). Background – from Thailand, PhD from NC State University. Her research program focuses integrating physical chemistry and material science principles to develop fundamental knowledge that can be applied to create novel food ingredients, improve functional properties, and design foods with enhanced health benefits. Has worked to understand protein-polysaccharide interactions (at $\text{pH} > \text{PI}$ of protein); have looked at solubility, stability, gelation, interfacial properties, foaming properties, emulsion quality. Also looking into the effect of food forms on satiety, formation of intragastric gel and its effect on satiety and delayed postprandial glucose release. One study they have done is looking at intragastric gels between protein and fibers (soy protein with alginate) – optimized conditions to get strong gel in vitro, and then looked at sucrose release rate, which was confirmed using human studies. The objective was to develop a soy protein-based drink to delay glucose response.

11:00 am - Kirk Dolan/Ilce Medina Meza, Michigan State University

Ilce Medina Meza discussed her new research program – “Health Engineering Laboratory” (risk assessment/modeling, natural products/drug discovery, lipidomics/processomics). Their focus is in human health, modeling, and food processing. They are utilizing several types of approaches – “processomics”, by characterizing food using multiple types of analytical approaches, and understand the relationship between biomarkers on human health. Specifically, they are looking at oxidation and model systems for food oxidation (using liposomes, LDL, and human endothelial cell lines). Currently they are looking at: (1) the impact of low seasonal temperature and leaf removal on grape vine phenolic compounds and its implication for red wine quality in Michigan, (2) assessment of exposure and risk associated with cholesterol oxidation products in food using dietary intake modeling, and (3) production of phytochemicals from *Spirulina platensis* cultivated with food industry by-products. Their group is especially interested in the impact of traditional and novel processing technologies on functionality of biomolecules and to use these technologies on the assisted extraction of bioactive compounds. In addition, they are interested in lipidomics, such as the mechanism of oxidation, and metabolomics. Asked members for potential collaborations, because research area is multidisciplinary.

11:12 am - Fanbin Kong, University of Georgia

Gave introduction of his background (is a representative, but has never attended the meeting). Discussed his research interests – radiofrequency heating for pasteurization, in vitro modeling, bioaccessibility and bioavailability. Specifically talked about his collaboration with Juming Tang (WSU) on a project on developing radio frequency heating for pasteurizing food powders, including dried vegetable powder, flours, and spices. He sent students to WSU and some students from WSU came to UGA for collaborative experiments. They have several publications together. Discussed collaborative research with Jeyam Subbiah (UNL) on measurement of dielectric properties of spices/peanut butter. Samples have been prepared at UNL and measured in Nebraska, then sent to Georgia for measurement with other equipment for comparison. They are preparing joint publications with these results. Discussed collaboration with Missouri on behavior of nanocellulose in the gastrointestinal tract. Have collaborated with the industry (Bio-Cat), to understand the efficacy of enzymes on food digestibility.

11:28 am - Dharmendra Mishra/Jen-Yi Huang, Purdue University

Mishra discussed his background (8 years in industry, started 2 years ago at Purdue), and gave an overview of his research program. His research and extension program focuses on dynamic validation technology to provide the food industry with tools that they can use in development of new processes. He is working on smart sensors (including IoT) to solve specific needs of the industry, including smart sensors. His goals are to integrate sensors with process modeling (using inverse problem solving) and parameter estimation to develop tools that help the food industry. Discussed some of the extension courses that are given at Purdue, including Better Process Control School, Aseptic Processing Workshop, Validation Workshop, FDA Inspector Training, New Entrepreneurs Programs, and Advancement in Food Manufacturing courses. Discussed collaboration with Michigan State University (Kirk Dolan); just received funding from NSF STTR Phase I grant on a project related to rapid estimation of thermal properties at high temperatures. Discussed a publication that was a result of the collaboration with MSU on using scaled sensitivity coefficient relations for parameter estimation.

