CORNUCOPIA

including the AGFD program and Abstracts for the
258th American Chemical Society National Meeting in

SAN DIEGO
August 25 - 29, 2019

LIANGLI (LUCY) YU & XUETONG FAN
Program Chairs

Attend AGFD technical sessions at the
San Diego Convention Center

Join the AGFD Awards Banquet
Tuesday, Aug. 27, 6:00 pm at the
Harbor House, 831 W. Harbor Drive
(Directions below. Tickets available at AGFD info table.)

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back cover Schedule of AGFD technical/business/planning and merrymaking activities

Directions to AGFD Awards Banquet — exit the Convention Center via the Grand Stairway entrance facing the waterfront. At the waterfront turn right. Walk along the Embarcadero/waterfront to the first street intersection – Kettner Boulevard. Cross Kettner. The Harbor House is on your right. (0.6 miles/12 minute walk from the Convention Center)

Visit our website - www.agfd.sites.acs.org - for a pdf of Cornucopia, job postings, awards, and much more.
Check out our Facebook page - www.facebook.com/agandfood We’re on LinkedIn, too!
MESSAGE FROM THE CHAIR

It has been a great experience and honor to serve as the chair of the Division of Agricultural and Food Chemistry (AGFD). The work of the Division was made possible with the dedication and commitment of numerous volunteers including symposium organizers/moderators, executive committee members, sub-division leaders, and many other AGFD members. These individuals have made volunteering for ACS and AGFD an enjoyable and rewarding experience.

The spring national meeting in Orlando was a great success. We presented more than 200 abstracts that covered a diverse range of topics. The Withycombe-Charalambous Graduate Student Symposium and Undergraduate Student poster competition were held at the Orlando national meeting. Congratulations to Yagmur Yegin, Madeleine Bee and Zihao Wei for winning the graduate student symposium, and Lia Lozano Salazar, Honglin Chen, Jack Jingyuan Zheng and Yiyun Liu for winning the undergraduate poster competition. I’d like to acknowledge Kathryn Deibler, Alyson Mitchell and all other judges for their contribution in student competitions.

Moving forward, the fall meeting in San Diego will be a great success. Our program chair, Lucy Yu, has diligently worked on the San Diego National Meeting with more than 400 presentations including 91 posters and 288 oral presentations. There are 19 symposia in 42 sessions covering a wide range of topics from agro-based materials to microbiomes. Please consider attending the following special sessions and award lectures:

- Agnes Rimando Memorial Symposium in honor of the Scientist & International Ambassador of Agricultural & Food Chemistry, Tue, Aug. 27th, San Diego Convention Center. Room 32A
- ACS-AGFD Young Scientist Award, R. Ramanathan, Biomolecular interactions between myoglobin, mitochondria, and metabolites governing fresh meat color, Tue, Aug. 27th, 10:00 am – 10:40 am, San Diego Convention Center, room 31C
- USDA-ARS Sterling B. Hendricks Memorial Lectureship Symposium, J.W. Finley, Evolution and future needs of food chemistry in a changing world, Tue, Aug. 27th, 11:30 am – 12:30 pm, San Diego Convention Center, room 31C
- AGFD Award Symposium Honoring Dr. Fidel Toldra, Tue, Aug. 27th, 2:00 pm – 4:30 pm, San Diego Convention Center, room 33A
- JAFC Research Article of the Year Award presentation, M. Hellwig, T. Henle, Microbial metabolization of glycated amino acids, Tue, Aug. 27th, 1:20 pm – 2:10 pm. San Diego Convention Center, room 32B

We value your input and contributions, and would like to invite you to get involved in AGFD programming. Please consider attending the Future Programs Meeting on Mon, Aug. 26th to share your ideas.

During the last couple of years, our membership has increased more than 20%. The division’s success in increasing membership has been made possible by the commitment of many volunteers and committee members, particularly, thanks to the dedication and leadership of many individuals, including our two student representatives: Zhuzhu Wang and Kathleen Luo. They have helped recruit new division members and are inspiring supporters for our division. AGFD is seeking additional student leaders to advocate for the division. Michael Qian’s leadership as the AGFD Membership Chair and the new members that joined at the international flavor conferences are instrumental to AGFD membership growth.

Also, I’d like to thank Brian Guthrie, our immediate past chair, for his tremendous contribution. He initiated several programs to engage and encourage participation from division members, including organizing symposia on the publication process and career trajectory, webinars on various topics to attract division members, and establishing the AGFD VIP poster session. It is under his leadership that our division membership has increased dramatically. We strive to continue to increase and maintain division membership via many outreach activities and encourage division involvement.

I congratulate all the award winners at the San Diego meeting. In addition to the previously mentioned awardees that will give lectures at San Diego, I would also like to acknowledge Navindra Seeram of University of Rhode Island for the Distinguished Service award, Brianne Linne of Ohio State University for the AGFD Teranishi Graduate Fellowship, Michael C. Qian of Oregon State University for becoming an ACS Fellow. Congratulations to Thomas Sparks of Corteva Agriscience, DowDuPont for the Spencer Award. Luke Howard of University of Arkansas, Bosoon Park and continued on next page
Xuetong Fan of USDA-ARS, Michael Granvogl of Technical University of Munich & University of Hohenheim and Yan Xu of Jiangnan University are the most recent AGFD fellow. I thank Michael Morello, Kathryn Deibler, Fereidoon Shahidi, and Chi-Tang Ho for their efforts in selecting the awardees.

The AGFD award banquet will be held at Harbor House on Tuesday, August 27th at 6:00 PM, which has the best views in town. The address is 831 West Harbor Drive, San Diego. Website: http://www.harborhousesd.com/. Tickets will be available at the AGFD desk at the convention center. Thanks go to Alyson Mitchell for organizing the event.

I acknowledge and thank our Cornucopia editor, Carl Frey, Alyson Mitchell, Stephen Toth, Michael Appell, Michael Tunick, Michael Morello, Lauren Jackson, John Finley and many others for their contributions and commitments to the division.

I look forward to seeing you in San Diego.

Xuetong Fan
AGFD Chair 2019
Email: xuetong.fan@usda.gov

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FUTURE PROGRAMS

PHILADELPHIA March 22-26, 2020

ACS Meeting Theme: Macromolecular Chemistry: the 2nd Century

Advances in Sensory Evaluation Michael Tunick mht39@drexel.edu Rosemary Trout rek23@drexel.edu

Chemistry and Health Benefits of Fermented Foods Youngmok Kim Youngmok.Kim@finlays.net Hyang-Sook Chun hschun@cau.ac.kr Kwang-Geun Lee kwglee@dongguk.edu

Food Authentication and Adulteration Detection Zhuohong Xie USP KYX@usp.org James Harnly ARS-USDA james.harnly@ars.usda.gov

Food Packaging Materials: Safety, Active Packaging & Sustainability Timothy Duncan
Timothy.Duncan@fda.hhs.gov Xuetong Fan Xuetong.fan@ars.usda.gov John W. Finley jfinley5@lsu.edu Tony Jin Tony.Jin@ars.usda.gov John Koontz John.Koontz@fda.hhs.gov Michael Morello mjmorello226@gmail.com

General Papers (Oral) and General Papers (Poster)

Method Development for Complex Food Matrices – Analytical and Statistical Considerations Sourav Chakraborty Central Connecticut State Univ. schakraborty@ccsu.edu


Nanoencapsulation and Delivery of Bioactive Food Ingredients Using Food Biopolymers Qingrong Huang Rutgers Univ. qhuang@aesop.rutgers.edu Qin Wang Univ. of Maryland wangqin@umd.edu

Pectin Chemistry and Health Linshu Liu ERRC-USDA linshu.liu@ars.usda.gov Arland Hotchkiss Hotchkiss.arland@usda.gov ERRC-USDA Kate Davis CPKelco kate.davis@cpkelco.com Raisa Gorshkova Inst. of Macromolecular Compounds, Russian Academy of Sciences Gorshkova.raisa@gmail.com Zayniddin Kamarovich Muhidinov Inst. of Chemistry of the Tajikistan Academy of Sciences muhidinovzayniddin@gmail.gov

Withycombe-Charalambous Graduate Student Symposium Kathryn Deibler Kdd3@cornell.edu

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**Green Polymer Chemistry** (possible co-sponsorship with POLY) H.N. Cheng USDA-ARS HN.Cheng@ars.usda.gov Rich Gross Rensselaer Polytechnic Institute grossr@rpi.edu

**ACS NASA Symposium** (co-sponsored with CME group of the ACS NY section) George Rodriguez grodriguez@argeni.com

**SAN FRANCISCO** August 16-20, 2020

**Agnes Rimando Memorial International Student Symposium** Mike Tunick mht39@drexel.edu Michael Granvogl michael.granvogl@uni-hohenheim.de Boyan Gao gaoboyan@sjtu.edu.cn Roberta Tardugno roberta.tardugno@gmail.com

**Artificial Intelligence in Food and Agriculture** Michael Appell Michael.appell@gmail.com Brian Guthrie Brian_Guthrie@cargill.com

**Biomarker Discovery** Jonathan Beauchamp Fraunhofer-Institute for Process Engineering and Packaging IVV jonathan.beauchamp@ivv.fraunhofer.de Cristina Davis UC Davis cedavis@ucdavis.edu

**Chemistry Behind Consumer Acceptance of Flavor and Health Benefits** Bhimu Patil Texas A&M Univ. b-patil@tamu.edu

**Chemistry of Traditional Chinese Medicine** Wallace Yokoyama yokoyama@ars.usda.gov WRRC ARS-USDA Xianli Wu USDA-ARS xianli.wu@ars.usda.gov Jinlin Guo Chengdu Univ. of Traditional Medicine guo596@163.com

**Chemistry of Wine** Alyson Mitchell aemitchell@ucdavis.edu (Alyson will not organize. Hold this place)

**Chemistry, Safety and Sustainability of Nuts and Nut Products** Alyson Mitchell aemitchell@ucdavis.edu

**Electronic Sensors for Food Safety** Brian Guthrie Brian_Guthrie@cargill.com

**Food Allergens: Discovery, Characterization, Detection, and Mitigation** Yuzhu Zhang yuzhu.zhang@ars.usda.gov Lauren Jackson Lauren.Jackson@fda.hhs.gov

**Food Macromolecules: Functionality, Health Benefits, Delivery Systems** Wallace Yokoyama WRRC ARS-USDA yokoyama@ars.usda.gov

**Impact of Industrial Processing and Home Preparation Methods on Nutrients and Bioactive Compounds in Foods** (tentative) Xianli Wu Xianli.Wu@ars.usda.gov Shaoping Li spli@umac.mo

**JAFC Research Article of the Year Award Symposium** Thomas Hofmann Thomas.hofmann@tum.de

**Nutraceutical Lipids** Fereidoon Shahidi Memorial Univ. of Newfoundland fshahidi@mun.ca

**Omics-based Natural Product Discovery** Hyang-Sook Chun hschun@cau.ac.kr Youngmok Kim youngmok.kim@finlays.net

**Processing and Storage Induced Food Toxicants** (3-MCPD esters, 2-MCPD esters, trans fat, Acrylamide, heterocyclic amines, polycyclic aromatic hydrocarbons et al.) Liangli (Lucy) Yu lyu5@umd.edu

**Smart Textile and Cellulosic Products from Chemistry** SeChin Chang SRRC-USDA SeChin.Chang@ars.usda.gov

**Chemistry of Chocolate: From Bench to Market** Susan Ebeler UC Davis seebeler@ucdavis.edu Helene Hopfer Penn State hxh83@psu.edu Josh Lambert Penn State jdl134@psu.edu

**Sterling B. Hendricks Memorial Lectureship Symposium** Michael Appell Michael.Appell@ars.usda.gov

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Executive Committee Meeting Minutes

Monday, April 1, 2019  Orlando Convention Center, Orlando, FL  
*Takes place at each ACS National Meeting*


AGFD Chair Xuetong Fan called the meeting to order at 5:08 p.m.
The minutes of the previous meeting were approved with no changes.

Stephen Toth gave the **Treasurer's Report.** The division spent $3000 for website development. We are spending $110-$125,000 annually. We have $671,757 in the bank and in investments. The division is financially healthy. Revenues minus expenditures are at $7734 so far this year. The total assets for the division are $671,757 including $616,046 in investments and $52,260 in the checking account. The total cost for the Boston meeting was $36,851 (projected $45,000). The poster night and banquet were less than expected and we came in under budget. The Orlando meeting is projected to cost $35,000. Report approved.

Xuetong Fan gave the **Program Report** for Orlando and indicated that there were 206 abstracts and 16 sessions. Lucy Yu reported that there are 380 abstracts for San Diego, Fall 2019 and 40-45 sessions are expected. A budget of $48,000 for San Diego proposed and was passed.

Lucy gave the **Future Programs** report and indicated that some symposium had been moved from San Diego to San Francisco and Philadelphia meetings. John Finley pointed out that the San Antonio, 2020 meeting has a theme of “bonding through chemistry” so we may want to reach out to other organizations and countries. Michael Qian indicated that the Third International Flavor and Fragrance Conference will be held in Santiago, Chile in October, 2019. Kanjana will be organizing a second symposium at the Thailand conference. She organized one in 2014 and will be organizing the second in Sept. 15-18, 2019. It is organized with a couple other conferences and is co-sponsored by the JAFIC. Michael Tunick is chairing Food Analysis, Lucy Yu and Alyson Mitchell are chairing Food Safety and Adulteration and Kanjana Mahattanatavee is chairing Flavor Analysis. Each symposium is proposed to be 1 day. Michael Tunick successfully submitted and receiving an IPG through ACS for $7,500 aimed at students (e.g. how do you write a journal article, how to you review a paper, etc.) for this meeting. The meeting will be held in conjunction with Food Ingredients Asia. In 2013 they had 19,000 visitors from 50 countries with 800 exhibitors. Michael Qian indicated that the Division may want to financially support the 4 symposia and suggested contacting Kanjana to determine estimated costs. The Executive Committee will be emailed details to follow and will vote on support. John Finley suggested that if anyone has a idea to put an IPG proposal in as ACS needs more submissions. Mike Tunick reminded everyone that they need to submit a final report for all IPG grants, as another cannot be submitted until a final report is filed. There is an annual cap of $12,000. Pacifichem will be held in Honolulu in December 2020.
**Subdivision Reports**, Flavor Vice-Chair G.K. Jayaprakasha reported that they did not have enough abstracts submitted for the flavor symposium for San Diego 2019 so they moved the abstracts to the Chemistry of Aged Beer and Spirits. Functional Foods & Natural Products Chair Hyang-Sook Chen said that they have three symposia in Orlando (2019), and one on fermented foods planned for Philadelphia and one on natural foods for San Francisco 2020. Hang Ma said that they were also planning a 3rd Global Maple symposium for San Antonio, TX for 2021. Ma also indicated that Xian Wu of Miami University volunteered to be the incoming secretary for the Functional Foods Subdivision. John Finley said that the Biotechnology Subdivision has fallen on hard times. To address this, he has recruited John Mehaney and Yu Wang to help with refreshing the Subdivision and requests changing the Subdivision name to Food Bioengineering due to the negative public image of “Biotechnology”. The division will propose symposium at the next meeting. A motion to approve the name change to Food Bioengineering was passed. Chair LinShu Liu reported that the Nutrition Subdivision has one symposium each in Boston, Orlando, and San Diego. Food Safety Chair Michael Granvogl reported that they have two symposia in San Diego and he will organize one in Philadelphia in Spring 2020.

