**Minutes of NC-1023, USDA Multistate Project Meeting**

**October 16 to 18, 2016**

**Oregon State University**

**Corvallis, OR**

Pawan Takhar (Chair)

Yanyun Zhao (Vice-Chair)

Gustavo V. Barbosa-Cánovas (Secretary)

David Jackson (Administrative Advisor)

Lester Wilson (Steering Committee Chair)

**Attendees**

Akinbode Adedeji, Ashim Datta, Balunkeswar (Balu) Nayak, David Jackson, Elena Castell-Perez, Gail Bornhorst, Graciela Padua, Gustavo V. Barbosa-Cánovas, Jeyam Subbiah, Ozan Ciftci, Kirk Dolan, Lester Wilson, Pawan Takhar, Roger R. Ruan, Swamy Anantheswaran, Yanyun Zhao, Youngsoo Lee, Mukund V. Karwe, Helen Joyner, Silvana Martini, Rohan Tikekar, Rosana Moreira, Dharmendra Mishra, Jeanne Gleason, Haibo Huang, Jen-Yi Huang

**Sun, Oct 16, 2016**

5:00-6:00 PM - Attendees arrived and registered for the meeting.

6:00-7:30 PM - Mixer/Dinner was held at the Hilton Garden Inn, Corvallis, OR

7:30-9:00 PM – Ad hoc committee meetings in meeting rooms and hotel lobby

**Monday, Oct 17, 2016**

**8:00 am – Pawan Takhar**

Initiated meeting with opening comments. Thank host station

**Yanyun Zhao** – welcomed attendees and gave overview of meeting activities for the next 2 days

**Introductions**

All meeting participants gave their names and affiliations

**Joyce Loper, Assoc. Dean College of Agricultural Sciences**

Welcomed attendees and gave OSU introduction and statistics. Discussed the research areas and focuses of Oregon State University and the importance of Food Science and Technology.

**Robert McGorrin, Department Head, Food Science and Technology Department**

Welcomed attendees to OSU. Gave some information about FST department – almost 100 years old; 2nd oldest in USA. Discussed undergraduate program, ~200 students in FST (~40 graduate students). Not combined with Nutrition program. Discussed history of FST department. Used to be Horticultural Products Department, then Food Technology, finally Food Science and Technology (since 1960’s). FST significantly grew up due to the Fermentation Science program. Students can have specializations in Food Science; Fermentation Science; and Viticulture and Enology. The department received $1M for precision brewing equipment that will be used for projects on brewing technology. The FST is now a USDA Western Research Center, one site out of 4. Currently, it has 4 sub-contract with Washington State University, University of California- Davis, Univ. of Hawaii and others. This center is responsible for training on the Food Safety Modernization Act (FSMA) on the West Coast. Dr. McGorrin mentioned that they are trying to get a new building for FST department. Need 50% of the building funded by gifts (25% as a lead gift) for the state to match the other 50%. They are trying to get funding for a $18M project including 3 pilot plants (cheese, wine, and beer) as well as other labs, facilities, etc. FST already received gift money for part of the pilot plants, and construction will start in 1.5 yrs.

**David Jackson, University of Nebraska, NC-1023 advisor gave Washington, DC Update**

USDA is on a continuing budget resolution through December 2016. This department still needs to work on budgets for fiscal year 2017. President Obama has proposed a FY 2017 budget that increases AFRI funding by $25M and have also asked for $350M to fully fund the appropriations for AFRI. However, not sure if all will be approved. But this may mean a slight increase in AFRI funding. RFA for USDA Foundational Program anticipated release two months earlier than last year. The entire program is expected to be released between December – April.

**Comments on FY 2015** – Success rates ranged between <10 – 30% depending on the program. David is not sure specifically on the Food Engineering funding. In the case of Animal Science areas, the success rate was in the range of ~15-16%.

David encouraged us to prepare a white paper on “How food engineering approaches, in collaboration with other disciplines, will address certain societal challenges?”. Although engineering is not directly mentioned in many of these challenges, it is inherently embedded in many of them. It would benefit the food engineering group if we put together materials showing the importance of engineering in solving some of these challenges, this way it will facilitate to include “engineering” verbage in RFP for FY 2018.