11:46 am - Jen-Yi Huang, Purdue University

Is in his second year at Purdue, discussed some of his research program, including green cleaning, which entails optimization of the cleaning efficiency of liquid jet impingement, innovative clean-in-place technology with micro-bubbles. Also working on fractionation of bioactive peptides from rainbow trout by-products, and recovery of acetic acid in lignocellulosic bioethanol production. He is also interested in conducting life cycle assessment, including evaluation of the end-point effects of preservation techniques. In addition, he wants to define a nutritionally and environmentally healthy omega-3 fatty acid for diets (e.g. comparing between salmon and eggs enriched with omega-3). He also works on comparison of environmental footprint of alternative diets for animal production, and comparison of fresh imported and frozen domestic organic blueberries consumed in Indiana. Asked for collaborations in conducting life cycle assessments for food and food processing.

11:59 – Break for Lunch

12:45 pm – Group photo

1:00 – 3:15 pm – Food Engineering Lab Facility Tour

3:15 pm – Business Meeting

Gustavo Barbosa – Announced that Girish will give a lab tour after the meeting concludes today (25-30 min) if anyone is interested. He suggested that we should increase the registration fee to cover all meeting expenses in the future.

Todd Vanek – Gave directions to the meeting site tomorrow at the Global Animal Health Building for tomorrow's meeting.

3:20 pm - Yanyun Zhao – Discussed logistics for the rest of the afternoon

Last year – Elected Rohan Tikekar for 2018 Secretary

Confirmed 2018 meeting will be in Maine (Balu will host). Dates will be decided later in the year – right now, the tentative dates may be during the 2nd or 3rd week of October.

Discussed 2019 meeting location. In 2016, had a discussion that meeting may be in New Mexico (NMSU). Confirmed 2019 meeting in New Mexico.

Discussed 2020 meeting in Illinois.

Discussed election of steering committee members. Wanted to have members with >5 years of active service to the committee.

Denny discussed that the steering committee is supposed to look at the direction of the NC1023 committee and really look to the future. Executive committee is meant to look at the present (meeting planning, etc.), while steering committee looks to the future.

Members discussed that you must have gone through the process of serving as Secretary, Vice Chair, and Chair before you can be elected to the steering committee (need some experience first). All agreed that members will discuss later tonight and will make nominations for elections tomorrow. General discussion on the process for how to get on the steering committee and clarity of the members. We need a written description of procedures for how to get on the steering committee (how to get on, what is necessary, number of years of service, etc.). While developing a list of committee procedures, perhaps develop a list of nominees as well. Denny, Gustavo, Roger, Denny, Bala, and Gail volunteered to discuss this later in the evening to prepare a document for Tuesday's meeting.

3:42 pm – Gonul Kaltenuc –Society of Food Engineering

At the CoFE meeting in 2016, attendees decided to form the Society of Food Engineering. Sudhir Sastry has been elected as the president of the new society. All attendees to CoFE2016 are currently members. They have formed a transition team of academic and industry members (14 people) who are currently reviewing constitution and by-laws for the society. These are posted on the CoFE2016 website. Society is registered as a non-profit organization; hired lawyer to review constitution and by-laws. Also set up Executive Committee (4 members). A “caretaker committee” is going to govern the society until elections can be held. There is a society website being developed (a professional developer has been hired). Once the website is set up, they plan to hold elections for the Executive committee members. The Society of Food Engineering will host the CoFE meeting – it will be 2018 in Minnesota (Minneapolis – September 9-12, 2018). This society

has been formed to be the voice of food engineers both in academic and industry. Gonul will pass around a list of possible sessions for members to include potential sessions for the 2018 meeting, and asking for volunteers for organizing potential sessions.

4:00 pm – Station Reports (continued)

4:00 pm - Silvana Martini, Utah State University

Discussed her research in lipids and using ultrasound as a new or additional processing condition to induce structure in a lipid that has increased health properties. In the past year, they evaluated the effect of ultrasound parameters (20 kHz vs. 40 kHz) on lipid quality parameters. They were able to use ultrasound to change the crystalline structure of lipids. Used ultrasound to decrease oil migration with fats, measured rate of migration of oil. They found that samples that were sonicated had reduction of 60% of oil migration. Ultrasound was more effective in samples that had lower saturated lipids. Third project that they worked on was related to how does ultrasound efficiency change when the chemical composition of the lipid is changed.