Lucy Yu has asked to have a call for symposia proposals for the San Francisco meeting sent out to Division members 6 weeks before the Fall meetings with a symposium template attached. The symposium template is on the Division website. Alyson Mitchell will send out a separate email for a call for symposia on July 1, 2019 and direct organizers to contact the current Division Chair with new proposals. John Finley suggested that we may want to reinstate a Future Program Coordinator to help maintain consistency in communication between chairs. All Subdivisions have leadership through 2020 with exception of Functional Foods and Natural Products which has leadership through 2019. A request for a FFNP secretary will be included in a fall email blast.

Mike Appell gave the **Councilor’s Report**. He encouraged division members to serve on committees and said if anyone was interested in serving to let him or another council member know so they can make introductions. Mike Appell said that ACS membership grew last year by about 400 members. Mike pointed out that of the 400 new members, about 200 were in AGFD. To improve member retention, John Finley said that DAC suggested that Divisions send out a welcome letter to new members, and letters to jog the memories of members who forget to renew membership. Mike Tunick indicated the need for an alternate councilor to replace Lauren Jackson at this week’s council meeting. Alternative councilor Michael Qian was selected.

The **Nominations report** was given by Brian Guthrie. The slate of officers will be Liangli (Lucy) Yu, Chair; Youngmok Kim, Chair-Elect; H.N. Cheng, Vice Chair; Alyson Mitchell, Secretary; and Stephen Toth, Treasurer. H.N. Cheng is also a candidate for ACS President, and if he wins we will need a replacement for him.

Councilors: Michael Appell, John Finley, Michael Tunick, and Lauren Jackson.
Alternate Councilors: Alyson Mitchell, Michael Qian, Kathryn Deibler, and Keith Cadwallader.

The **Awards Committee** report was given by Xuetong Fan. Professor Fidel Toldra of Agroquimica y Tecnologla de Alimentos, Spain was selected for the IFF/AGFD award. He did not receive any information from Dr. Shahidi regarding the AGFD fellow award yet. The 2019 Roy Teranishi graduate fellowship award will be given to Brianne Linne of The Ohio State University. The winners of the Young Scientist Award is Dr. Ranjith Ramanathan of Oklahoma State University. The Sterling Hendricks award will be received by John Finley. Winner of the graduate student symposium are Yagmur Yegin (1st), Madeleine Bee (2nd) and Zihao Wei (3d). Winners of the undergraduate poster session include Lozano Salazar, (1st), Honglin Chen (2nd) and J. Zheng and Y. Liu (3rd). Kathryn Deibler asked though email how to increase student submissions to the Undergraduate Student Symposium and Young Scientist Award and asked if we should consider having the symposium every other year. Alyson Mitchell pointed out the challenge of increasing undergraduate participation as students don’t take advanced chemistry courses or join labs until their senior year. The AGFD student reps are connecting with more students via the student email list and this may help increase submissions. Lucy Yu suggested having undergraduate students present posters on literature reviews. The committee recognizes that financial support, networking and social events for students as critical for growing student membership. The Spencer Award, given by the Kansas City Local Section for achievement in agricultural and food chemistry, has been won by Thomas Sparks. Michael Qian and Bhimu Patel are both nominated for ACS Fellow Award.

The **Student Committee** report was given by Kathleen Luo and Zhuzhu Wang. During the poster session, the student
reps talked with all poster presenters, recruited 22 new members, handed out division “swag” and informed students about the Technical Divisions and the Cornucopia. The student reps held a social hour after the poster session that was attended by 11 students and the 2 reps. The student reps indicated that it would be beneficial to have a mechanism for paying Division membership online. Paypal is especially useful for International members. New payment options can be incorporated into the new website. Kathleen said that her and Zhuzhu’s 2-year appointment as reps would end after the San Diego meeting. Kathryn Deibler and Alyson Mitchell have documentation on how out-going student reps will be replaced. Alyson will send this information out to the executive committee and candidates will be identified based upon this information.

The **Strategic Planning** committee report was given for Lauren Jackson by Xuetong Fan. The division has met most goals outlined in the strategic plan. Lauren asked who will replace Agnes as the AGRO-AGFD liaison. Michael Appell volunteered.

Xuetong Fan reported for **Cornucopia** editor Carl Frey, who said that 224 copies of the short version (no abstracts) were sent to Orlando. The New Members Corner was liked by all. More gender and age diversity will be highlighted in the members that are highlighted moving forward.

**Hospitality/Public Relations**, Alyson Mitchell organized the Chair reception at Bahama Breeze and executive committee dinner at Oceanaire.

**Membership Chair** Michael Qian said that AGFD has 2,766 members and indicates that new membership is related to member recruitment by the AGFD student reps, the Flavor Conference in Wuxi in 2018, and Webinars which are an excellent recruitment tool for our division. In March 2018 the division membership was 2,393, so the division increased by 373 in one year. John Finley also spoke to the strength of having more food related Webinars for our Division and asked members to put forward their ideas. John Finley suggested applying for an innovative grant focused on recruiting and retaining members. Mike Appell will write something up to share with ACS leadership so they can recognize our efforts over the past year.

The **Journal report** was deferred until the Fall meeting by Associate Editor Lucy Yu.

During the **Communications report**, Mike Appell said ACS will no longer support Division websites as of May 1, 2019. They won’t take stuff down until the division has moved it. Ted Glass is currently creating a new website for the Division. We can use this as an opportunity to incorporate new functionality (e.g. payment, registration, merchandise, white papers, etc.). Platforms such as Square were discussed. A subcommittee focused on improving the website was formed and is Mike Appell, Kathleen Luo, Zhuzhu Wang, Alyson Mitchell, Stephen Toth and Michael Qian. Alyson Mitchell. She reminded everyone that newsworthy items for the monthly email blast are due a week before the end of the month.

**Old Business.** Lucy Yu asked on behalf of an organizer for the San Diego meeting if the committee would agree to support the travel of a distinguished professor and fellow from China. The committee agreed that it is the responsibility of organizers to raise travel funds for speakers and that this would set a precedence so the request was declined.

The Executive committee authorizes (and thanks) Mike Morello to collect the pictures of past Division Award winners and create a historical record for the Division website. The ACS Publications Division wants to know if our division is interested in publishing books. Mike Tunick indicated that ACS no longer puts book displays out, however we still get royalties for books and downloaded chapters. Mixed interest was shown for generating books as these are not counted the same as journal publications and usually have no impact factor.

**New Business.** John Finley indicated that ACS is putting forth an effort towards understanding and stopping sexual harassment, and suggests that we may want to incorporate language into our own division Bylaws. He also said Mike Morello is retiring and asked if the Division could consider having a special recognition of his many contributions. All agreed and will address this outside of the meeting.

The meeting adjourned at 7:56 p.m

Submitted by Alyson Mitchell, AGFD Secretary
Scenes from Orlando

Undergrad Poster Competition winners with Xuetong Fan

Zihao Wei, Madeleine Bee, Yagmur Yegin

Michael Granvogl, Brian Guthrie, Alyson Mitchell, Jerry Zweigenbaum

Steve Toth, Lucy Yu, Bhimu Patil

The Usual (AGFD) Suspects
A prize to the first send a correct solution to Carl Frey (via smartphone photo/e-mail) at cfreyenterprise@gmail.com

Congratulations to the first to submit a correct solution to the Spring 2019 crossword - John A. Immaraju of AMVAC Chemical Corporation Newport Beach, California

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<td>Earl Grey or Oolong</td>
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<tr>
<td>22</td>
<td>Tiny taste of beverage</td>
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<tr>
<td>23</td>
<td>House cat, for example</td>
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<tr>
<td>24</td>
<td>Big antlered forest resident</td>
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<tr>
<td>25</td>
<td>nitrotoluene or --- angle</td>
</tr>
<tr>
<td>26</td>
<td>Double this to call a Lady</td>
</tr>
<tr>
<td>27</td>
<td>Prefix: half</td>
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<tr>
<td>28</td>
<td>Wool-bearing S. American</td>
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<td>29</td>
<td>Insurance and mining -----</td>
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<td>30</td>
<td>San Diego’s ----- Park</td>
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<td>31</td>
<td>Bricklayer</td>
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<td>32</td>
<td>NaCl crystalline structure</td>
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<tr>
<td>33</td>
<td>Noah’s craft</td>
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<tr>
<td>34</td>
<td>Suitable or fitting</td>
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<tr>
<td>35</td>
<td>Israeli leader Golda ----</td>
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<tr>
<td>36</td>
<td>Jittery or anxious</td>
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<tr>
<td>37</td>
<td>Black burnt residue</td>
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<td>38</td>
<td>Blend or a commotion</td>
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<td>39</td>
<td>Nervous movements</td>
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<tr>
<td>40</td>
<td>You Like It</td>
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<td>41</td>
<td>Element of steel</td>
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AGFD DIVISION MEMBERSHIP APPLICATION

The Agricultural and Food Chemistry Division (AGFD) of the American Chemical Society (ACS) is a non-profit organization dedicated to the technical advancement of all aspects of agricultural and food chemistry. AGFD encourages technical advancement in the field by -
- organizing symposia/workshops on agricultural/food chemistry at ACS national meetings and other venues
- publishing proceedings of AGFD symposia
- publishing the Cornucopia newsletter
- updating members several times a year via e-mail blasts
- hosting social and networking gatherings at ACS national meetings
- providing cash awards and recognition to leading undergraduate and graduate students, young scientists and established scientists in the field of agricultural and food chemistry.

Join the 2500 members of AGFD. At ACS National Meetings you can discuss division activities at the AGFD Information table located near the AGFD technical session rooms. Join us via the application form (below) or on-line at www.acs.org (click on Membership & Networks, Technical Divisions, Join a Technical Division) or call ACS (800)333-9511 (in US) or 616-447-3776 (outside US). Payment by Visa/Master Card or AmEx.

Check out AGFD on You Tube: https://mail.google.com/mail/u/0/#inbox/160d7729ab173de5?projector=1

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<th>APPLICATION FOR AGFD DIVISION MEMBERSHIP (7623P)</th>
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<td>I am an ACS member and wish to join AGFD ($10.00)</td>
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<td>I am a full time student and wish to join AGFD ($10.00)</td>
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Be cool
JOIN AGFD

Return application, with payment (payable to American Chemical Society), to AGFD Membership Chair:
Michael Qian, Professor
Department of Food Science and Technology
Oregon State University
Corvallis OR 97330
AGFD OFFICERS & COMMITTEE LEADERSHIP

Chair - Serves 1 year. Presides over Division meetings & appoints committees
Xuetong Fan
USDA-ARS
Eastern Regional Research Center
600 E. Mermaid La.
Wyndmoor PA 19038
215-836-3785
xuetong.fani@ars.usda.gov

Chair-Elect - Serves 1 year. Substitutes for the chair as needed
Liangli (Lucy) Yu
University of Maryland
112 Skinner Bldg.
College Park MD 20742
301-405-0761 lyu5@umd.edu

Vice-Chair - Serves 1 year. Assists Chair-elect. Develops future technical programs.
Youngmok Kim
Finlays
81 Ocean State Drive
North Kingstown RI 02852
1-401-522-5553
youngmok.kim@finlays.net

Secretary - Responsible for Division correspondence and meeting minutes.
Allyson Mitchell
University of California
One Shields Avenue
Davis CA 95616 530-304-6618
aemitchell@ucdavis.edu

Treasurer - Responsible for Division finances.
Stephen Toth
International Flavors & Fragrances R&D
1515 Hwy. 36 Union Beach NJ 07735
732-335-2772
stephen.toth@iff.com

Cornucopia Editor - Edits newsletter.
Carl Frey cfreyenterprise@gmail.com
203-918-6007

Councilors - Represent Division for 3 years on ACS council.
Michael Appell (thru ’19)
michael.appell@ars.usda.gov
John Finley (thru ’20) jfinle5@lsu.edu
Lauren Jackson (thru ’20)
laurajackson@ida.hhs.gov
Michael Tunick (thru ’21)
mht39@drexel.edu

Alternate Councilors - Substitute for Councilors. Serves 3 years.
Kathy Cadwallader (thru ’20)
cadwlldr@uiuc.edu
Kathryn Deibler (thru ’21)
kdd3@cornell.edu
Alyson Mitchell (thru ’19)
aemitchell@ucdavis.edu
Michael Qian (thru ’18)
michael.qian@oregonstate.edu

At-Large Executive Committee

Members - Assist in Div. management
Serves 3 years.
Terry Acree (thru ’21) tea2@cornell.edu
Jane Leland (thru ’20)
JLelandEnterprises@gmail.com
Robert McGorrin (thru ’20)
robert.mcgorrin@oregonstate.edu
Mathias Sucan (thru ’21)
Mathias.sucan@gmail.com

Awards - Solicits nominations, oversees awards process.
Chair Michael Morello
mjmorrello226@gmail.com
Student Awards - Chi-Tang Ho ho@aesop.rutgers.edu
Fellow Awards - Fereidoon Shahidi fshahidi@mun.ca
Student Presentations - Kathryn Deibler
kdd3@cornell.edu
Canvassing - Stephen Toth
stephen.toth@iff.com

Finance - Monitors Division’s finances for 1 year. Led by Immediate Past Chair
Brian Guthrie brian.guthrie@cargill.com

Hospitality - Organizes receptions and banquets. Allyson Mitchell
aemitchell@ucdavis.edu

Membership - Recruits and retains Division members.
Michael Qian
michael.qian@oregonstate.edu

Multidisciplinary Program Planning helps coordinate nat’l mtg programming
John Finley jfinle5@lsu.edu

Nominations - Develops officer slate
Served by Immediate Past Chair.
Brian Guthrie brian.guthrie@cargill.com

Public Relations - Publicizes Division.
Allyson Mitchell aemitchell@ucdavis.edu

Student Activities - Attracts and retains graduate & undergraduate student members.
Kathleen Luokkluo@ucdavis.edu
Zhuzhu Wang zhuzhuw2@illinois.edu

Web Master - Maintains web site.
Michael Appell
michael.appell@ars.usda.gov

Sub-divisions

Flavor
Chair, Elizabeth Kreger
Liz.Kreger@pepsico.com
Chair-Elect, Tony Shao
Tony.shao@pepsico.com
Vice-Chair, GK Jayaprakasha
gkjp@tamu.edu
Secretary, Yu Wang yu.wang@ufl.edu

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hschun@cau.ac.kr
Chair-Elect, Hang Ma
hang_ma@uri.edu
Vice-Chair, Yu Wang
yu.wang@ufl.edu
Secretary, (open)

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Chair-Elect, Sam Alcaine
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Vice-Chair, Christopher Simmons
cwsimmons@ucdavis.edu
Secretary, (open)

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Chair-Elect, Youngmok Kim
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Vice-Chair, Mina Kim
minakim@jbnu.ac.kr
Secretary, Mathias Sucan
Mathias.sucan@gmailcom

Food Safety
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michael.granvogl@tum.de
Chair-Elect, Xiaohua He,
xiaohua.he@ars.usda.gov
Vice-Chair, Juhong Chen
jhong@cornell.edu
Secretary (2019), Tony Jin
Secretary (2020), Reuven Rasooly
AWARD NEWS

Thomas Sparks received the 2019 Kenneth A. Spencer Award for Outstanding Achievement in Agricultural and Food Chemistry. The award is given by the Kansas City Section of the ACS. The Spencer Award, the most prestigious ACS award recognizing advancements in agricultural and food chemistry is the latest of the numerous awards he has received for his work on entomology and insecticide toxicology. He recently retired as a Research Fellow from Corteva Agriscience DowDuPont and is currently a consultant at Agrilucent LLC.