David mentioned the importance of including Big Data in our scope of work and also mentioned that some members of the NC-1023 group attended a “Big Data in Agriculture Summit”. David and Ashim Datta noted that it was mainly focused on production agriculture.

David mentioned that standard Hatch and Extension funding should remain the same.

**David gave the** **NC-1023 Administrator Update**

Group members and college need to be proactive in interacting with granting agencies as to how we can impact the kinds of questions that funding agencies want to support.

Graciela asked for specific examples of what David mentioned.

David responded as follows: Application of engineering for food safety such as looking at surfaces, biofilms, etc. However, if you have people in agencies with very traditional mindset, they may not think of engineering for food safety. For this reason, it is necessary to discuss new research and applications of our research with funding agencies. Need to meet with national program leaders, go to DC to advocate for yourself/field. Also can update your congressional delegation, especially if you have gotten a large gift from a donor.

Make sure to point out how food engineering can be used to impact climate change, human health, etc., by emphasizing engineering approaches. This may be helpful to get more RFPs that involve food engineering.

David encouraged everyone to work in collaborations and collecting data to use in these proposals.

Engineering plays a crucial role in health and well-being, for this reason, he encouraged collaboration with medical schools and/or biomedical scientists/engineers.

To finish, David repeated that collaboration is a must because future funding is going towards large grant proposals that require collaboration with many colleagues/institutions.

**Ashim presented information from Agriculture Summit on Big Data.**

He mentioned that most of the topics were related to Agricultural Production. He added a topic related to food production (quality, safety, manufacturing) is not well-ranked within topics to be addressed. Genetics, for example, is receiving more attentions and they had more on Big Data. It is worth mentioning that ranking of the topic might not be important, but it might count.

Swamy Anantheswaran suggested that we can’t give up on application of Big Data in our fields. He mentioned that in the past other ideas such as motility of microorganisms in produce weren’t popular at the beginning, but then have been picked up by funding agencies.

Graciela asked if there is an opportunity for us to edit our ideas or to make the comments stronger in the online site. In response, Ashim suggested editing or adding more ideas, but he is not sure if it is public information. At the end, he mentioned that the question that was specifically discussed was “What are the most promising opportunities for data-driven advances in agriculture and food-production systems?”

David reported that Hongda Chen (USDA) mentioned that there may be another workshop in this area. This could be a good forum for additional discussion regarding Big Data. It might be good to prepare something for this workshop that might take place in the near future.

David suggested putting together a short document (~1 pg) as to how food engineering can be leveraged to solve some of USDA’s identified societal challenges. It would be helpful to include engineering in places where it hasn’t been shown before.

**Lester Wilson, Steering Committee Chair**

He mentioned that collaboration is occurring, but he is not sure how visible it is. Some people don’t include those collaborations in their reports. So, we have to make sure that those collaborations are included in reports, as this will go into larger report for other projects. Lester mentioned that some administrators discourage including collaboration with other stations, but in our NC-1023 project it is counterproductive not to do it.

Jeanne Gleason asked if it is possible to have collaborations with others that are not in this group.

David said there is benefit to articulating collaborations with other people in the same multi-state project, so this is first priority. If you can indicate other impactful interactions with other universities, there is no harm, but not most important.

Helen Joyner asked there is any weight into include university- industry collaborations.

David mentioned that the value is in the renewal process in that it will support the application going further by showing that university interactions have been leveraged to get industry collaborations, especially if technologies, etc. have been adopted. As a reminder, this is a multi-state *research* project, so focus is on research! David also mentioned that research could also be on educational methods e.g. “How effective are new methods in teaching food engineering?” David mentioned this is an appropriate research topic but it is necessary to show that research/education programs have a national impact.

Lester - We can have a significant impact on this program but that there is a need to properly document it and make sure other are aware of it.

Swamy – Did we nominate ourselves for the experiment station award? It is good to make administrators aware of our accomplishments.

Lester – Yes, we have done it, but it is difficult to get the award since we are starting the first year of the new 5-year project.

David will check about the timing for the nomination process, as he thinks our group deserves consideration for the award. However, he needs to find when things are due and he volunteers to put the package together.