4:18 pm - Mukund Karwe/Deepti Salvi, Rutgers University

Deepti Salvi presenting for Rutgers University. Overview of Rutgers University food engineering projects including: thermal and non-thermal processing (high pressure processing, extrusion), food safety and quality (UV processing, plasma processing), and modeling (digestion in the human small intestine, bacterial attachment/detachment on fresh produce). Described project of plasma activated water (obtained when water is exposed to plasma discharge directly or indirectly – pH of the water changes from 6.5 to 3.1). They are trying to study whether the change in pH or the effect of reactive species is responsible for microbial inactivation. The idea is to use this type of water in washing fresh produce. To test this, they used different types of produce with varying surface roughness (determined by SEM) – produce was washed with plasma activated water compared to water (control), buffer with the same pH as plasma activated water, and plasma activated buffer. They found that the highest microbial inactivation was from the plasma inactivated buffer, which had reactive species and a low pH, which resulted in higher inactivation. Didn't find a large effect of surface roughness on the microbial inactivation. When they measured microbial population in washing water, plasma activated water and plasma activated buffer had

significantly lower population compared to normal wash water and buffer. Asked for any possible collaborations with other members. Discussed a second project on modeling bacterial inactivation during produce washing (collaboration with UC Davis and Drexel University). Experiments were conducted at UC Davis and Rutgers is working on modeling bacterial detachment from the experimental data. Quantifying bacterial detachment as a function of shear rate in a rotating system. Developing a Comsol model to predict microbial detachment. Briefly discussed third area, examining how viscosity impacts food glycemic index. They have access to the TIM-1 model and now the SHIME model. The hypothesis is that a lower viscosity will have higher diffusion rate and higher glycemic index, while higher viscosity meals will have lower diffusion rate and lower glycemic index.

4:38 pm - Helen Joyner, University of Idaho

Discussed lab overall research goal – looking at structure, functional, texture relationship using mechanical and frictional behaviors. Uses texture analyzer, DSC/TGA, three rheometers (DHR3, MCR302, MCR702) – with a pressure cell (up to 150 MPa), tribology attachments, and a microscopy attachment. Also discussed some of her education research including curriculum assessment, concept mapping and student learning, active learning strategies, development of interactive problem-solving modules, and development of virtual reality teaching modules. Discussed some of her collaboration with industry including: starch texture maps, reduction of salad dressing spoilage using dairy proteins, cheese rheology, and contract rheological testing. Discussed multistate collaborations including UHT milk astringency collaboration with NC State, solid fat wear with Utah (with Silvana Martini), extrusion and pressure cell rheology (with WSU – Girish Ganjyal), yogurt structure-function texture relationships (with NC State/Missouri – Chris Daubert), and protein bar and cheese wear. In the future, they are planning to continue research on wear behavior of foods, development of wear models for foods, understanding rheological behaviors under pressure, developing best practices for promoting and assessing learning. Looking for collaborations with other members – wants to help out with rheological property testing.

4:50 pm - Akinbode Adedeji, University of Kentucky

Described his research focus – noninvasive methods for food quality and assessment and safety assurance (hyperspectral imaging; Vis-NIR spectroscopy, and acoustic emission) as well as grain

value addition (millet – hydrocolloid interaction for development of gluten free products and bourbon distilling waste (spent grains) characterization, fractionation, and incorporation as a source of dietary fiber in extruded products). Is working on a project to understand millet-hydrocolloid-starch interaction for development of gluten free bread (millet is gluten free). Worked to characterize different varieties of millet (proximate composition, amylose content). They are trying to develop relationships between different types of millet and bread viscoelastic properties. They found that waxy millet varieties showed differences in elastic and viscous moduli.

5:10 pm - Pawan Takhar, University of Illinois

Focusing on his research on hybrid mixture theory based modeling of ice crystal growth and decay in foods subjected to freeze thaw cycles. This is a collaboration with WSU (Shyam Sablai). WSU is doing the experimental work, and IL is working on the modeling portion of the project. They are trying to understand the microstructural changes during freeze-thaw cycles and developing models of the process. Developed 3-D image analysis procedure. Also developed a three-scale mass balance equation to describe the process. Typically this type of model has been used in other disciplines, but not necessarily in food processing. Also modeling the solute concentration changes. Working in collaboration with Ohio State (Gonul Kaletunc) to model the release of purple corn and blueberry anthocyanins from food systems – they have joint publications from this project. Collaborated with Michigan State University (Kirk Dolan) for inverse estimation of model parameters and worked together on pilot plant renovations.