John W. Finley won the 2019 Sterling B. Hendricks Award for Outstanding Achievement in Agricultural and Food Chemistry. The award will be presented at a lecture co-sponsored by the AGFD and AGRO divisions at the ACS Meeting in San Diego honoring his wide body of work ranging from amino acids, proteins, lipid metabolism, reduced calorie lipid substitutes, fiber and resistant starch, antioxidants, bioactives, food chemistry, food analysis and food components and their impact on health. He is a past AGFD division Chair and Associate Editor of the Journal of Agricultural and Food Chemistry. He is currently School of Nutrition and Food Sciences Adjunct Professor at Louisiana State University.

Fidel Toldrá won the 2019 Award for the Advancement of Application of Agricultural and Food Chemistry. This award recognizes outstanding contributions to pure and applied agricultural and food chemistry. The award presentation will take place at the AGFD banquet at the 2019 Fall ACS Meeting and celebrates his career researching the chemistry of proteases, the biochemical mechanisms that generate aroma and taste compounds and the development of electrodes to detect nucleotides, amines and amino acids. He is currently Professor at the Instituto Agroquímica y Tecnología de Alimentos in Valencia, Spain. This award is co-sponsored by IFF and AGFD.

Bosoon Park, USDA, ARS, U.S. National Poultry Research Center, Xuetong Fan, USDA, ARS, ERRC, Michael Granvogl, Technical Univ. of Munich & Univ. of Hohenheim, Luke R. Howard, Dept. of Food Science, University of Arkansas and Yan Xu, School of Biotechnology, Jiangnan University received 2109 AGFD Fellow Awards. The AGFD Fellow Award recognizes outstanding scientific contributions to the field of agricultural and food chemistry.

Navindra P. Seeram, University of Rhode Island received the 2019 Award for Distinguished Service to the Division of Agricultural and Food Chemistry, recognizing his frequent presentations at AGFD symposia and service in Division leadership positions, including Division Chair.

Brianne M. Linne, The Ohio State University received the 2019 Roy Teranishi Graduate Fellowship in Food Chemistry. This honor goes to a beginning graduate student with an outstanding graduate GPA who shows promise of an excellent research career. Her recent research has focused on quantification of perceived food texture.

Yagmur Yegin, Texas A&M Univ. won the 2019 Withycombe–Charalambous Award for Excellence in Graduate Research in Agricultural or Food Chemistry. She presented a paper at the Spring 2019 ACS National Meeting in Orlando describing her work on modifying food glove surfaces to enhance food safety. Coming in 2nd and 3rd place were Madeleine Bee, Food Science, Cornell Univ. and Zihao Wei, Dept. of Food Science, Rutgers University.

Lia Lozano Salazar, Point Loma Nazarene Univ., won the 2019 AGFD Undergraduate Poster Presentation Award for her work on isolation and formulation of radicinin as a biopesticide. Coming in 2nd and 3rd were Honglin Chin, Univ. of California, Davis and (tied) Yiyun Liu and Jack Jingyuan Zheng, both of Univ. of California, Davis.

AGFD’s own Michael C. Qian of Oregon State University received a 2019 ACS Fellow Award.

Ranjith Ramanathan won the 2019 AGFD Young Scientist Award at the ACS National Meeting in Orlando. He currently leads a group at the Department of Animal and Food Sciences Oklahoma State Univ., Stillwater, that studies both fundamental and applied aspects of beef quality to better understand beef color issues. This honor recognizes scientists early in their careers for their outstanding scientific contributions to agricultural and food chemistry.
more AWARD NEWS

Michael Hellwig, Technische Universität Dresden won the 2019 *Journal of Agriculture and Food Chemistry* Research Article of the Year Award for his publication *Yeast Metabolites of Glycated Amino Acids in Beer*.

The following loyal members of AGFD received the 25 Year AGFD Service Award in 2019: Robert Stephen Anthony, Anton Apriyantono, Russell Albert Bazemore, Feng Chen, Carolyn A Corder, Lynn Denson, John Didzbalis, Nicki Engeseth, Casey Craig Grimm, Matthias A Guentert, Kimberley Hooker Gray, Ganesan Narsimhan, Anne Plotto, Michael C Qian, Charles Ray, Giuseppe Ruberto, Mahmoud Abbas Saleh, Walter F Schmidt, Gregory Alan Sherman, Daniel Solaiman, Matthew J Toussant, Chao Wu, Yasumasa Yamada, Gow-Chin Yen.

AGFD congratulates all these awardees and looks forward to their continued successes and contributions.

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**Call for Nominations**

**Advancement of Application of Agricultural and Food Chemistry Award**

Recognizing and encouraging outstanding contributions to pure and/or applied agricultural and food chemistry.

Do you know someone who has (1) successfully applied chemistry and/or chemical technology to the solution of agricultural or food problems of importance to the nourishment and health of mankind or (2) has made outstanding contributions to the advancement of pure and/or applied agricultural and food chemistry? If so, go to (agfd.sites.acs.org/awards.htm) and complete the nomination form with the name, present affiliation, and achievements of the candidate and include up to 3 letters of endorsement. Email nominations to the Chair of the AGFD Awards Committee, Michael J. Morello (mjmorello226@gmail.com) by January 31, 2020. The award consists of a $3,000 honorarium, a plaque, up to $2,000 reimbursement of travel expenses incurred to attend the ACS National Meeting where the award is presented. A coordinated symposium highlights the awardee’s research. This award is administered by the Agricultural and Food Chemistry Division of ACS and is sponsored by International Flavors & Fragrances, Inc.
AGFD Technical Program

SUNDAY MORNING  August 25
Conv. Ctr. Room 33B  Section A
Chemistry & Utilization of Agro-Based Materials  Water in Chemistry & Agriculture  Cospons. AGRO, CELL, POLY

Conv. Ctr. Room 33A  Section B
Novel Structures from Food Biopolymers for Delivery of Bioactive Components

Conv. Ctr. Room 33B  Section A  Chemistry & Utilization of Agro-Based Materials  Value-Added Products from Agricultural Raw Materials  Cospons. AGRO, CELL and POLY

Conv. Ctr. Room 32A  Section D

CRISPR/Gene Editing & RNAi: Utilization for Enhanced Crop Production  Cospons. AGRO, Cospons. AGFD and BIOL