Swamy – Need to find the right collaborative project to encourage people to work on it after they leave the meeting, such as previous projects on DSC methods.

Lester updated the group on current membership of the Steering Committee: Sudhir Sastry, Rich Hartel, Lester Wilson (Rich and Lester have alternated chairing), Pawan Takhar.

**9:00 Coffee Break**

**9:15 Meeting Reconvened**

David Jackson asked about award nominations which are due on February 28, 2017. If we want to do this, it would be possible for the next cycle. He added that not too much information is necessary – 3 single-spaced pages but needs to be a well-written document.

David mentioned that nominations should consider issues addressed, solution to problem outcomes, Funding, Number of Institutions, etc. where each item weighed between 5-40%. David would help move nomination forward if the NC-1023 wants to put together the information to be included in the package.

**Pawan Takhar**

He asks for approval of the NC-1023 minutes of the 2015 meeting

Jeyam Subbiah moved to approve

Lester seconded the motion

Pawan asked for discussion but no questions or comments were made. The delegates were all in favor of approval of minutes and there was no abstention, therefore the minutes were approved.

**Station Reports**

It was agreed that each report should be 15 minutes/station and the reports will be presented in alphabetically order but to give priority to those delegates that are leaving today.

**Jeanne Gleason, New Mexico State University (NMSU)**

This university working on education and outreach programs in animations. Another faculty member from NMSU, Barbara Chamberlin, is working in the same area of education program/animation development. This program has many partners including University of Hawaii, Michigan State University, Rutgers University, University of Maine, Purdue University, etc. Most partnerships are in the following areas: Food safety/processing, STEM education, international programs. Jeanne explained how people would know about these developed resources. They have a specialized person that works to make sure materials are widely accessible to the public. For example, 4 million views of “BrainPOP” games, 2 million views of science-based YouTube videos. Animations and scientific visualizations can be found at: **mediaproductions.nmsu.edu**, where significant material is available for free at this site. It is worth mentioning some animations on norovirus were used in a graduate course. Nonthermal processing or alternative processing of produce were developed for a consumer audience. NMSU also worked on virtual labs for food safety applications, such as Bacteria Sampling, Gram Staining, Understanding Water Activity, etc. Apps are only available for iPad and they charge $0.99 for each app, or $4.99 for all 8 apps. Gram staining will be free for a while at their website. These apps were used as a pre-lab exercise in South Dakota State University where students ended up watching videos during class. At the same time, she worked with Florida State University on nanoparticles in citrus re-greening.

**Ashim Datta, New York**

To start with, Ashim mentioned collaborative project with Ohio State University about mechanistic understanding of how fresh produce is contaminated by looking at passive and active attachment mechanisms. Cornell working on modeling and OSU working on microfluidics and microbiology. They developed models to understand how microstructure on plant surfaces affect attachment on contamination. Used experimental approach from UC Davis (Mike Delwiche) to validate the model that could predict (passive) the attachment based on type of surface.

Mukund asked about how you decide if the bacteria attaches? Is it a probabilistic function?

The answer was yes; it is a probabilistic function.

Ashim briefly described some of the projects his station is working on. One of them is how nanostructured surfaces could prevent microbial attachment. Understanding of why and how nanostructured surfaces can minimize bacterial attachment was further advanced during the last year. A model linking attachment to the bacteria-surface interaction force was also developed.

Another project consisted on developing a three dimensional, multiscale model for growth, dispersion, spreading/shoving, and nutrient consumption of bacteria on a leaf surface.

He also reported on the modeling of passive internalization of bacteria into stomata during vacuum cooling of spinach leaves. Some parts of related experimental work will be done at The Ohio State University in this jointly funded NIFA project. Modeling of passive attachment has been completed and complementary experimentation is currently underway at The Ohio State University.

Swamy – Opportunity to look at fresh cantaloupe that does not allow listeria into skin. However, cantaloupe that is sitting in soil (and it is softer) allows listeria into skin. Could we collaborate in this area?

Ashim – Yes, we had previously looked into this area, for example, with tomatoes to see that warm tomatoes could internalize bacteria through the break at the stem. Due to surface properties, cantaloupe could be an interesting model.