5:21 pm - Rohan Tikekar, University of Maryland

Discussing some of the research in his lab. One recent project was working on understanding the stability of encapsulants on solid lipid nanoparticles, nanostructured lipid carriers, and emulsions. In this project, they are trying to understand the best encapsulation system to prevent oxidative degradation of encapsulants looking at various types of system. Worked with collaborators to conduct a Monte Carlo simulation of diffusion of oxidants throughout system to understand the effect of solid lipid fraction on the number and concentration of oxidant diffused within a nanoparticle. Discussed other work in the area of synergistic interaction between food grade ingredients and light for improved fresh produce safety and washing. Currently working with compounds that can be activated by light, in collaboration with other, including UC Davis (Nitin).

Also have another project looking at the synergistic effect of sanitizers with ultrasound for antimicrobial properties (in collaboration with UC Davis). Have looked at a variety of different compounds with varying mechanisms of action.

5:33 pm – Yanyun Zhao

Gave announcements for the schedule for Tuesday. Vans will leave at 7:45 am from hotel to arrive on time tomorrow. Reminded volunteers for Steering Committee discussion to sit together at dinner tonight. Still have 8 station reports for tomorrow.

5:36 pm Meeting Adjourned

6:30-9:00 pm

Dinner at Banyan's on the Ridge Golf Club, with Ad Hoc Committee Meetings following dinner

Tuesday, October 18th

7:30 - 8:00 am - Breakfast at hotel

8:20 am – Yanyun Zhao began meeting

Adhoc Committee Reports

1. Nonthermal processing – Bala Balasubramaniam

During meeting, discussed research in each station and got to know active research of new members. They agreed on 2 action items: (1) prepare review paper on current trends and future research needs in nonthermal technologies and related topics; (2) tried to identify a certain problem that could be solved by nonthermal technologies and use complementary technologies that are available at different stations – their goal is to submit a proposal to USDA or NSF. They elected Rohan Tikekar as the Vice Chair. Planned to have quarterly teleconferences to follow up prior to next meeting.

2. Extraction of Bioactive Compounds – Yanyun Zhao

Held election for chair and co-chair. Gonul Kaletunc is the chair, Ozan Ciftci is the co-chair. Balu is responsible for organizing conference calls each quarter by Zoom. They are going to focus on anthocyanin stabilization during storage. They are going to focus on

cherries, blueberries, and black rice. These were chosen as they have varying anthocyanin composition. They will share samples, and each station will extract compounds using their own extraction methods and encapsulation methods. Their initial goal is to try to publish a paper on this work, and potentially a proposal in the future (USDA?). They are also developing a Google Doc with each station to add their respective extraction and encapsulation method.

3. Mathematical Modeling – Dharmendra Mishra

Only 2-3 members present yesterday. They discussed some previous initiatives and how they could continue forward with this in the future. They did not come up with any action items, but are planning to meet in the future to develop action items. It was suggested that they contact Ashim Datta for follow up, as he was not able to attend the meeting.

4. Teaching Food Engineering to Engineers – Kirk Dolan

The group history is involved in developing food engineering education

- (1) Provide assistance to faculty who teach undergraduate engineers
- (2) Promote development

Needs: Few food engineering courses exist in Biosystems Engineering departments

Actionable items: (1) post syllabi on Google Docs; (2) discuss issue of decline in Food Engineering in the new CoFE meeting.

5. Physical Properties – Helen Joyner

Group met last night with 5 members. They had talked about some smaller collaborative projects, but then looked to a larger collaboration with the members. They decided to work on a review of how to characterize foods with varying structure (ranging from fluid – solid). Their goals are to have a draft paper by the next meeting, and they plan to meet during the next year. As the members have overlapping capabilities, they are planning to test the same products (using the same methods) and compare results.

6. Nanotechnology – Balu Nayak

Many members were missing – discussed with Soojin Jun. Balu and Soojin planned to look at the next USDA proposal call. They would like to focus on the packaging and delivery and how it interacts with the food. Balu will follow up with Graciela Padua on past committee action items and future plans.

There was a general consensus of the group was that the Chair of each committee will be accountable for the committee outputs. It was recommended that the committees meeting at CoFE and/or IFT.