SUNDAY AFTERNOON
Conv. Ctr. Room 33B  Section A
Chemistry & Utilization of Agro-Based Materials  Value-Added Products from Agricultural Raw Materials  Cospons. AGRO, CELL and POLY
M. Appell, A. Biswas, S. Chang, H. Cheng, Organizers Z. Liu, Presiding
1:30 27. Preparation of polysaccharide-based functional soft materials using ionic liquids. J. Kadokawa
2:00 28. Advanced biopolymers for environmental and biomedical applications. S. Sun
3:00 30. Novel biobased and biodegradable thermoplastic polymer. S.D. Luebben
3:30 Intermission.
4:15 32. Modified tung oil-based fatty acid esters used as diesel additives to give improved lubricity. Z. Liu, J. Li, G. Knothe, B. Sharma, J. Jiang
4:45 33. Effects of water addition and microwave on natural deep eutectic solvents (NADES) and their extraction properties. A.V. Gomez, A. Biswas, C.C. Tadini, H.N. Cheng
Conv. Ctr. Room 33A Section B
Novel Structures from Food Biopolymers for Delivery of Bioactive Components
Q. Wang, Organizer A. Luo, Y. Zhang, Organizers, Presiding
1:30 34. Novel protein-liquid composite nanoparticles as delivery systems of hydrophilic nutraceutical compounds. L. Chen, G. Liu, Z. Tian
2:00 35. Formation and characterization of zein-oleic acid oleogels. G.W. Padua
2:30 36. Preparation and characterization of zein and gum arabic binary nanocomplexes in aqueous ethanol. C. Sun, J. Song, Y. Fang
3:00 37. WITHDRAWN
3:30 Intermission.
3:45 38. Effects of polysaccharides incorporating into sodium caseinate-high melting point fat microparticles to the survival of probiotic bacteria during simulated gastrointestinal digestion and storage. H. Liu, S. Nie, J. Gong, S.W. Cui, F. Zhong, Q. Wang
4:45 40. Development of cereal prolamin based nanoparticles as oral drug delivery system. Y. Zhang
Conv. Ctr. Room 32B Section C
Food Bioactives: Chemistry & Health Effects Cospons. AGRO
1:30 Introductory Remarks.
F. Shahidi, C. Udenigwe, Organizers, Presiding
2:35 43. Functionality and bioactivity of edible bioplastics derived from yellow pea proteins. C. Acquah, E. Di Stefano, Y. Zhang, M. Dube, C. Udenigwe
3:05 Intermission.
3:20 44. Role of plastein structure in biomolecular interactions of peptides. I.D. Nwachukwu, S. Yao, C. Acquah, C. Udenigwe
3:50 45. Impact of dietary γ-glutamylvaline (EV) against TNF-alpha induced inflammatory response in adipocytes via the activation of CaSR and PPAR-γ pathways. Y. Mine
4:20 46. Bioactive peptides in cured meats and its health relevance. F. Toldra, M. Gallego, M. Arisoy, M. Reig, L. Mora
4:50 47. Green, all-natural approach to extracting antioxidants from rosemary leaves. S. Ginsburg, F. Maleky (moved from Section C/Sunday Morning due to the religious reason)
Conv. Ctr. Room 32A Section D
Metals & Trace Elements in Food Safety, Health & Food Quality Cospons. AGRO
L. Jackson, B. Redan, Organizers, Presiding
1:30 48. Role of iron in meat pigment and quality. F. Shahidi
2:00 49. Effects of copper-based fungicides on Pennsylvania hop quality. B. Chrisfield, B. Gugino, H. Hopfer, R. Elias
3:00 Intermission.
3:15 50. Heavy metal speciation in agricultural soils. S.M. Uchimiya
3:45 51. Fate of silver nanoparticles in lettuce wash water as impacted by chlorine and organic matter. G. Gunathilaka, J. He, H. Li, W. Zhang, E. Ryser
4:15 52. Interaction of leafy vegetable romaine lettuce (Lactuca sativa L. var. Longifolia) with coexisting of ZnO nanoparticles and divalent heavy metals (Cd and Pb) with and in planta accumulation. H. Sharifan, J. Moore
Conv. Ctr. Room 31C Section E
Agnes Rimando Memorial International Student Symposium Biomedical & Biochemical Research Cospons. AGRO
B. Gao, R. Tardugno, M. H. Tunic, Organizers M. Granvogli, Organizer, Presiding
1:30 Introductory Remarks.
1:35 53. Procyanidin B2 attenuates metabolic syndrome by promoting TFEB nuclear translocation and restoring redox status. H. Su, W. Chen
1:55 54. WITHDRAWN
2:35 56. Gut microbiota-mediated protective effects of whole strawberry against colonic inflammation. Y. Han, H. Xiao
2:55 Intermission.
3:10 57. Anti-inflammatory and anti-cancer effects of free and bound polyphenols from Laminaria japonica, a widely consumed seaweed. Y. Gao, L. Yi, Y. Yang, Y. Han, H. Xiao
3:50 59. Piceatannol protects human retinal pigment epithelial cells against hydrogen peroxide mediated oxidative stress and apoptosis through PI3K/Akt signaling pathway. Y. Hao, Z. Wang, J. Liu, J. Wang
4:10 60. Dietary intake of king oyster mushroom (Pleurotus eryngii) ameliorated dextran sulfate sodium induced colitis in mice. H. Du, B. Yuan, Y. Han, M. Gu, Q. Hu, H. Xiao
Agrochemical Residue & Metabolism Chemistry Spons. AGRO, Cospons. AGFD
SUNDAY EVENING 5:30 - 7:30p.m.
Conv. Ctr. Hall A Section A
General Posters
L. Yu, Organizer
61. Plasticizer di-(2-ethylhexyl) phthalate (DEHP) in vegetables and fruits. X. Cao
62. Espresso from first principles: Route to highly reproducible cup quality. C.H. Hendon
63. Effect of organic selenium supplementation in cattle on mozzarella cheese quality and antioxidant activity. Z. Liu, Y. Xiao, J. Liu, D. Ren
64. Enzyme inhibition, antioxidant, and insecticidal activities of flavonoids and fixed oil from Albizia zygia (J. F. Macbr). G.K. Olovede, M.S. Alli, M. Lateef
65. Potential evaluation of Ganoderma formosanum extract against PM2.5-induced ROS generation. S. Chen, Y. Chan, K. Cheng
66. Screening of yeasts from fruits for grape wine production. L. Tien-Han, Y. Lai, K. Cheng
68. Immobilized of laccase for ginkgolic acid degradation. H. Chen, K. Cheng, Y. Ting
69. Evaluation of Ganoderma formosanum extract against PM2.5-induced ROS generation and cell damage. Y. Hsu, Y. Chan, K. Cheng
70. Insulin regulates the expression and translocation of GLUT8 to increase glucose uptake in bovine mammary epithelial cells. Y. Li, W. Dai, Q. Wang, J. Liu, H. Liu
71. Trans-10, cis-12 conjugated linoleic acid reduced the activity of nSREBP1 in bovine mammary epithelial cells via altering SCAP and INSIG1 expression. H. Shi, D. Tai, C. Wang, J. Liu, H. Liu
72. Study on fatty acid profile, flavour, and quality of mozzarella cheese made from a high omega-3 milk produced by lactating cow fed with flaxseeds diet. D. Ren, C. Wang, C. Liu, X. Wang, J. Liu, M. He, H. Wang
73. Evaluation of the phytochemical and fatty acids compositions of Vernonia amygdalina, Ocimum gratissimum and Telfairia occidentalis leaves. P.B. Ayoola, O.O. Onawumi
74. Effect of ethylene content in EVOH films on activation energies of diffusion of organic migrants and polymer modeling parameters. J.L. Koontz, Y.S. Song, A. Sarang
75. Immobilization of reporter bacteriophage PP01 on electrospun PHB fibers for Escherichia coli O157:H7 detection. S. Chen, M. Harrison, D. Sauvageau, A. Elias
76. Identification of aroma compounds in frozen surimi made from silver carp (Hypophthalmichthys molitrix) by normal phase chromatography fractionation and gas chromatography/oilfactometry. Y. An, Y.L. Qian, S. Xiong, M.C. Qian
77. Uptake of cadmium and arsenic by radishes grown in bat guano amended soil and remediation using modified natural zeolites. s. carrillo, S. Crawford
78. Development of a biocontrol agent using rice husk biochar with Bacillus sp. IA. T. Ano, S. Ebe, T. Ohike, M. Okanami
79. Comparing tomato seed flour and oil as potential value-added products. E.R. Bailoni, U. Choe, Y. Li, B. Gao, L. Yu
80. Study on fatty acid profile, flavor, and quality of mozzarella cheese made from high omega-3 milk produced by lactating cows fed with flaxseeds diet. D. Ren, C. Wang, C. Liu, X. Wang, J. Liu, M. He, H. Wang
81. Enhanced bacterial cellulose production using response surface methodology for Komactobacter intermedius. C. Chou, K. Cheng
82. Bakkenolides and caffeoylquinic acids from the aerial portion of Pestasites japonicas and their bacterial neuraminidase inhibition. H. Woo, H. Cho, Y. Oh, Y. Kim, D. Kim
83. Effective application of anode solution in microbial fuel cell to agriculture. Y. Fukumoto, S. Ebe, T. Ohike, M. Okanami, T. Ano
84. Isolation of anticancer constituents from Cucumis prophetarum var. prophetarum through bioassay-guided fractionation. A. Alsayari
85. Interactions between casein and sodium phosphate salts in processed cheese using surface-enhanced Raman spectroscopy. A.P. Barth, Y. Qu, C.B. Karaziack, W.H. Viotto, L. He
86. Pectin extraction from lemon peels and characterization. A. Rukhadze, S. Mestvirishvili, N. Kokiashvili
87. Hazard characterization of commercial products of dark brown sugar in Taiwan using fluorescence spectroscopy. Y. Lin, G. Yen, J. Lin
89. Chemical composition of cold-pressed blackberry seed flour and its free radical scavenging and anti-inflammatory capacities. U. Choe, Y. Li, B. Gao, J. Sun, P. Chen, L. Yu
91. Acid-triggered gastric-floating emulsion gel for sustained release. X. Liu, L. Wang, H.S. Liang, J. Li, B. Li
93. Antioxidant activities and constituents of leaves and fruits of a Japanese persimmon (Fudegaki). M. Yasuda-Tori, M. Inuzuka, K. Furuhashi, A. Nagata
94. Comparison of volatile compounds in garlic extracts according to different extraction methods. E. Jang, S. Lee, Z. Shim, M. Jeon, D. Lee, Y. Kim
96. Characterization of food additive silica nanoparticles in commercial products. S. Choi
98. Alpha-hederin nanopore for single-molecule detection. K. Jeong, K. Luo, Y. Kim
100. Nutritional analysis and study of shiitake mushrooms focusing on the dietary fiber content. J. Lee, J. An, S. Kim, D. Seo
101. Significant 19 amino acid analysis using three eggs and determination of LOD and LOQ. S. Kim, D. Seo, J. Lee
102. Comparison of mineral contents in raw and boiled poultry eggs by ICP-OES and ICP-MS. D. Seo, S. Kim, J. Park, S. Kim, J. Lee
104. Purification and identification of a putative sperm chemoattractant in the liverwort Marchantia polymorpha L.
Yamasaki, M. Takehara, T. Matsukawa, K. Yamato, S. Kajiyama
105. WITHDRAWN
106. Protein engineering of recombinant L-ribose isomerase from Actinobacillus ferments ATCC 43279 to alter its thermostability. T. Fang, Y. Liou
109. WITHDRAWN
110. Bio-based antioxidants for lubricant additives. Y. Cao, K.E. Uhrich
111. Difference in the aroma profiles of mealworm (Tenebrio molitor) according to cooking methods. H. Seo, D. Kim, I. Cho
112. Accumulation of P3HB by Methylocystis parvus MK using methane gas produced from anaerobic digestion of rice straw. M. Kim, B. Kim, Y. Choi, K. Nam
114. Metabolic profiling of secondary metabolites in phorbol ester containing and deficient Jatropha curcas seeds. K. Matsukubo, T. Matsukawa, S. Kajiyama
115. Comparative transcription and experimental analysis of photosensitive and non-photosensitive eggplant to identify genes involved in dark regulated anthocyanin biosynthesis. Y. Liu, H. Chen, Y. He
116. Volatile sulfur compounds exuded from roots of garlic plants and their activities toward the germination of spore of fungus Sclerotium cepivorum. Y.L. Qian, M.C. Qian, J. Dung
117. Identification of volatile compounds of blended coffee bean and application of principal components analysis. Y. Lee, H. Kim, D. Hong, J. Yu
118. Aroma characterization of oolong teas using dynamic headspace and SPME arrow coupled with gas chromatography-mass spectrometry. Y. Lin, W. Chang, S. Li, M. Pan, C. Ho, C.Y. Lo
119. Newly recognized phosphine resistance mechanisms in the rice weevil, Sitophilus oryzae. K. Kim, H. Jeon, S. Lee
120. Noble biomarkers in Eisenia fetida induced by CuO nanoparticles. H. Jeon, K. Kim, S. Lee
121. Green energy generation in a metal-organic framework implemented in electrochemical reactors and microbial fuel cells. H. Jeon, K. Kim, S. Lee
123. Extraction and biological evaluation of polysaccharides from Niudali (Millettia speciosa champ.) roots. X. Tang, Y. Lu, D. Li, N.P. Seeram, H. Ma
124. Effects of particle size on protein extraction from catfish by-products. Y. Zhang, S.K. Chang
125. Ochra toxin A analysis in wine and grape juice using LC-fluorescence detection with nanosponge solid phase extraction clean-up. M. Appell, K.O. Evans, M.A. Jackson, D.L. Compton
127. Differentiation of commercial vanilla extracts by volatile and non-volatile chemical profiles employing GC-MS and UPLC-UV-ESI-QTOF-MS: A market basket authenticity study. J. Godshaw, R. Rucker
128. Sustainable conformational modification of soy proteins by physical and chemical treatments. J. Zou, N.T. Nguyen, G. Sun
130. Atmospheric cold plasma promoted mung bean sprouting and the content of bioactive components. Y. Chou, Y. Ting, J. Wu, K. Cheng
131. Long-term impact of mushroom derived β-glucan on obesity and gut microflora in mice fed with high fat diet. M. Cho, M. Karthika, Y. Kim
133. Detection of Vibrio parahaemolyticus in marine foods based on denatured bubble-mediated isothermal nucleic acid amplification. X. Zhao, C. Yan, C. Ma
134. Characterization of cadmium absorption and translocation in amaranth affected by iron deficiency. H. Fan, R. Zou, L. Wang
135. Exploration of the compositional changes of Californian Hass and Gem avocados throughout the season and its effect on avocado flavor. B. Hausch, D.M. Ombden, M. Arpaia
137. Comparative study of safety, nutrition and flavor of aronia berry (Aronia melanocarpa) grown in the United States. X. Xie, T. Yi, W. Fang, C. Xu
140. Removal of dilute ethylene using repetitive cycles of adsorption and plasma-catalytic oxidation over Pd/ZSM-5 catalyst. S. Kim, Y. Mok
141. Linear and non-linear calibration approaches for the rapid quantification of marine oil omega-3 supplements using vibrational spectroscopy. S. Karunathilaka, B. Yakes, S. Choi, L. Brückner, Z. Ellsworth, M.M. Mossoba
142. Efficient engineering of T4 bacteriophage via CRISPR-Cas9-M. M. Duong, S.R. Nugen
143. Protein oxidation in food: Focus on individual structures. P. Richter, M. Hellwig
144. Identification of predominant contributors to off-odors in thermally processed muskmelon juice using multidimensional gas chromatography techniques and comparative aroma extract dilution analysis. X. Pang, K.R. Cadwallader, F. Kong
146. Effect of thermal sterilization on the aroma profile of Lychee (Litchi chinensis Sonn.) juice. K. An, Y. Xu, M.C. Qian
147. WITHDRAWN
148. Differences in lipid content of young and aged Pinot Noir wines and their impacts on wine mouthfeel perception. Q. Phan, E. Tomasono
149. Identifying hyperstable proteins in legumes: Implications for food allergy and intolerance, and GMOs. W. Colon, J. Thibeault, K. Xiæ
150. Analysis of fungicides by liquid chromatography-mass spectrometry. R. Raina-Fulton, A. Mohamad, A. Behdarvand
151. Chemical composition of a red sorghum variety (Ji Liang No.1) and its antioxidant and anti-inflammatory properties. Y. Zhang, M. Li, H. Gao, B. Wang, T. Xu, B. Gao, L. Yu
153. Chemical compositions and antioxidant properties of cold-pressed edible seed flours. Z. Song, L. Yanfang, B. Gao, L. Yu
155. Novel metal-organic frameworks for encapsulating curcumin to achieve controlled release. Q. Wang, P. Ma
156. Effect of fragmentation degree on sensory and texture attributes of cooked rice. Z. Wang, H. Su, X. Bi, M. Zhang
157. Gypenosides prevent obesity and insulin resistance in C57BL/6J mice by improving thermogenesis in association with alleviating gut dysbiosis. J. Liu, L. Yanfang, P. Yang, L. Yu
159. Analysis of triacylglycerol, sterol, and tocopherol compositions of oils from 8 different berry seeds by ultra-performance convergence chromatography-quadrupole time-of-flight mass spectrometry. B. Gao, Y. Luo, F. Yuan, Y. Zhang, L. Yu

**MONDAY MORNING** August 26

Conv. Ctr. Room 33B Section A
Chemistry & Utilization of Agro-Based Materials Agro-Based Fibers & Textiles Cospons. AGRO, CELL, POLY
M. Appell, A. Biswas, H. Cheng, Organizers S. Chang, Organizer, Presiding
8:30 160. Gating infrared radiation in a textile. Y. Wang
10:00 Intermission.
10:45 164. Imaging of cotton fiber maturity using an infrared focal plane array detector. M. Santiago
11:15 165. Variation in the level of metals on raw, scoured, and bleached varietal cotton samples produced in different locations. C.A. Fortier, C.D. Delhom, M.K. Dowd

Conv. Ctr. Room 33A Section B
**Novel Structures from Food Biopolymers for Delivery of Bioactive Components**
A. Luo, Q. Wang, Y. Zhang, Organizers, Presiding
8:00 166. Lignin and hemicelluloses isolated from the largest bamboo species: Dendrocalamus sinicus. Z. Shi, C. Wu, G. Xu, J. Zhang, M. Dong, C. Liu, Z. Guo
8:30 167. Formation of coacervated Pickering emulsions: Effect of the interactions between protein and polysaccharide. Y. Yuan, M. Li, S. He
9:00 168. Development of phospholipid-based pterostilbene nanoemulsion system: Preparation, storage stability, and oral bioavailability. Y. Ting, F. Sun, Y. Chou
10:00 Intermission.
9:15 188. Barrel-aged compounds commonly associated with barrel substrate. J. Welbaum
9:55 Panel Discussion.
10:05 Intermission.
10:10 190. History and chemistry of tequila. C.E. Hobbs
10:30 191. Effect of oak spiral aging on beer IBU, dissolved oxygen, SRM, and ABV. N.O. Flynn
10:50 192. In-line detection of diacetyl throughout fermentation in brewing beer. A. Campanella, M.D. Mosher
11:10 193. Impact of water constituents on taste/mouthfeel properties of distilled spirits. Z. Wang, K.R. Cadwallader
11:50 Panel Discussion.

Agrochemical Residue & Metabolism Chemistry  Spons. AGRO, Cosponsors. AGFD
2019 ACS International Award for Research in Agrochemicals: Advances in the Physiology & Biochemistry of Insect Control  Spons. AGRO, Cosponsors. AGFD, BIOL, MEDI, POLY, PROF

MONDAY AFTERNOON
Conv. Ctr. Room 33B  Section A
Chemistry & Utilization of Agro-Based Materials  Improved Utilization of Agricultural Raw Materials  Cosponsors. AGRO, CELL, POLY
M. Appel, A. Biswas, H. Cheng, Organizers  S. Chang, Organizer, Presiding
2:00 196. Functional properties of pulse flours affected by processing. M. Singh
2:30 197. Variability of the chemical composition in the Abies species. J. Kim, S. Lim, C. Lee
3:00 198. Diabetes is an environmental risk factor: Chemistry, biochemistry, and structural characterization via MALDI-TOFMS of target molecules found in bitter melon peel potentially useful for fighting macrovascular complications as well as blindness in diabetic patients. B. Dayal, A. Kulkarni, G.S. Hall
3:30 Intermission.
3:45 199. Phosphorus flame retardants from crop plant phenolic acids. B.A. Howell, E.A. Ostrander, K. Oberdorfer
4:15 200. Experimental design for the extraction of phenolics from Mentha arvensis L. using green extraction media. Z. Naseem, M. Zahid, M.A. Hanif, M. Shahid, T. Hussain
4:45 201. Computer-aided agrochemistry: Overview of modelling possibilities at the molecular level. B. Horta

Conv. Ctr. Room 33A  Section B
Nanotechnology Applications for Food & Agriculture  Cosponsors. AGRO
T. V. Duncan, Organizer  S. Nam, B. Park, Organizers, Presiding
1:30 Introductory Remarks.
2:00 203. WITHDRAWN
2:25 204. High-throughput Shiga toxin detection using immune-sensing technology with surface plasmon resonance imaging. B. Park, J. Chen, X. He
2:50 Intermission.
3:05 205. Macromolecular therapies in treatment of citrus greening. V.A. Plunova, J. Hedrick, N. Haininen
3:55 Concluding Remarks.