Ashim also discussed an education project: How can you use simulation to enhance student learning? Modules have been developed through large collaboration including three main areas: microbiological growth/inactivation; microbiology and processing; and risk assessment. These modules have been developed in teaching both food scientists and engineers. Gail reported on the use of a module in a Food Science course last year. Mukund also used a module, but did not have student assessment results. Susie Liu at Michigan State University previously used a module also, but her version is different than the one we are talking about.

**Gail Bornhorst, University of California-Davis**

An enzyme-assisted aqueous extraction process is being developed to extract oil, proteins, and carbohydrates from almonds. Study was conducted in quantification of mass transport **processes in orange-fleshed sweet potatoes leading to structural changes during in vitro gastric digestion.** Classification of food product behavior during digestion and optimization of food functionality through increasing understanding of food behavior during digestion. Computational modules developed by NY station were included as part of a laboratory course in food processing offered to Food Science students to increase understanding of heat transfer during thermal processing.

**Helen Joyner, University of Idaho**

The overall research goal of Idaho station is to determine links between structure, mechanical/friction behavior, and texture to gain a better understanding of the relationships among these aspects of food. To accomplish this, rheological, and tribological behaviors of foods are evaluated using various techniques. Evaluation of these behaviors and determination of structure causes and impacts on texture will yield knowledge allowing a more fundamental approach to designing foods with palatable textures, particularly reduced-fat or reduced-calorie foods.

Projects include UHT milk friction, yogurt rheology and tribology, yogurt packaging, cottage cheese dressing sensory and tribological behaviors, reduced fat cheese structure–function relationships, fundamental properties of seed polysaccharides, the impact of storage temperature on blue cheese mechanical behavior, and fracture behavior of solid baby foods.

Helen also reported on the work of Girish Ganjyal (School of Food Science at Washington State University and University of Idaho)

Girish is focusing on value added processing of fruit and vegetable pomace as well as extrusion processing. Some of the area includes processing of quinoa, millets and pulses as well as starch and fiber interactions during extrusion to create high quality extruded foods.

Besides that, his program is providing training in the areas of “Food Ingredient Technology”, “Product Development for Value-added Foods”, “Extrusion Processing”, and “North West Food Safety and Sanitation Workshop” with over 300 people trained in the year 2015.

**Pawan Takhar, University of Illinois**

University of Illinois at Urbana-Champaign station is working on developing models that can be applied to various food processing operation. Hybrid Mixture Theory based unsaturated fluid transport equations were coupled with poroviscoelasticity and multiscale heat transfer equations and solved for frying of foods and expansion of starch during extrusion. The swelling/shrinking behavior during unsaturated transport was included by developing a general continuum mechanics and poroviscoelasticity based model. He is also working on enhancing the safety of low moisture food. Pawan illustrated some of what he is doing by showing a video on frying.

**Dharmendra Mishra, Purdue University**

Indiana station has been working on development of new and sustainable technologies to transform raw materials into safe, high quality, health enhanced and value added foods through processing, packaging and preservation as well as on the application of the theory of thermal properties cell (TP Cell). Knowledge developed through research and novel pedagogical methods to enhance student and other stakeholder learning and practice has been disseminated

Dr Corvalan’s research group, in collaboration with Dr. Campanella’s group, has been providing leadership on fundamental research at the nanoscale leading to: (a) lower cost, more effective nanosensors for rapid DNA, RNA and protein sequencing, (b) novel nano and micro-rheology techniques to ensure high-quality foods for consumers, and (c) techniques to ensure physically stable, high-quality micro-emulsions. Studies conducted include applied research leading to new insights on whey protein gelation induced by hydrolysis and heat treatments to ensure high-quality foods for consumers and protect food processors from losses.

Jen-Yi-Huang is working on sustainability of food processing, including energy consumption, fouling mitigation, and green cleaning,

**Akinbode Adedeji, University of Kentucky**

Presentation was made on progress on two research programs that he is developing. These are:

* 1. Underutilized grain value addition (millet)
  2. Non-invasive methods for food safety and quality assessment using Hyperspectral Imaging (HSI) and Acoustic Emission (AE) methods

Akinbode reported on the effort at characterizing macromolecules (starch and protein) extracted from nine identified cultivars of millet, an underutilized agricultural product in the US. Works on starch extraction, protein structural characterization using x-ray crystallography and NMR, are among the project currently going on at the Food Engineering group at University of Kentucky. Research on developing gluten free bread from millet was also presented.