8:50 am – Secretary Elections

2019 Secretary - Kirk Dolan

8:51 am – Steering Committee Elections

To clarify the committees, there is the Executive Committee (Past Chair, Chair, Chair-Elect/Co-Chair, and Secretary), and then the Steering Committee. For the Steering Committee, there are 5 members. The idea is to have 2 current members that will remain on the committee and elect 3 new members. The term for each steering committee member will be 2 years, and members can only serve 2 consecutive terms. To be eligible to be on the Steering Committee, members must have been a Past Chair, and have been part of the group for at least 5 years. There were 7 eligible members, and 3 withdrew their names from consideration. The 4 members that were eligible for election were: Roger Ruan, Swamy Anantheswaran, Gonul Kaletunc, and Soojun Jun.

After the votes were counted, the final vote was as follows: Roger Ruan (13), Swamy Anantheswaran (13), Gonul Kaletunc (8), and Soojun Jun (7). As such, Roger, Swamy, and Gonul were elected as new members to the Steering Committee.

9:00 am – Roger Ruan CoFE Meeting Update

Roger Ruan discussed the planning for the CoFE Meeting in 2018 in Minneapolis, MN. They will have 3 sessions with invited speakers, a Nanotechnology workshop, and they are inviting proposals for plenary sessions and suggestions for other sessions. They are looking for new topics, as well as suggestions on how to engage with the food industry. They are planning three or more concurrent half day or day long workshops, and are also looking for suggestions, some of which could come from the Ad Hoc committees. They will have the opening mixer on Sunday (Sept. 9), social hour on Tuesday (Sept. 11) followed by the banquet on Tuesday. They are looking for industrial sponsors at varying levels. The conference will be also have the Nanotechnology in Food Manufacturing symposium (organized by Carmen Gomes and Eric McLamore and pending sponsorship by USDA-NIFA). This will occur on the first day of the conference and attendees will contribute to the rest of the CoFE18 meeting.

9:10 am - Station Reports Continue

9:10 am - Gail Bornhorst, University of California-Davis

Introduced the research program of Juliana de Moura Bell, who is new to the faculty (but could not attend meeting), which focuses on the influence of extraction and recovery methods on protein functionality. She is using both aqueous extraction processes as well as enzyme-assisted extraction processes along with isoelectric precipitation and membrane filtration. Their current work is focusing on almond meal protein extraction and recovery. Also discussed her research program focusing on food property changes during digestion. Showed information on their dynamic gastric model, which can be used to understand the physical and chemical aspects of food digestion, gave some examples of information that can be gathered using the dynamic model, including rate of protein/starch hydrolysis, gastric emptying of solids, and particle size reduction. Mentioned previous collaborations with other institutions (Purdue University and University of Birmingham UK), and solicited possibilities for collaboration with other NC-1023 members. Also mentioned new research on intragastric gelation (raft-forming gels) as another potential for collaboration with NC-1023 members. After presentation, members had a discussion about potential to send students between labs so they can learn from the different models and start additional research collaboration, especially in the area of food digestino. Rutgers agreed to follow up on possibilities for funding.

9:26 am - Soojin Jun, University of Hawaii

Discussed his research program – had a shift of topic several years ago to the freezing area. As water is diamagnetic and dipolar, supercooling is an option. During supercooling, eliminates the freezing point – possible for supercooled meat to be cut after supercooling as it has never had ice crystal formation (temperature at -5 to -10°C). Supercooled meat had similar characteristics to fresh meat in terms of texture, lipid oxidation, and other properties. The process has also been applied to pineapple and honey dew melon. They are looking at biopreservation (e.g. organ donation) as well as food storage. Looking for collaboration in terms of microbial activity, enzymatic activity, microstructure of meat (frozen vs. supercooled), and process scale up.

9:40 am - Balunkeswar (Balu) Nayak, University of Maine

Discussed some of his research areas, including: interventions for food allergenic protein safety (looking at lobster and shrimp as well as extraction and detection of allergenic proteins from processed foods); understanding the protein and food bioactive interactions at the nanoscale (developing encapsulation technology that is from natural products); trying to understand protein attachment or detachment to certain surfaces; and sustainable processing to retain phytonutrients in sea vegetables. For looking at sea vegetable processing, they are investigating drying processes including experimental results as well as modeling of the drying process. Discussed some activities in teaching, including using Maine Learning Assistants (undergraduate students who help with classes); these students are helping to better engage students in a class. Is involved in the Emerging Leaders group of IFT (along with Helen Joyner). Welcomed attendees for the next NC1023 meeting in Maine in 2018.