Conv. Ctr. Room 32B  Section C
Food Bioactives: Chemistry & Health Effects  Cosponsors. AGRO
F. Shahidi, C. Udenigwe, Organizers, Presiding
1:30 Introductory Remarks.
1:35 207. Omega-3 oils and lipophenols as important food bioactives. F. Shahidi
2:05 208. Canola oil: Important source of omega-3 fatty acids, but also an oil with flavor challenges. M. Granvogl, K. Matheis
2:35 209. Effects of honey extracted polyphenols on serum antioxidant capacity and metabolic phenotype. H. Zhao
3:05 210. Effect of growing conditions on the digestibility and anti-oxidant activity of the Nebraskan Great Northern dry edible bean (Phaseolus vulgaris). K. Majumder
3:35 Intermission.
4:20 212. Nucleophilic chemistry of tea polyphenols. W. Hung, C. Ho

Conv. Ctr. Room 32A  Section D
Metals & Trace Elements in Food Safety, Health & Food Quality  Analytical Methods of Metals & Trace Elements  Cosponsors. AGRO
L. Jackson, B. Redan, Organizers, Presiding
1:30 214. Status update on methods for arsenic speciation at FDA. S. Conklin
2:00 215. Two-year study of elemental differences in pinot noir wines from different neighborhoods within one AVA. C.K. Tanabe, J. Nelson, S.E. Ebeler, H. Hopfer
2:30 216. Selective and sensitive determination of bromate in bread by IC-MS. M. Aggrawal, J.S. Rohrer
3:00 Intermission.
3:15 217. Rapid detection of engineered nanomaterials in environmental and food matrices using surface-enhanced Raman spectroscopy. L. He
4:15 Concluding Remarks.

Conv. Ctr. Room 31C  Section E
Agnes Rimando Memorial International Student Symposium  Cosponsors. AGRO
B. Gao, M. Granvogl, M. H. Tunick, Organizers  R. Tardugno, Organizer, Presiding
1:30 219. Comparison of aroma compounds in fresh-water and salt-water frozen surimi. Y. An, Y.L. Qian, S. Xiong, M.C. Qian
1:50 220. Elucidation of the molecular background of smoky and hammy off-flavors in cocoa. D. Fuellmann, M. Steinhaus
2:10 221. Thermally induced generation of desirable aroma-active and undesirable toxicologically relevant compounds from glucosinolates. C. Schury, T. Hofmann, M. Granvogl
2:30 222. Fatty acid profiles of neutral and polar whey lipids determined by ionic liquid stationary phase gas chromatography. Q. Ferraris, M.C. Qian
2:50 Intermission.
3:05 223. Discovery of novel α-amylase inhibitors from natural products with a computer-aided approach. L. Xie, W. Chen
3:25 224. Development of a filter-based SERS platform for total and specific bacterial detection. S. Gao
4:05 226. Identification and characterization of curcumin-metabolizing gut bacteria. E. Zhao, K. Chacon-Vargas, J. Gibbons, H. Xiao

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Challenges & Opportunities Facing Early Career Scientists: Early Career Scientist Symposium Spons. AGRO, Cospons. AGFD, BIOL

MONDAY EVENING  8:00 - 10:00p.m.
Conv. Ctr. Hall B  Section A
Sci-Mix
L. Yu, Organizer
61, 63, 65, 68, 74, 75, 76, 79, 80, 82, 83, 87, 88, 131, 133, 136, 138, 346 See Previous and Subsequent Listings.

TUESDAY MORNING  August 27
Conv. Ctr. Room 33B  Section A
Chemistry & Utilization of Agro-Based Materials Nanoscience & Related Materials  Cospons. AGRO, CELL, POLY
M. Appel, A. Biswas, S. Chang, H. Cheng, Organizers  C. Sabliov, Presiding
9:00 228. Development of functional materials by utilizing bioresource polymers. J. Li
9:30 229. Pesticide-loaded cationic zein nanoparticle as a control agent against soybean looper. C. Sabliov, S. Navarro, C.E. Astete, J. Davis
10:00 230. Seed priming with nanomaterials from agro-industrial byproducts modulate the growth and metabolome of onion seedlings. J. Semper, P. Acharya, G.K. Jayaprakash, B. Patil
10:30 231. Therapeutic nanoparticles penetrate leaves and deliver nutrients to agricultural crops improving tomato yields. A. Schroeder
11:00 232. Cellulose nanocrystals confined to polymer microgels. S. Lee, E. Reichmanis, J. Park, M. Srinivasarao

Conv. Ctr. Room 33A  Section B
Nanotechnology Applications for Food & Agriculture Cospons. AGRO
T. V. Duncan, Organizer  S. Nam, B. Park, Organizers, Presiding
8:30 Introductory Remarks.
8:35 233. Tuning aesthetic and mechanical properties of oleogels via formulation of enzyme-enabled stereoisomeric molecular gellers. M. Samateh, S.S. Sagiri, R. Sanni, G. John
9:00 234. Reclaiming phosphorus from secondary treated municipal wastewater with engineered biochar. Y. Zheng, B. Gao
9:50 Intermission.
10:30 237. Continuous flow formulations by fast nanoprecipitation and in silico structure determination of selected agrochemical active ingredients. Á. Bódí, F. Somodi, T. Bihari, F. Darvas
10:55 Concluding Remarks.

Conv. Ctr. Room 32B  Section C
Nutrition, Diet, Functional Foods in Health W. Chen, Y. Ito, M. Kobori, L. Liu, D. Ren, Organizers, Presiding
8:00 Introductory Remarks.
8:05 238. Diet and microbiota during adulthood in health and disease. G. Wu
8:40 239. Antioxidative properties of dietary quercetin in plasma and tissues in diet-induced obese mice and aged mice. M. Kobori
9:00 240. Current research in intestinal microbiota, synbiotics, and obesity-related disease. H. Kim, K. Seo, D. Kim, W.H. Yokoyama
9:40 Intermission.
10:10 243. Western diets affect hippocampus metabolism and neuropeptides through gut-microbiota-brain axis. M. Zhang, S. Song, G. Zhou, X. Xu, C. Li
10:30 244. Activation of AMPK/SIRT1 pathway contributes to Salvianolic acid A-conferred protection against lipotoxicity in hepatocytes and NAFLD in mice. S. Li, Q. Qian, N. Ying, J. Lai, L. Feng, s. Zheng, F. Jiang, H. Chai, X. Dou
10:50 245. Advancing the delivery of curcumin and its primary metabolite in plants. J.W. Finley, S.O. Duke
8:25 247. Amazing health benefits of pterostilbene: Beloved molecule of Dr. Agnes M. Rimando. C. Ho

Conv. Ctr. Room 32A  Section D
Agnes Rimando Memorial Symposium in honor of the Scientist & International Ambassador of Agricultural & Food Chemistry Cospons. AGRO
K. Mahattanatawnee, Organizer  J. V. Leland, W. H. Yokoyama, L. Yu, Organizers, Presiding
8:00 Introductory Remarks.
8:05 246. Agnes Rimando, a pioneer in the fate of glyphosate and it primary metabolite in plants. J.W. Finley, S.O. Duke
8:45 248. Early career discovery of bioactive natural products. M. Appell
9:05 249. Methods for identifying and characterizing health-promoting compounds in fruit and other agricultural products: Tribute to the work of Dr. Agnes Rimando. L. Jackson
9:25 Intermission.
9:40 250. Agnes Rimando, scientist and international ambassador. H.N. Cheng
10:00 251. Healthy and tasty fruit products from pterostilbene to raspberry ketone. M.C. Qian
10:20 252. Inactivation of pathogenic bacteria, fungi, and protozoa by phenolic and other natural compounds. C. Tam, J. Kim, C. Levin, L.W. Cheng, K. Land, M. Friedman
11:00 254. Subcritical hydrolysis of ice-cream wastewater for value-added applications. M. Enteshari, S. Martinez-Monteagudo
11:20 Concluding Remarks.

Conv. Ctr. Room 31C Section E

ACS-AGFD Young Scientist Award Cospons. PROF
K. Deibler, L. Yu, Organizers, Presiding
10:00 Introductory Remarks.
10:05 255. Biomolecular interactions between myoglobin, mitochondria, and metabolites governing fresh meat color. R. Ramanathan
10:45 Concluding Remarks.

Conv. Ctr. Room 31C Section E

USDA-ARS Sterling B. Hendricks Memorial Lectureship Symposium Cospons. AGFD, AGRO
M. Appell, C. Hapeman, Organizers, Presiding
11:30 Introductory Remarks.
11:40 256. Evolution and future needs of food chemistry in a changing world. J.W. Finley
12:30 Concluding Remarks.

2019 ACS International Award for Research in Agrochemicals: Advances in the Physiology & Biochemistry of Insect Control Spons. AGRO, Cospans. AGFD, BIOL, MEDI, PROF

TUESDAY AFTERNOON

Conv. Ctr. Room 33B Section A

Chemistry & Utilization of Agro-Based Materials Advanced Materials from Agricultural Sources Cospans. AGRO, CELL, POLY
M. Appell, A. Biswas, S. Chang, H. Cheng, Organizers D. L. Compton, Presiding
1:30 257. Utilizing the organization of nanocellulose and semiconducting polymers towards next generation bio-based electronics. B. Risteen, E. Reichmanis
2:00 258. Bio-derived molecular materials: Ability to adapt, clean, energy storage and therapeutic. G. John
2:30 259. Graft-modification of chitosan biopolymer with phosphonated polymer via nitroxide-mediated polymerization. X. Solimando, P. Champagne, M. Cunningham
3:00 260. Customization of chemical structure and reactivity of agro-based materials for applications in coatings. V.M. Mannari
3:30 Intermission.
3:45 261. Characterization of carbohydrate polymers using molecular rotor as a structural probe. Y. Yao

Conv. Ctr. Room 33A Section B

AGFD Award Symposium Honoring Dr. Fidel Toldra Cospons. PROF
X. Fan, Organizer F. Shahidi, Organizer, Presiding
2:00 Introductory Remarks.
2:10 264. Protein hydrolysates and biopeptides from seafood and processing by-products thereof. F. Shahidi
2:30 265. Pea protein-derived peptides as inhibitory agents against carbohydrate and lipid-digesting enzymes. T. Awasika, R. Aluko
2:50 266. Computational approach to mimic gastrointestinal digestion and predict novel peptides with angiotensin converting enzyme-I (ACE-I) inhibitory activity. S. Hazra, K. Majumder
3:10 267. Chemistry and biological significance of food-derived pyroglutamyl peptides. C. Udenigwe
3:30 268. Investigation of the concept of refreshing perception, related flavor components, and its application in sugar-reduced beverage by flavor instrumental analysis and sensory evaluation. X. Du
3:50 269. Considerations in the hydrolysis of insect proteins to improve their bioactivity and decrease allergenicity. A. Liceaga
4:10 270. Recent progress in enzymatic release of food-derived peptides and assessment of bioactivity. F. Toldra

Conv. Ctr. Room 32B Section C

1:20 Introductory Remarks for 2019 Journal of Agricultural and Food Chemistry the research article of the year award presentation.
1:30 271. Microbial metabolism of glycated amino acids. M. Hellwig, T. Henle (the 2019 JAFC the year award presentation)
2:10 Intermission.
2:30 272. Combined proteomics and transcriptomics analysis of Lactococcus lactis under different culture conditions. L. Li, X. Yang, R. Hong
2:50 273. Comparative kinetics of soy protein gel digestion: Role of mechanical structure and spatial organization. Y. Guo, P. Takhir
3:10 274. Consequences of superfine grinding treatment on structure, physicochemical, and rheological properties of transglutaminase-crosslinked whey protein isolate. C. Wang, T. Li, L. Ma, T. Li, J. Hou, Z. Jiang
3:30 275. Phenolic composition of blue honeysuckle and its protective effect against oxidative damage following gastrointestinal digestion and gut microbiota fermentation. T. Bao, L. Xie, J. Xie, W. Chen
3:50 276. Evaluation of trans-resveratrol levels in grape wine using laser-induced graphene-based electrochemical sensors. C. Zhang, J. Ping, Y. Ying

Conv. Ctr. Room 32A Section D

Proposition 65 on Food Safety M. Granvogl, S. Macmahon, Organizers Presiding
1:30 Introductory Remarks
1:35 277. Food-borne toxicants in Proposition 65: Formation and analysis. M. Granvogl
2:05 278. Risk assessment of inherent chemical contaminants. P. Hanlon


Conv. Ctr. Room 31C, Section E

Functional Foods: The Chemistry, Bioactivity, Bioavailability, & Biomarkers of Dietary Phytochemicals


WEDNESDAY MORNING August 28

Conv. Ctr. Room 33B, Section A

Innovative Approaches to Enhancing Food Safety & Reducing Food Waste: Cospcons. AGRO


Conv. Ctr. Room 33A, Section B

Teaching & Learning Food Chemistry & Analysis


Conv. Ctr. Room 32B, Section C

Nutrition, Diet, Functional Foods in Health


Conv. Ctr. Room 32A, Section D

Proposition 65 on Food Safety: Cospsons. AGRO

10:45 315. Reducing the acrylamide-forming potential of wheat, rye, and potato: From crop management to variety selection and genome editing. N. Halford
11:15 316. Pyrrolizidine alkaloids: Occurrence, properties, and analysis. J. Kuhlmann
11:45 317. WITHDRAWN

Conv. Ctr. Room 31C  Section E
Functional Foods: The Chemistry, Bioactivity, Bioavailability, & Biomarkers of Dietary Phytochemicals
S. Sang, Organizer  J. Daily, Y. Zhu, Organizers, Presiding
8:00 Introductory Remarks.
8:05 318. Chungkookjang, a fermented soybean food, fermented with Bacillus amyloliquefaciens SRCM100730 and SRCM100731 protected against ischemic stroke and post-hypoglycemia by improving blood flow in gerbils. J. Daily, S. Park
8:30 319. Modulation of energy sensing targets by natural products: Effects on health span. M.B. Zemel
8:55 320. Oxidative fragmentation of aspalathin leads to the formation of dihydrocaffeic acid and the related lysine amide adduct. M.A. Glomb, N. Mertens
9:20 321. Mechanistic investigation of methylglyoxal adducts of 5-hydroxytryptamine in mice. T. Yao, C. Hu, S. Sang
9:45 Intermission.
9:55 322. Quantitative analysis, bioactive evaluation, and biotransformation of oat avenanthramides with two double bonds. C. Hu, Y. Tang, S. Sang
10:20 323. Isolation and purification of 5-n-alkylresorcinols from 21 different wheat varieties and its inflammation inhibitory potential under LPS induced RAW264.7 macrophages. J. Liu, Y. Hao, Z. Wang, J. Wang
10:45 324. Phytochemical investigation, biological assessment, and quantitative analysis of Ziziphus jujuba resources from China. N. Bai, S. Guo, L. Bai, T. Wang, S. Zhang
11:10 325. Phytochemical characterization and antioxidant capacity of four native populations of fine or flavour cocoa (Theobroma cacao L.) from Peru. I. Best, K. Grabiel, C. Plasencia, L. Mendoza, F. Pérez-Canø, M. Castell, S. Pastor-Soplin