Two projects on noninvasive methods (hyperspectral imaging and acoustic emission) were presented. These include application of HSI and AE for detection and classification of codling moth infestation in apples. Other small projects on frying optimization and impact of freezing rate, carrot quality prediction and bio-hydrogen development from food processing waste were also presented.

**Balunkeswar (Balu) Nayak, University of Maine**

Balu presented his work on development of technique/method for the extraction of crustacean allergenic protein in compost which is one of the most difficult matrices with organic matters and a number of animal products. The developed method accurately helped in quantifying crustacean allergenic proteins from compost as well as tropomyosin, an allergen in shellfish. The research targeted crustacean processors and suppliers for safe and hypoallergenic processed products.

**Rohan Tikekar, University of Maryland**

Rohan talked about photodynamic and sonochemcial processes to improve the safety of wash water used in the fresh produce industry. A 30-minute exposure of Gallic acid (GA 10 mM) in presence of UV-A light was able to achieve more than 5 log CFU/mL reduction in *Escherichia coli* O157:H7 in solution, and approximately 2 log CFU/mL reduction on the surface of produce. The treatment was efficient in presence of organic load of 500 mg/L. GA could be recycled thrice without loss in antimicrobial efficacy, demonstrating a significant advantage over conventional sanitizers. Similarly, synergistic antimicrobial effect of ZnO nanoparticles and low-frequency ultrasound was also studied where a combined treatment resulted in a 5 log CFU/mL reduction in *Listeria innocua* within 12 minutes, while individual treatment resulted in less than 1 log CFU/mL reduction. The approaches developed in these studies are attractive alternatives to improve fresh produce safety.

**Roger Ruan, University of Minnesota**

Roger presented a summary of his station contributions to Objectives 1 and 3 of the overall project.

Objective 1: Advancing the fundamental science and application of technologies to ensure food safety and improve quality of food products

1a. Utilize innovative methods to characterize food materials

Magnetic resonance imaging (MRI) is a very useful non-destructive and non-invasive technique for the study of food structure, distribution of water, fat, and temperature in foods, and heat and mass transfer in foods. We continued to improve NMR and MRI instrumentation for characterization of physiochemical properties of food ingredients and products, especially low moisture content foods.

1b. Develop new and improved processing technologies

The food industry and consumers have significant interest in nonthermal pasteurization processes because they offer better quality and nutrition1 retention and are more energy efficient than traditional thermal processes. Nonthermal processes may also create value added products and open new market opportunities. We are developing and evaluating three nonthermal processes. The concentrated high intensity electric field (CHIEF) process invented by our group was tested and analyzed using mathematical models. A project funded by a company is looking into the application of nonthermal plasma to pasteurize dry milk powder. A CAP project funded by the USDA AFRI program is looking at the application of intense pulsed light for pasteurization of powdered foods. These two new projects involved engineering design of the process and systems and systematic evaluation of the processes on the effectiveness and nutritional, sensory, and economic values of the processes.

1c. Develop mathematical models to enhance understanding of, and optimize food processes

The concentrated high intensity electric field (CHIEF) process developed at the UMN is considered a promising nonthermal pasteurization technology. The unique configuration of CHIEF reactor allows it to use medium to low voltage and frequency AC power supply to provide efficient log reduction of pathogens. Understanding the mechanism of CHIEF system requires computational efforts in fluid mechanics, electrostatics and heat transfer. We used Finite Element method to model and simulate the fluid flow, electric field distribution and temperature rise in CHIEF reactor. The simulation was confirmed to be valid by comparing it with experimental results.

Objective 3: Develop outreach programs to disseminate best practices for enhancing food safety and quality to stakeholders.

Research results were disseminated to the academic community through peer-reviewed publications and conference presentations. Some research results were used in classroom teaching to benefit students. On-site demonstrations were conducted to showcase our results to a broad range of audience including academic researchers, government officials, funding agencies, students, entrepreneurs, and the general public.