9:55 – 10:19 am - Break

10:19 am Jeanne Gleason, New Mexico State University (NMSU)

Presented about what they do regarding animations and scientific visualizations. They have done previous work developing visualizations of Norovirus. They developed a video to show the structure of Norovirus which was used in an introductory graduate course. They also developed illustrations on nonthermal processing to be used with industry. They have also developed virtual labs for training with processes such as testing and adjusting pH, controlling water activity, gram staining, and others. These virtual labs were meant to be a pre-lab experience for introductory students to get students an idea of how to do labs before actually going into a chemistry/microbiology lab. They have also developed educational games. They are currently looking at public perception of water reclamation for agricultural production. They are also working with collaborators in Florida to educate the public about citrus greening disease. They are also working on developing animations of chemistry to use as tools for college students. Welcomed attendees in 2019.

10:33 am - Roger Ruan, University of Minnesota

Discussed CAP USDA project on development of continuous intense pulsed light technology for non-thermal pasteurization of powdered foods. As part of this project, they have developed a system to use with powders. They had previously worked on systems with seeds and other materials, but new challenges arise with powders. As such, they decided to use a vibrating bed system to transport and process food powders with good results thus far. Now they are looking at different types of non-thermal systems (individually and in combination) for microbial inactivation, including plasma treatment. As part of this project, they are working in collaboration with food industry members, both in collaboration and as part of their project advisory board. They are also organizing symposia and industry visits, as well as incorporating findings in food.

10:53 am - Denny Heldman, The Ohio State University

Discussing collaborative work between the station members. One example is work from Sudhir Sastry on advancing the fundamental science and application of technologies to ensure food safety and improve quality of food products, including investigation of the effects of vacuum cooling on internalization of microorganisms into leafy greens. Another example is from Bala who is working on high pressure systems, including development of an isobaric cooling method for crystallization of model fats. This project is in collaboration with Farnaz Maleky, who is a lipid chemist, and Denny has collaborations with her also. Discussed some of his own work on cleaning, including investigation of fundamental parameters impacting the cleaning of food-contact surfaces. They are looking at new processes for cleaning that include reducing water and energy during the process. They have had a positive response from the food industry (they would like to reduce total cleaning time). The work is in collaboration with Peter Fryer and Serafim Bakalis at the University of Birmingham. Discussed additional work on food freezing and frozen food storage to describe the impact of the freezing process on quality changes during frozen food storage. Most of the work in this area is antiquated, and the storage data was based on 1 year of storage (compared to normal storage for 3-6 months). They are also working on utilization of waste streams from food manufacturing operations. They have looked at using advanced membrane technologies to separate out different components from waste streams that will result in water that can be discharged without a fee and potentially recover beneficial compounds. Also discussed project on food waste – trying to reduce food waste. Consumers do not understand the use by date and they are

conservative (and some consumers are confused about this). They are looking at putting time-temperature indicators on food packages to inform consumers as to when they actually need to use the food and when they should throw it away (may be able to reduce 50% of the 27% of food waste thrown away by consumers).

Suggestion to potentially add an Ad Hoc committee on Food Waste next year if sufficient interest.

11:16 am - Yanyun Zhao, Oregon State University

Discussed some major accomplishments from this station including: characterization of food materials (berries, hazelnut, surimi, and milk) and food processing byproducts (fish bones, fruit hazelnut shell, and wine grape pomace). They are also working in value-added food processing including laser assisted food processing to improve food quality, energy efficiency, and yield; development of characterization of fruit pomace application as functional food ingredients and packaging materials; and using RFID applications in the food industry for identifying and tracking food products. They are also working on development and characterization of cellulose nanomaterial based food coatings and films, and development of strategies to reduce cracking rate of hazelnuts during drying. Discussed more in detail about her work on using fruit and vegetable and wine grape pomace. Some new developments are their interest in the plant-based fiber, trying to understand the microstructure, types of fiber (and size), oil absorption, swelling ability, water holding capacity. These properties are important for use in different types of food processing or as food ingredients. They are also looking at wet milling to reduce the size of plant-based fibers (~500-900 nm). Also discussed packaging applications of apple, blueberry, and cranberry pomace film. They are working to replace some of the recycled newspaper fiber with fruit and vegetable pomace. Working as part of a safety committee on nanocellulose (nanofiber or nanocrystals). Their groups is researching the functionality of these products and their safety. They have been doing work on nanocellulose coating for fruit to extend shelf life. Also explored penetration of nanocellulose into food materials (as this is a consumer concern for this type of coatings). Thus far, they have found that nanocellulose does not penetrate more than 20 μm into the fruit peel. Discussed many potential applications for nanocellulose-based films. Discussed project on hazelnut drying – looking at physical property differences in different varieties, which may also be influenced by initial moisture content. Is looking for collaborations in the area of drying.