Agrochemical Residue & Metabolism Chemistry  Spons. AGRO, Cospons. AGFD
Biological Considerations for Agrochemical Control  Spons. AGRO, Cospons. AGFD

WEDNESDAY AFTERNOON
Conv. Ctr. Room 33B  Section A
Innovative Approaches to Enhancing Food Safety & Reducing Food Waste  Cospons. AGRO  M. Guo, Organizer  T. Z. Jin, Organizers, Presiding  X. Fan, Presiding
1:30 Introductory Remarks.
1:35 327. Introduction of food waste reduction & recovery program in San Diego. G. Grootenhuis
2:00 328. Systems approach to reducing postharvest losses of fresh fruits due to rot-causing pathogens. C. Xiao
2:30 329. WITHDRAWN
2:55 330. Edible coating to keep fresh-cut fruits fresh and safe. T.Z. Jin
3:20 Intermission.
3:55 332. Light-activated antimicrobial plastic material with chitosan: Characterization and reusability. L.J. Bastarrachea, A. Gagon
4:20 333. Targeted inactivation of antibiotic-resistant Escherichia coli and Pseudomonas aeruginosa in a soil-lettuce system by combined polyvalent bacteriophage and biochar treatment. Y. Mao, S. Mingming

Conv. Ctr. Room 33A  Section B
Edible Functional Food Packaging from Agricultural Biomacromolecules  Cospons. AGRO
L. Chen, X. Liu, Organizers, Presiding
1:30 Introductory Remarks.
1:35 334. Chain conformation and biological activities of fungal polysaccharides. L. Zhang, X. Xu
2:25 335. Silver nanoclusters embedded zein films as antimicrobial coating materials for food packaging. L. Mei, Q. Wang
3:05 Intermission.
4:00 339. Anti-glycation effect and advanced glycation end-products protein cross-links breaking ability of Psidium guajava leaf extracts. O.I. Adeniran, M.A. Mogale
4:20 Concluding Remarks.

Conv. Ctr. Room 32B  Section C
Nutrition, Diet, Functional Foods in Health
L. Liu, Organizer  W. Chen, Y. Ito, M. Kobori, D. Ren, Organizers, Presiding  K. Deibler, Presiding
2:10 341. Functional foods: Advancement of definition and evaluation of scientific investigations. D.M. Martirosyan
3:15 Intermission.
3:30 343. Lactobacillus rhamnosus GG components exert protective effects on mouse macrophages upon lipopolysaccharide challenge. H. Wang, S. Qi, X. Luo
4:45 346. ASCT2 and SARS are involved in Metabolic syndrome. Y. Zhao, J. Liu, H. Liu

Conv. Ctr. Room 32A  Section D
Proposition 65 on Food Safety  Cospons. AGRO
M. Granvogl, S. Macmahon, Organizers Presiding
1:30 347. Reliable analysis of bisphenol A in beverage, food, infant formula, feed and dietary supplement matrices. K. Mastovska, S. Li, J. Shippar
2:00 348. Plasticiser residues in edible oils and fats: Occurrence & analysis. J. Kuhlmann
2:30 349. Non-targeted screening of nuts and nut products for Proposition 65 compounds. J. Zweigenbaum, A.E. Mitchell
3:00 Intermission.
3:15 350. Distinguishing between natural and industrial lead in consumer products and other environmental matrices. A. Flegal, K. Odigie
3:45 351. Toxic elements in food in the United States. J. Fong Sam
4:15 352. Prop 65: Analysis of As, Se, Cd, Hg, & Pb in traditional foods and “new foods” using inductively coupled mass spectrometry (ICPMS). J. Nelson, C. Jones

Plant-Insect-Microbe Communications in Agriculture: General Session Spons. AGRO, Cospons. AGFD

THURSDAY MORNING August 29
Conv. Ctr. Room 33B Section A
Innovative Approaches to Enhancing Food Safety & Reducing Food Waste Cospons. AGRO
M. Guo, Organizer T. Z. Jin, Organizer, Presiding X. Fan, Presiding
8:30 Introductory Remarks.
8:35 353. Antioxidant activities of potato peel extractives. C. Wu, K. Yang, J. Li, E. Eibkade, D.G. Vlachos
9:00 354. Microbial volatile biomarkers for MP charcoal rot and Rhizopus soft tissues in sweet potatoes. C. Gamlath Mohottige, T. Mslna, R. Baird
9:25 355. Microencapsulation of antibiotic alternatives to modulate microflora at target intestinal location. Y. Wu
9:50 356. Efforts to improve the long-term precision of fumonisins quantitation by LC/MS using a 13C labeled internal standard and a well characterized trending sample. B. Strong, R. Sarver, E. Bergeron
10:15 Intermission.
10:50 358. The discrimination of production process and age of Zhenjiang aromatic vinegar based on SPME-MS. Z. Sun, X. Liao, X. Liu, X. Yan
11:05 359. WITHDRAWN

Conv. Ctr. Room 33A Section B
Edible Functional Food Packaging from Agricultural Biomacromolecules Cospons. AGRO
L. Chen, X. Liu, Organizers, Presiding
8:30 360. Visible colorimetric oxygen indicator for quick response and real-time measurement of the integrity of modified atmosphere packaging. X. Li
8:50 361. Fabrication of chitin nanofiber/calcium alginate sponges and their application as wound healing. Y. Du, Z. Pang
9:30 362. Protein unfolding and aggregation of PSE-like chicken meat protein at an extreme alkaline pH: Influence on edible film-forming properties. X. Zhao, T. Xing, X. Xu
9:50 Intermission.
10:05 363. RFID-enabled wireless humidity sensor for food packaging. S. Ye
10:25 364. Improved thermal stability of W1/O/W2 double emulsions with bioactive peptide/polysaccharide complexes prepared by self-assembled electrostatic interaction. Y. Jo, U. van der Schaaf, S. Min

Conv. Ctr. Room 32B Section C
The Role of the Microbiome in Mediating Health Effects of Dietary Components
H. Xiao, G. Zhang, Organizers, Presiding
8:00 Introductory Remarks.
8:05 365. Impact of gut microbiota on the metabolism and bioactivity of [6]-shogaol in ginger. S. Sang
8:30 366. Dietary flavonoid and gut microbiota interaction: Critical in anti-inflammation and anti-cancer in the colon. H. Xiao
8:55 367. Vitamin E forms: Protective effects on gut health and modulation of gut microbiome. Q. Jiang
9:20 Intermission.
9:35 368. Mildly oxidized vegetable oil exaggerates colitis and colitis-associated colon tumorigenesis. G. Zhang
10:25 370. Targeted metabolomics identifies linoleic acid-derived epoxyoctadecenoic acids (EpOMEs) as critical regulators of colon tumorigenesis. G. Zhang
10:50 371. Impact of different starter cultures on the quality of salami sausages. Y. Liu, J. Wei, J. Wang

Conv. Ctr. Room 32A Section D
General Papers
L. Yu, Organizer B. Gao, E. Kreger, C. Shao, Presiding
8:30 Introductory remarks.
8:35 372. Studies on the effect of processing method on the loss of nutrients in some grains and legumes. M.C. Azih
9:35 375. Pru du 8: First member of a new food allergen family. C. Fryganas, R.H. Brown, C. Drake, R. Sepela, A.E. Hagerman
10:35 378. Identification of aroma compounds in four Chinese mango juices, and effects of thermal and high-pressure processing on the mango juice aroma profiles. W. Zhang, F. Lao, J. Wu

Plant-Insect-Microbe Communications in Agriculture: General Session Spons. AGRO, Cospons. AGFD
AGFD 1 Biomimetic agrobased materials for food safety
Michael Appell3, michael.appell@gmail.com, Michael A. Jackson1, Kervin O. Evans1, David L. Compton1, Wayne Bosma2. (1) Renewable Products Tech., USDA/NCAUR, Peoria, Illinois (2) Dept of Chemistry and Biochemistry, Bradley Univ., Peoria, Illinois (3) Mycotoxin Prevention and Applied Microbiology, USDA-ARS, Peoria, Illinois Food contamination by toxins poses serious health risks and is a costly issue that reduces commodity values as well as consumer understanding. Exposure to regulated toxins is evaluated through popular detection methods. More efficient, economical, and reliable diagnostic tools will enable broader sampling and better understanding of exposure. The incorporation of rationally designed synthetic materials into methods of detection offers a means to overcome the limitations of traditional methods and improve robustness in analyses through the inclusion of functional groups that do not exist in commonly used biomaterials, such as proteins. Biomimetic synthetic receptor materials have been developed for selective recognition of the mycotoxins citrinin, patulin, fusaric acid, zearalenone, and ochratoxin A under aqueous conditions. The biomimetic materials were successfully applied in sample clean-up to determine toxin levels in beverages and corn using liquid chromatography-based detection methods.

AGFD 2 Developing novel catalytic coupling of phenols for efficient lignin biomass utilizations Chao-Jun Li, cj.li@mcgill.ca. McGill Univ., Montréal, Canada Arylamines are ubiquitous building blocks for various dyes, fine chemicals, electronic materials, and among the most prevalent structural motifs in pharmaceutical agents. Consequently, continuing efforts have been made to develop new and effective approaches for the formation of aryl amines throughout the history of organic chemistry. Among the various methods, the most prominent reactions are the transition-metal catalyzed coupling of aryl halides with amines. However, the need of pre-synthesizing the aryl halides and the generation of unwanted halide waste in the end are the drawbacks of aryl halide based strategies. On the other hand, phenols (mostly in its polymeric forms in lignin and coal) are the second most prevalent naturally occurring structural units of renewable biomass on the planet, and have the same oxidation state as haloarenes. Thus, the direct coupling of phenols readily available from naturally abundant lignins, instead of the haloarenes, has long been a synthetic aspiration and great scientific challenge. However, previous methods require the transformation of phenol hydroxyl groups first to a better leaving group, and then couple with amine through transition-metal catalysis, which increases number of steps and waste. In this talk, we will present our recent development of novel catalytic direct coupling of phenols with various amines and anilines. A variety of substituted phenols were compatible with this method.

AGFD 3 WITHDRAWN

AGFD 4 Long-term persistence of polymer hydrogels in silt loam soil: Soil water retention Rodrick Lentz, rick.lentz@ars.usda.gov. NWISRL, USDA-ARS, Kimberly, Idaho Cross-linked polymer hydrogels, such as polyacrylamide co-polymer (XPAM) or K-acrylate have been shown to increase soil H2O retention in agricultural soils, potentially mitigating effects of drought. The persistence of polymer-derived H2O-retention benefits in soils has been little studied, yet this information is critical for assessing economic feasibility of the practice, particularly at the farm-scale. This 9-yr, outdoor, large-pot study amended an irrigated, artificially-eroded, calcareous silt loam with a single, one-time, 0.25% or 0.5% dry wt. (5.6 or 11.2 Mg ha-1) application of either XPAM or K-acrylate; an untreated control, and untreated, uneroded topsoil. The soils were hand-tilled and planted to crops each year. Soil water retention and plant available water (PAW, g H2O per g dry soil) was measured on soil samples collected in spring for 7 of the 9 yrs. Across all years, the 2% XPAM produced the greatest PAW (0.313) and the PAW of other treatments followed in the order: 2% XPAM > 1% XPAM > Topsoil > 1% K-acrylate = 2% K-acrylate = control (0.222). In all years, the 1% XPAM and 2% XPAM treatments increased soil PAW relative to the control, i.e. their PAW ratios exceeded unity. Topsoil PAW exceeded that of the control in 6 of the 7 yrs measured. The PAW of 1% XPAM and 2% XPAM peaked in year one after application and declined linearly with time (P<0.004), at -0.0061 yr-1 and -0.0066 yr-1, respectively. The half-life of the XPAM-related H2O-retention benefit was 14 to 20 years. In this study, soil H2O-retention benefits from XPAM amendments exceeded projections proposed by the industry (5 to 6 yrs in the soil)
and suggest that the cost-benefits of farm-scale XPAM applications are more favorable than previously anticipated.

AGFD 5 Chitosan biopolymer particles decorated with synthetic polymer for the removal of EDCs by adsorption from water Xavier Solimando1, xavier.solimando@hotmail.fr, Michael F. Cunningham2, Pascale Champagne3. (1) Chem. Eng. Dept. and Civil Eng. Dept., Queen's Univ., Kingston, Canada (2) Chem. Eng. Dept., Queen's Univ., Kingston, Canada (3) Civil Eng. Dept., Queen's Univ., Kingston, Canada During the last 10 years, the appearance of endocrine disrupter compounds (EDCs) in wastewaters and water resources has become a major concern for public health authorities, the entire industrialized world and the agricultural sector. EDCs are one class of micropollutants capable of interfering with the hormonal system of wildlife and producing developmental, reproductive, neurological, and immune system disruptions. The two most produced synthetic EDCs attracting the attention of the authorities are bisphenol A (BPA, production of 5000 ktons/year) and 4-nonylphenol (NP, production of 225 ktons/year). Because they are widely used (in plastics, construction, paints for BPA, and surfactants washing, textiles for NP), they have been detected at significant concentrations in our environment; potentially leading to endocrinological effects. Since few or no established procedures exist for the removal of EDCs in water or wastewater treatment, this work describes the development of a method involving modified biopolymer (chitosan) particles for the selective capture of EDCs. Chitosan, an abundant biopolymer derived from industrial food-processing industry waste (crustacean, fungi, etc.), was valorized by preparing particles (beads) via aqueous precipitation. Then, the selective particles were prepared in three synthetic steps. After a first step of surface functionalization, the grafting from RAFT polymerization of 4-vinlypyridine (4VP) allowed the decoration of the particles with well-defined synthetic grafts. Finally, the particles were protected from being dissolved in acidic aqueous media by a crosslinking step. The ability of these CTS-g-P4VP particles to capture BPA and NP from water was investigated. The particles were dispersed in water for an appropriate time and then settling step led to an easy separation between the beads and the supernatant. Determination of the remaining quantity of BPA and NP after contact with the particles allowed evaluation of the removal efficiency. Finally, the influence of different factors were investigated to determine the optimal conditions for EDCs removal (concentration, time, reuse).