**Jeyam Subbiah, University of Nebraska**

The Nebraska group is formed by Ozan Ciftci (Food Engineering and Lipid Chemistry), Andreia Bianchini (Food Microbiology and Engineering), and Jeyam Subbiah (Food Engineering). Efforts on educational aspects includes the work of Jeyam who published a paper titled “Using Just-in-Time Teaching in a Flipped Undergraduate Biological Systems Engineering Course”. In this paper Jeyam provides a detailed overview of the course design, development, and implementation of JIT in a flipped approach to instruction by communicating the technologies used, pedagogy employed to integrate online and in-class activities, and the collaboration between the instructional design support and instructor. Based on the results, he provided recommendations for engineering faculty that want to explore the flipped approach to teaching, examples for online learning activities and how to integrate them with clicker in-class active learning activities to increase student engagement and success rates. Jeyam has a slide presentation based on this article that was developed together with Tareq Daher, Jiajia Chen, David Jones.

University of Nebraska is also working on innovative methods to characterize food materials. Temperature dependent dielectric properties and thermal properties of date paste were collected. Coarse and finely ground black pepper were characterized by determining physical properties such as moisture content, specific heat capacity, thermal conductivity and dielectric properties. In addition, preliminary studies on chemical properties such as piperine content, total phenolic, volatile oil content and composition were also conducted.

Developed and validated a three-dimensional finite element model coupling electromagnetic, heat, and mass transport for describing multiphysics during microwave cooking of frozen microwaveable foods. Team developed a methodology to incorporate the entire electromagnetic spectrum produced by magnetron instead of a single frequency. They published a method to determine speed to achieve a desired operating point for a given fan or pump using analytical solution. This will be handy for practicing engineers and undergraduate students learning to select a fan or pump for a given application.

**Mukund Karwe, Rutgers University**

The team at Rutgers is working on the effect of surface roughness in fruit systems on the microbial inactivation using plasma activated water (PAW) and plasma activated buffer (PAB). Model systems confirmed that the microbial inactivation efficacy of PAW and PAB was due to the presence of reactive species and not acidic pH. No significant differences were observed in the microbial inactivation efficacy of PAW and PAB for a given fruit system and between fruit systems of different surface roughness values.

Another study at this university is on the sequential treatment of mild heat followed by UV radiation to inactivate *Alicyclobacillus acidoterrestris* spores in apple juice. Sensory evaluation using Fizz triangle test conducted on commercially pasteurized apple juice and compared with heat-UV treated sample revealed no significant difference. Head-space GC-MS further supported the results.

**Swamy Anantheswaran, Pennsylvania State University**

Pennsylvania team is working on multiple projects: understanding the effects of processing on polyphenols in cocoa; mechanisms and kinetics of nisin release from chitosan films; increased production of polyphenols in lettuce and spinach by pulsed UV light treatment; and novel nonthermal processing methods for food safety. The research on understanding the effects of processing on cocoa polyphenols can be used to optimize chocolate manufacturing process to maximize these health-benefiting compounds. Antimicrobials such as nisin can be delivered into food products using edible food biopolymers. An understanding of the factors that govern the thermodynamics and kinetics of nisin release from the biopolymer films will be useful in designing a coating within a package. Novel technologies are being investigated for improving the nutritional qualities of food products by increasing the level of polyphenols.

**3:45-4:30 pm Business meeting**

Host station for 2018: University of Maine

Host: Balunkeswar (Balu) Nayak

New NC-1023 Secretary: TBA

Host station for 2019:

New Mexico State University

Host: Jeanne Gleason)

**4:30- 5:30 pm**

Linus Pauling Institute tour

**6:30-9:00 pm**

Dinner at Big River Restaurant

**Tuesday, October 18th**

7:30 - 8:00 am Breakfast

**8:00 am Station Reports Continue**

**Yanyun Zhao, Oregon State University**

Oregon State works on optimization of solvent and ultrasound assisted extraction for different anthocyanin rich fruits. Nanocellulose fibril and nanocellulose crystal based coatings were developed and characterized to improve storability of fresh pears and bananas during postharvest ambient storages. Chitosan-CNC microcapsules were developed to stabilize fruit anthocyanin extracts.