11:30 am – Gustavo thanked Yanyun and attendees; presented attendees with group photo and magnet from WSU.

11:35 am – Gustavo

Discussed logistics for the afternoon and potential seminars for Wednesday.

Thanked attendees for attending the meeting in Pullman. Stated that it was a collaborative effort between Gustavo, department chair Juming Tang, Yanyun, and Gail. Also involved the WSU conference management team.

Recapped the Steering Committee election procedures and other general organization. Discussed the Executive committee for the next year (2017 – 2018): Chair – Gustavo Barbosa; Chair Elect/Co-Chair – Gail Bornhorst; Secretary – Rohan Tikekar; Past Chair – Yanyun Zhao

The main roles of the executive committee are to provide support for a successful annual meeting and to follow up with Ad Hoc committees (make sure that there is work done throughout the year before the next meeting). The main role of the Steering Committee is to monitor that the NC1023 group is progressing towards the project objectives and to look to the future of the group. The chair of the Executive Committee will be the liaison to the Steering Committee. In the future, need to make sure that station reports are more about the station (and less personal), and to focus on how accomplishments are contributing to project objectives. Suggestion to have a template for station reports that can be used in future meetings (combine outputs with project objectives).

11:55 am – Yanyun Zhao adjourned the meeting. Thanked WSU team for organization.

12:00 pm – Lunch offered at the Global Animal Science Building

6:30 pm – Dinner for attendees still in Pullman at the Black Cypress

Update on Ad-Hoc committee membership

This is the composition of the six NC-1023 Ad-Hoc committees:

Ad-Hoc Committee Members

1. Nonthermal Processing

Bala Balasubramaniam (Chair)
Jen-Yi Huang
Silvana Martini
Rohan Tikekar (co-Chair)
Mukund Karwe
Gustavo Barbosa-Cánovas
Dharmendra Mishra
Jen-Yi Huang
Ilce Medina Meza

2. Extraction of Bioactive Components

Yanyun Zhou
Gonul Kaletunc (Chair)
Elena Castell-Perez
Roger Ruan
Jen-Yi Huang
Lester Wilson
Haibo Huang
Ozan Ciftci (co-Chair)
Balu Nayak
Gustavo Barbosa-Cánovas
Sam Chang
Ilce Medina Meza

3. Mathematical Modeling

Ashim Datta (Chair)
Akinbode Adedeji
Jeyam Subbiah
Pawan Takhar
Kirk Dolan
Dharmendra Mishra (co-Chair)
Mukund Karwe
Deepti Salvi

4. Teaching Food Engineering to Engineers

Kirk Dolan (Chair)
Akinbode Adedeji
Haibo Huang
Jeyam Subbiah
Mukund Karwe
Gonul Kaletunc
Fu-Hung Hsieh
Jeanne Gleason
Brad Marks
Yan (Susie) Liu
Rogers Ruan

5. Physical Properties

Rich Hartel (Chair)
Helen Joyner (co-Chair)
Lester Wilson
Ozan Ciftci
Gail Bornhorst
Balu Nayak
Rohan Tikekar
Gustavo Barbosa
Fanbin Kong
Silvana Martini
Bongkosh (Jeab) Vardhanabhuti

6. Nanotechnology

Graciela Padua (Chair)
Fernanda San Martin
Carmen Gomes
Soojin Jun
Ozan Ciftci
Silvana Martini
Gail Bornhorst
Balu Nayak
Yanyun Zhao
Youngsoo Lee
Fanbin Kong