AGFD 6 Milk fat globules: Universal delivery systems for bioactives Nitin Nitin, nnitin@ucdavis.edu, Maha Alshehab. Univ. of California, Davis The conventional approaches to deliver hydrophobic micronutrients and phytochemicals in food systems have used engineered emulsions, liposomes and other lipid based delivery systems including solid lipid nanoparticles. These engineered systems face significant challenges due to (a) requirements to use preservatives and/or metal ion chelators and sacrificial antioxidants to stabilize encapsulated bioactives; (b) emerging evidence that relatively low concentrations of these emulsifiers, namely carboxymethylcellulose and polysorbate-80, can negatively influence gut health and (c) negative consumer perception. In our quest to address these challenges, we have discovered that naturally present milk fat globules (MFGs) composed of a lipid core surrounded by unique and complex multilayer lipoprotein membrane (MFGM) can effectively encapsulate diversity of exogenous micronutrients such as vitamins A and D and phytochemicals including curcumin and quercetin. The presentation will discuss the role of process conditions in influencing encapsulation efficiency and yield of bioactives in MFGs. Under optimal conditions, the efficiency of this process is high enough that 1 g of milk fat globules can deliver 100% of the recommended daily intake of a vitamin such as Vitamin D, thus enabling efficient use of a naturally occurring resource. The presentation will also discuss the barrier and release properties of MFGs and present data on the role of these properties in reducing degradation of bioactives under acidic and oxidative conditions and release during digestion. In summary, this discovery provides a natural alternative to conventional lipid carriers and has a potential to address many of the key limitations.

AGFD 7 Molecular encapsulation of bioactive compounds by starch-guest inclusion complex Jiayue Guo, Lingyan Kong, lkingong@ches.ua.edu. Human Nutrition, Univ. of Alabama, Tuscaloosa Supramolecular host–guest assemblies represent an advanced complex macromolecular architecture that enables rationale design of delivery systems for bioactive compounds. Starch-guest inclusion complex is a type of such assemblies that can provide protection for and controlled release of guest molecules. A number of small molecules have been shown to form host-guest inclusion complexes with starch, especially its the linear component, amylose. However, no practical applications of starch inclusion complex have been realized. This is largely due to the lack of a cost-efficient and reproducible method for their preparation. We have developed a simple, cost effective, and scalable method to produce starch inclusion complex with a variety of bioactive compounds. In this talk, we will demonstrate the principles of our new method, pre-formed “empty” V-type method, to molecularly encapsulate a series of guest compounds, including lipids, vitamins, aroma, and phytochemicals. Complementary techniques, including X-ray diffraction, differential scanning calorimetry, Fourier-transform infrared spectroscopy, UV–vis spectrophotometry, and gas chromatography–mass spectrometry were employed to evidence successful inclusion complexation and determine the encapsulation loading capacity. We will also discuss the potential applications of starch-guest inclusion in food products and beyond.

AGFD 8 WITHDRAWN

AGFD 9 Novel self-assembly strategy for high efficiency delivery system based on polyphenol self-polymerization Di Wu, qdwds@126.com, Hong S. Liang, Bin Li. Huazhong Agricultural Univ., Wuhan, China Massive functional drugs are healthy-friendly but so poorly water-soluble that suffer from low bioavailability. Although plenty of delivery carriers based on macromolecular proteins and polysaccharides have been developed to solve these problems, they are still severely limited by hard-resolubility, low-loading and other undesired side effects. Herein, we solve these problems through a method of in situ self-polymerization and synthesize biocompatible and biodegradable polyphenol-coated nanoparticles for establishing an intelligent-response delivery system based on small molecule polyphenols. As a proof of concept, we fabricated polyphenol-coated nanoparticles by the polyphenol of tannic acid and functional factors of nobiletin. Briefly, we first formed prototypical nobiletin nanocores through solvent exchange, and then added tannic acid for adsorbing on their surface immediately, making it self-polymerize under alkaline conditions and form a uniform layer to encapsulate nobiletin nanocores. The ultimate compounds were regarded as the expected nanoparticles. Actually, the coating of polyphenol on functional factors may not only improve the stability of functional factors and prevented drug leakage, but also provided an extremely high load-capacity (150% at most). Our findings suggested that the polyphenol-coated nanoparticles of small and uniform size could own an apparent cytotoxic effect and inhibit the migration and invasion of cancer cells effectively. Our results demonstrate that these potentially polyphenol-coated nanoparticles are promising vectors in the field of controlled-release biomedicine and cancer therapy.
AGFD 10 Computer-assisted design for stable porous metal-organic framework (MOF) as a carrier for curcumin delivery  Qin Wang, wanglein@umd.edu. Nutrition and Food Sci., Univ. of Maryland at College Park  In this study, a novel metal-organic framework (MOF) delivery system for a food bioactive was developed. A series of molecular simulations tools, reported in recent years, have been applied to predict and optimize the delivery system. First, Zr-based MOF UiO-66, was synthesized with Zirconium (IV) chloride and benzene-1,4-dicarboxylic acid. Then, curcumin was encapsulated in it. Both spectroscopy and thermogravimetric analysis showed that the system achieved a high loading capacity of 3.45% w/w. The crystal structure, porosity, morphology of this curcumin delivery system was characterized using X-ray diffraction (XRD), physiosorption analyzer, scanning electron microscopy (SEM) and energy-dispersive X-ray spectrometer (EDS). In vitro test showed control release of curcumin after digestion in the simulated intestinal fluids (SIF). Around sixty percent of curcumin was released after 180 min of digestion. This research demonstrated that low toxicity and stable MOFs might have potential in constructing efficient delivery systems.

AGFD 11 Octenylsuccinate hydroxypropyl phytoglycogen to enhance the solubility and in vitro permeation of resveratrol  Jingfan Chen1,2,3, chen741@purdue.edu, Yuan Yao3,2,1. (1) Food Sci., Purdue Univ., West Lafayette, Indiana (2) Whistler Carbohydrate Research Center, Purdue Univ., West Lafayette, Indiana (3) Purdue Univ., West Lafayette, Indiana  The poor solubility of resveratrol (RES) leads to incomplete absorption and low bioavailability, which may restrict its clinical trials and potential applications. Numerous delivery systems of RES have been proposed for enhanced RES solubility and dissolution rate, however, with various limitations. The objective of this study was to evaluate the capabilities of octenylsuccinate hydroxypropyl phytoglycogen (OHPP), a recently developed amphiphilic dendrimer-like biopolymer, to improve the water solubility, dissolution rate, and Caco-2 monolayer permeation of RES. The RES-OHPP solid dispersion was prepared using spray-drying at OHPP/RES ratio of 4/1. The obtained RES-OHPP solid dispersion was characterized for RES soluble amount, crystallinity, RES-OHPP interactions, dissolution profile, and Caco-2 permeation. Results showed that for RES-OHPP solid dispersion the instant soluble amount of RES reached 638.1 µg/mL, which was over 17 times that of pure RES (35.2 µg/mL). The dissolution study showed that RES in RES-OHPP solid dispersion completely dissolved in 3 h upon dissolution, whereas only 33% of pure RES dissolved. Noticeably, X-ray powder diffraction crystallograms showed a significant reduction of RES crystallinity in RES-OHPP solid dispersion. In addition, FTIR spectra indicated the formation of hydrogen bonds between RES and OHPP in RES-OHPP solid dispersion. For Caco-2 permeation test, only RES-OHPP solid dispersion achieved RES permeation at high RES loading amount (>35 µg/mL), which was associated with improved soluble amount of RES. The study suggested that the hydroxypropyl and octenylsuccinate groups at the surface of OHPP particulates interacted with RES molecules through hydrogen bonding. The dendrimer-like structure of OHPP particulate provided steric hindrance that could prevent the crystallization of dispersed RES molecules. These interactions could facilitate the incorporation of RES with OHPP particulates, and therefore improved the soluble amount of RES. Through increasing the soluble amount of RES, OHPP may improve the bioavailability of RES.

AGFD 12 Natural fluorescent L-histidine crystals surface-functionalized with tumor-specific self-degradable hydrogels for systemic delivery of hydrophobic small molecules  Raheleh Ravanfar, Alireza Abbaspourrad, alireza@cornell.edu. Food Sci., Cornell Univ.  L-Histidine (L-His) molecules in the water-ethanol solution form a highly ordered fluorescent crystals with a tunable size and geometry based on solvent ratio and growth time. This particular assembly of L-His fluorescent crystals provide hydrophobic cavities inside the crystals. Here, we demonstrate that these hydrophobic cavities arrange a proper zone to store hydrophobic small molecules such as Nile red, pyrene and B-carotene. Armed with understanding this exclusive capability of L-His fluorescent crystals, we present a novel platform with tumor targetability and site-specific release. We embed doxorubicin (DOX) in the hydrophobic cavities of L-His crystals and modified the crystal surface using covalently cross-linked hyaluronic acid (HA). HA serves as an active targeting ligand with high binding affinity to cell-membrane-bound CD44 receptors overexpressed in various cancer cells. Thus, this design principle provides a tunable mean to create natural smart carriers for site-specific delivery and controlled release of hydrophobic small molecules. These scaffolds possess a strong fluorescence, which makes them easily traceable in the tumor.

AGFD 13 Redox reactivity of phenolics in sweet sorghum and sugarcane  Sophie M. Uchimiya, sophie.uchimiya@ars.usda.gov. CUR, USDA-ARS, New Orleans, Louisiana  Over the past several years, sorghum production for the consumer food industry has drastically grown within the U.S. This market trend originates from high phenolics in sorghum, along with other attributes including gluten-free and high-fiber characteristics. Sorghum genotypes could be engineered through breeding to accumulate desirable phenolics for a wide range of food products including sweeteners (for sweet sorghum varieties), cereals, and antioxidant food additives. Redox chemistry underlies antioxidant and other health-promoting properties. This presentation will first focus on electrochemical and 2D correlation spectroscopy-based characterization of redox-active moieties in sweet sorghum juice and biomass. Cyclic voltammetry, bulk electrolysis, and square wave voltammetry methods were developed using inexpensive screen-printed electrodes utilizing different peak integration models. Developed methods were combined with Tukey’s honest significant difference (HSD) test and VIP/regression coefficient statistics of partial least squares to evaluate the genotypic, agronomic, and environmental impacts on redox reactivity. Detailed discussion will describe (i) the chemical structural ranges of naturally-occurring reversible electron donor in analogy to battery operations and (ii) importance of redox chemistry in feedstock property including the pest resistance.

AGFD 14 Green, all-natural approach to extracting antioxidants from rosemary leaves Shoshana Ginsburg, ginsburg.40@osu.edu, Farmaz Maleky. Food Sci. & Tech., The Ohio State Univ., Columbus  Antioxidants are essential to protect food from lipid oxidation. Both synthetic and natural antioxidants are used, however with the food industry moving toward creating clean labels, a non-chemical-based extraction method of antioxidants from herbs is needed. This study helps to develop a new technique for extracting antioxidants from Rosemary leaves without any chemical aid. Rosemary leaves were mixed with heated oil, (high oleic soybean oil (HOSO), or peanut oil (PO) or cottonseed oil (CO)) (1:5 w/w). With proper control of time and temperature, oil soluble Rosemary antioxidants were extracted and filtered from the Rosemary residue. The extract’s composition was analyzed using gas chromatography paired with a mass spectrometer (GC-MS) and high-performance liquid chromatograph (HPLC). GC results confirmed the presence of 1,8-cineole, alpha-pinene, borneol, D-verbene, and Caryophyllene in all the extracts. HPLC detected and quantified the carnosic acid and carnosol found in the extracts. The antioxidant activity of the extracts were tested on soybean oil’s (SO) oxidative stability; Peroxide value (PV), iodine value (IV), and p-Anisidine value (AV) were used to evaluate the primary and secondary oxidation in SO. The amount of SO’s unsaturation did not decrease significantly in the samples with
Rosemary extract. A significant reduction in both PV and AV were documented in the SO containing Rosemary extract compared to SO with no Rosemary extract. The results confirm the effectiveness of the developed technique for antioxidant extraction from herbs that may replace the chemical-based extraction methods.

AGFD 15 Polyphenols in cells: Critical examination Joe A. Vinson, joe.vinson@scranton.edu. Chemistry, Univ. of Scranton, Dalton, Pennsylvania Consumption of polyphenols is well known by both epidemiology and intervention studies to decrease the risk of chronic diseases. Cell studies are a common method to determine the mechanisms of their beneficial effects on health. A PubMed search reveals over 61,000 citations on polyphenols/lavonoids and cells but only 3000 on their methyl, glucuronide and sulfate metabolites. Yet, almost exclusively, it is these metabolites, formed in the gastrointestinal tract by chemical hydrolysis and microbial enzymes and liver metabolism that reach the cell via the circulation. At the cell there can also be metabolism. We will critically examine the literature in five areas: stability in in vitro cell culture media, transport to cells by proteins and red blood cells, cell deconjugation/conjugation, cells in vivo, and the exciting new studies looking in the sub-cellular space. As a result of this literature examination and with the assistance of two excellent review and opinion articles, we will offer guidelines to cell research.

AGFD 16 Reducing phenolic compounds related to bitterness in table olives using amberlite resins: Influence of pH and salt Alyson E. Mitchell, aemitchell@ucdavis.edu. Food Sci. Tech., UC Davis Olives, the edible drupes from the olive tree (Olea europaea), are one of the oldest food products in human civilization and are a major component of the Mediterranean diet; a diet associated with a reduced risk of cancer, cardiovascular mortality, and other age related diseases. Ripe olives contain high levels of bitter phenolic compounds including oleuropein and its derivatives. These compounds must be reduced to make olive fruit edible. Currently, most producers rely on the lye-assisted hydrolysis of oleuropein to debitter olives (i.e. Spanish-style and California-style black ripe olives). Recently, we demonstrated that Amberlite macroporous resins (e.g. FPX66) can assist commercial olive processing by adsorbing bitter phenolic compounds during brine storage. Herein, we examine the influence of pH (i.e. pH 3, 5, 7, and 11) and sodium chloride concentration (0-10% NaCl) on the adsorption of oleuropein and its derivatives to FPX66. Results indicate that sodium chloride concentration examined have no significant influence on the adsorption of phenolic compounds to the FPX66 resin. The FPX66 resins adsorbed bitter phenolic across the pH ranged examined. However, the optimal pH for adsorption of high-value phenolics (e.g. hydroxytyrosol) occurred at pH 7 and the optimal pH for adsorption of elenolic acid and 3,4-dihydroxyphenyl acetic acid occurred at pH 3. Results also demonstrate that resins can reduce the total phenolic concentration during processing to reduce the toxicity burden of olive wastewater.