Correlation between drying processes and product quality of hazelnut was studied. Drying and storage conditions for Oregon hazelnuts were studied to ensure quality and extend shelf-life of nuts. Outreach programs were implemented to disseminate the research findings and help the stakeholders for ensuring their product safety and quality. This includes FSMA training, surimi school, Better Process Control School, milk quality and artisan cheese making workshop.

**Silvana Martini, Utah State University**

Utah team has used high intensity ultrasound to induce the crystallization of various edible lipids including anhydrous milk fat, all-purpose shortening, interesterified soybean oil, coconut oil, and palm oil, among others.  High intensity ultrasound can be used as an additional processing condition to induce the crystallization of fats, generate smaller crystals and generate materials that are harder, more elastic, and that melt over a narrower temperature range.  High intensity ultrasound can be used in batch and on-line and has also been proved to induce the formation of the most stable polymorphic forms in fats such as cocoa butter and fractions of high oleic high steric sunflower oil. This technology can be used to improve the physical properties of fats with low content of saturated fats and free of trans fats.

**Haibo Huang, Virginia Tech Station**

Team at Virginia Tech is studying on valorization of Brewer’s Spent Grain (BSG) by a fractionation process. The aim is to valorize BSG by developing an effective fractionation process to separate proteins and fibers from BSG which is subjected to pretreatment to reduce its recalcitrance structure, followed by chemical and enzymatic incubations to solubilize protein. Finally, small and solubilized proteins are separated from the large and insoluble fibers by membrane separation. The separated proteins can be potentially used as dietary protein, advanced animal feed, and bioactive peptide by further enzymatic hydrolysis. The separated fibers can be used as dietary fiber, packaging materials, and fermentation or digestion feedstock. The developed fractionation process can be an effective way to valorize the currently underutilized BSG.

**Gustavo V. Barbosa-Cánovas, Washington State University Station**

Gustavo made a presentation highlighting the State of Washington and the Food Processing Program at Washington State University. His presentation was aimed to welcome NC-1023 to attend the meeting in 2017 at Pullman, Washington.

Gustavo also presented the work carried out by Shyam Sablani and his team. They designed and developed multilayer polymeric films for pasteurization processes. These films utilized coated PET, nylon and/or EVOH as core barrier layers. The barrier layer was protected with PP and PE layers. They also examined the influence of oxygen and water vapor barrier properties of multilayer films on the chemical changes and shelf-life of different foods. The findings will help food companies to select films for desired shelf life of selected products.

**Update on Ad-Hoc committee membership**

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

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| **Ad-Hoc Committee Members** | |
| 1. **Nonthermal Processing**   Bala Balasubramaniam (Chair)  Jen-Yi Huang  Silvana Martini  Rohan Tikekar  Mukund Karwe  Gustavo V. Barbosa-Cánovas  Dharmendra Mishra  Jen-Yi Huang | 1. **Extraction of Bioactive Components**   Yanyun Zhou (Chair)  Gonul Kaletunc  Elena Castell-Perez  Roger Ruan  Jen-Yi Huang  Lester Wilson  Haibo Huang  Ozan N. Ciftci  Balu Nayak  Gustavo V. Barbosa-Cánovas  Sam Chang |

|  |  |
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| 1. **Mathematical Modeling**   Ashim Datta (Chair)  Akinbode Adedeji  Jeyam Subbiah  Pawan Takhar  Kirk Dolan  Dharmendra Mishra | 1. **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 |
| 1. **Physical Properties**   Rich Hartel (Chair)  Helen Joyner  Lester Wilson  Ozan N. Ciftci  Gail Bornhorst  Balu Nayak  RohanTikekar | 1. **Nanotechnology**   Graciela Padua (Chair)  Fernanda San Martin  Carmen Gomes  Soojin Jun  Ozan N. Ciftci  Silvana Martini  Gail Bornhorst  Balu Nayak  Yanyun Zhao  Youngsoo Lee |

**Business meeting**

**Host station for 2017: Washington State University**

The host is Gustavo V. Barbosa-Cánovas.

The dates for the NC-1023 meeting will be announced during summer of 2017.

**11:00 am Adjourn** – Lunch break

Afternoon - Visit to the Food Innovation Center in Portland, Oregon