AGFD 17 Role of sour guava (Psidium friechstdhshlauian) Nied.) fruit polyphenols on human gut microbiota Carmen Tatiana Cuadrado1, Maria Angeles Pozo-bayon2, Coralia Osorio Roa1, cosorior@unal.edu.co. (1) Departamento de Quimica, Univ. Nacional de Colombia, Bogota (2) Instituto de Investigacion en Ciencias de la Madr, Spain The phenolic-rich fractions exhibiting antioxidant activity (ABTS assay) were obtained by solvent partition and subsequent size exclusion and RP-18 chromatography from polar extract of Psidium friechstdhshlauian fruit. The most active fraction (F. AcOEI) was analyzed by UPLC-ESI/QqQ/MS/MS in MRM mode. The targeted analysis allowed to indentified 22 phenolic compounds, among which, (+)-catechin, procyanidin B1, procyanidin B2, and (-)-epicatechin were found as constituents of this fruit. Ellagic acid and 3,3′,4-tri-O-methyllaglic acid-4′-O-D-glucopyranoside were also identified by LCMS and 1H NMR. Then, the in vitro fermentation of phenolic-rich fractions was performed by using the representative colonic microbiota isolated from human faeces of three healthy volunteers. As result, 12 phenolic compounds were identified and the complete disappearance of procyandins B1 and B2 by gut microbiota action was observed. Their transformation on smaller phenolic compounds could allow an easier absorption in the human colon. In addition, the phenolic-rich fractions showed a growth-promoting effect of the health-related lactic bacteria population, beneficial to health, as well as a decrease in the obesity-related firmicutes bacteria population suggesting a prebiotic effect of some phenolic components of P. friechstdhshlauian fruit.

AGFD 18 Physical complexation between phenolic acid and starch can modulate starch digestibility and intestinal glucose absorption from model starch food systems Min Li1, mli33@ncsu.edu, Cheikh Ndiaye2, Sydney Corbin1, E. A. foegeding3, Mario G. Ferruzzi1,3. (1) Plants for Human Health Inst., NC State Univ., Kannapolis (2) Purdue Univ., West Lafayette, Indiana (3) Food, Bioprocessing and Nutrition Sciences, NC State Univ., Raleigh Leveraging the potential polyphenols has become a popular strategy in developing clean label food ingredients and products for consumers interested in low glycemic starch based foods. However, mechanistic insights into physical starch-phenolic interactions that impact these endpoints remains limited. The objective of this study was to explore how physical complexation between phenolic acid (caffic acid, ferulic acid and gallic acid) and maize amylopectin and potato starch could modulate the digestibility and subsequent glucose intestinal transport in a cell based model. Phenolic complexes were generated by steeping of native starches with phenolic acids (50 mg/g starch) in acid solution (pH = 2.0) followed by freeze drying. GC-MS and NMR characterization suggested the complexation treatments significantly increased non-covalent interactions between starch and phenolics while had minimal impact on the monosaccharide compositions of the resulting starch-phenolic complexes. Simulated gastrointestinal digestion found a modestly lower digestibility for starch-phenolic complex relative to the native starch and the matching starch-phenolic complex. Relative glucose transport through highly differentiated Caco-2 human intestinal monolayer was slower for maize amylopectin-phenolic complex (58.7-119 %) than native amylopectin (100 %) and the matching amylopectin-phenolic mixture (104-128 %), but higher for potato starch-phenolic complex (73.7-156 %). Interestingly, the level of cellular phenolic uptake was lower for amylopectin-phenolic complex and higher for potato starch-phenolic complex. These observations suggest that physical phenolic-starch interactions might be a factor modulating digestive release and intestinal absorption of both starch and phenolics.

AGFD 19 Molecular-sensory studies on key bitter and astringent compounds in hazelnuts Andreas Dunkel2, andreas.dunkel@tum.de, Barbara Singldinger1, Thomas Hofmann2,1. (1) Chair of Food Chemistry and molecular sensory, Technical Univ. of Munich, Freising, Germany (2) Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Bavaria, Germany Due to the appealing sensory profile, hazelnuts (Corylus avellana L.) are used globally as a valuable ingredient for the manufacturing of confectionary, chocolate, and snack products. Hazelnuts, in particular when originating from Turkey, have been reported to develop a sporadic bitter off-taste that is maintained throughout processing to exhibit a flavor defect in final products and leads to consumer complaints. Application of an unbiased, activity-oriented fractionation in combination with taste dilution analysis led to the localization of the compounds with the highest relative intensity with...
regard to bitterness and astringency. Structure elucidation by means of LC-HRMS and 1D/2D-NMR spectroscopy finally enabled the structural characterization of astringent oxindoliny1 acetic acid glycosides and bitter tasting diarylheptanoids. The cyclic diarylheptanoid asadanin was identified as the major inducer of the bitter off-taste of hazelnut kernels with a human bitter taste recognition threshold of 13 µmol/kg. Quantitative studies using UHPLC-MS/MS, followed by dose/activity considerations confirmed the presence of suprathreshold concentrations of asadanine in hazelnuts exhibiting a bitter-off taste and yielded a first insight into inducing determinants of diarylheptanoid biosynthesis. Besides infection with bugs of the Hemiptera order like Gonocerus acuteangulatus and Coreus marginatus, germination was found for the first time to trigger diarylheptanoid biosynthesis resulting in the development of the bitter off-taste. In the end molecular basis for a quality control system for hazelnuts was established enabling the replacement of time-intensive psychophysical evaluations.

**AGFD 20 Identification of somatosensory compounds in prunes**  
Sagar A. Deshpande, deshpande.116@osu.edu, Devin G. Peterson.  
Food Sci. & Tech., The Ohio State Univ., Columbus This project focused on the identification of small molecules that contribute to the somatosensory sensations of prune (Prunus Domestica). Prune extracts were profiled using sensory guided multi-dimensional liquid chromatography fractionation techniques. Multiple phenolic compounds of secondary plant metabolites with ‘slippery’ and ‘thick’ attributes were identified using accurate Mass Spectrometry and Nuclear Magnetic Resonance. Sensory recombination experiments with a trained panel reported that an acidified aqueous solution consisting of these compounds at the levels quantified in prunes were significantly more ‘slippery’ and ‘thicker’ than the corresponding acidified aqueous solution (α= 0.05). This observation confirmed the contribution of non-volatile, small molecules to the overall mouthfeel perception. These results support the development of small molecule ingredient technologies to tailor the ‘mouthfeel’ flavor attributes of foodstuffs.

**AGFD 21 Overview of USDA-FSIS heavy metals monitoring program**  
Laine Zipperer, laine.zipperer@fsis.usda.gov. FSIS, USDA, Athens, Georgia Prolonged exposure through ingestion of heavy metals can pose significant health risks for the regular consumer of meat products. USDA-Food Safety Inspection Service (FSIS) actively monitors eighteen metals at trace levels using two analytical techniques of inductively coupled plasma spectrometry. This program primarily focuses on quantitative determination of multiple metals in muscle tissue of the following matrices: bovine, poultry, swine, fish of the order Siluriformes and processed products. The discussion includes the progression of FSIS methodology and data accumulation from the last few years. The modernization efforts of the heavy metals program enable FSIS to continue protecting the public’s health by ensuring the safety of meats, poultry and processed egg products.

**AGFD 22 Survey of cadmium and lead in cocoa powder and chocolate products in the U.S. market**  
Eileen Abd, eileen.abt@fda.hhs.gov, Jennifer Fong Sam, Patrick J. Gray, Lauren P. Robin. Center for Food Safety and Applied Nutrition, U.S. FDA, College Park, Maryland Cocoa powder and chocolate products are known to sometimes contain cadmium (Cd) and lead (Pb) from environmental origins. A convenience sample of cocoa powder, dark chocolate, milk chocolate, and cocoa nib products was purchased in a small survey at retail in the US and analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to assess Cd and Pb concentrations. Cd and Pb concentrations were evaluated in relation to the percent cocoa solids and to the reported origin of the cocoa powder and chocolate products. Cd and Pb concentrations in the cocoa powder and chocolate products ranged from 0.004-3.15 mg/kg and 0.002-0.38 mg/kg, respectively. Cd and Pb concentrations increased with increasing percent cocoa solids content, and cocoa powder with the highest percent cocoa solids content also contained the highest mean Cd and Pb concentrations. As reported in other studies, geographic variation was observed for Cd concentrations, with higher Cd concentrations found in products reported as originating from Latin America than from Africa. The influence of percent cocoa solids and cocoa origin on Cd levels are relevant to international standards for Cd in chocolate products. The presentation will provide updates on various maximum levels and codes of practice relevant to Pb and Cd in cocoa beans and chocolate under consideration at Codex Alimentarius.

**AGFD 23 Use of food processing aids in manufacturing: Potential sources of trace metal contaminants and methods for remediation**  
Benjamin Redan, benjamin.redan@fda.hhs.gov. FDA, Bedford Park, Illinois Increased efforts are currently being directed toward determining critical sources of trace metal contaminants in food and beverages. Although there are many possible sources of elemental contamination throughout the food supply chain, the processing of foods has more recently been given further attention as a potential source of contamination. Food processing aids are a critical part of the manufacture of food, where they serve a specific technical purpose during processing. However, these processing aids can also act as a potential source of trace metal contaminants that can transfer to food and beverages. Here, we will focus on the process aids used in common industrial processing methods including filtration, beverage fining, and hydrogenation, which have been targeted as potential sources of trace elements with varying degrees of toxicity. Finally, we will review potential remediation methods to reduce elemental transfer occurring during processing.

**AGFD 24 Novel mechanism for potential adverse effects induced by foodborne titanium dioxide nanoparticles: Gut microbiota dysbiosis**  
Xiaoqiong Cao, Hengjun Du, Hang Xiao, hangxiao@gmail.com. Food Sci., Univ. of Massachusetts, Amherst  
Titanium dioxide (TiO2), a commonly used food additive, contains an appreciable fraction of particles in nano-scale. There is increasing concern about the potential health risks associated with foodborne TiO2 nanoparticles (NPs), especially within certain susceptible populations, such as the obese. This study aimed to determine the potential adverse effects of TiO2 NPs in obese individuals and the potential role of gut microbiota in mediating the adverse effects. Two types of TiO2 (30 nm and E171-Food grade TiO2, 0.1% wt%) were fed to two populations of mice (high-fat diet-fed obese mice and low-fat diet-fed non-obese mice). Meanwhile, fecal samples from the above groups were collected for orally transplanting to mice fed a low-fat diet for 10 weeks. Histological analysis, immunohistochemistry, 16s rRNA gene amplicon sequencing and short-chain fatty acid (SCFA) analysis were utilized to characterize inflammation status, composition of the microbiota and the effects of altered gut microbiota on the inflammation status of mouse colon. The results showed that dietary TiO2 NPs led to a significant dysbiosis of gut microbiota with stronger alterations in the high-fat diet-fed obese mice than the low-fat diet-fed non-obese mice. The abundance of inflammation-related cytokines (e.g. IL-10, IL-12p70, and IL-17) and myeloperoxidase (MPO) in colon mucosa were significantly altered by TiO2 NPs to produce an inflammatory state. TiO2 NPs decreased theecal levels of SCFAs such as butyrate. After 10 weeks of microbial transplant, microbiota from the obese mice consuming a high-fat diet with TiO2 NPs led to an increase of pro-inflammatory cytokines and loss of healthy colonic morphology in the colon of the low-fat diet-fed recipient mice, indicating a significantcolonic inflammation. Overall, these findings provided a
valuable new perspective on the potential adverse effects and underlying mechanisms of foodborne TiO2 NPs among obese vs. non-obese populations.

AGFD 25 Health risks of dietary cadmium exposure in Shanghai residents Gengsheng He, gshe@shmu.edu.cn, Jiaqi Yang, Ying Qing. School of Public Health, Fudan Univ., China, Shanghai, China Objective: To evaluate the exposure level to cadmium by diet and smoking in Shanghai residents, and to assess the current health risks of dietary and smoking cadmium exposure. Methods: Using general questionnaires to obtain the sociodemographic characteristics and smoking status of Shanghai residents, and collecting the dietary characteristics of the population by a three-day 24h questionnaire. Point and probability evaluation, which was conducted through @risk, were used to estimate daily dietary and smoking cadmium exposure, combined with the Shanghai food cadmium contamination level data in the Fifth China Total Diet Study. Meanwhile, blood and urinary cadmium levels were measured. Mann-Whitney test was used to analyze the effects of different genders and smoking status on blood cadmium and urinary cadmium. The population health risk was assessed according to the PTMI of cadmium set by JECFA as 25 µg/kg bw per month. Results: A total of 1557 residents were enrolled in the study, among them, 1477 completed questionnaires, 1225 provided blood samples, and 1428 provided urine samples. Among the 1477 people, the mean dietary cadmium intake was 10.97 µg/day, and cereals, aquatic products and vegetables were the main dietary exposure sources for cadmium. One hundred and sixty-seven people were smokers, and the average exposure level to cadmium by smoking was 2.89 µg/day. The probability assessment found that 96.8% of the entire population and 80.0% of the smokers had a lower total cadmium intake than the JECFA criteria. The Mann-Whitney test found that male blood cadmium was higher than female, while urinary cadmium was lower than female; smokers had higher blood cadmium levels than non-smokers. Conclusions: The main source of cadmium in Shanghai residents was dietary exposure, and the cadmium intake of most people was within the safe exposure dose range.

AGFD 26 WITHDRAWN

AGFD 27 Preparation of polysaccharide-based functional soft materials using ionic liquids Jun-Ichi Kodakawa, kadokawa@eng.kagoshima-u.ac.jp. Grad Schl of Sci Eng., Kagoshima Univ., Kagoshima, Japan Abundant structural polysaccharides, such as cellulose and chitin, are widely distributed on the earth, and thus, very important biomass resources. Because of their high crystallinity and stiff molecular chain packing, they often show poor solubility in water and common organic solvents, leading to difficulty in processability. Over the past decade, ionic liquids have been identified as powerful solvents for such crystalline polysaccharides. For example, in 2008, the author found the dissolution of chitin in an ionic liquid, 1-allyl-3-methimbiziazolium bromide (AMIMBr). The author also reported that cellulose ion gel was facilely formed from a solution in an ionic liquid, 1-butyl-3-methylimidazolium chloride (BMIMCl). This presentation reports the preparation of cellulose-based functional soft materials through the gelation process with BMIMCl. Chitin-based functional soft materials by derivatization in AMIMBr will be also discussed in this presentation. When a solution of cotton cellulose in BMIMCl (5 wt%) was immersed in water at room temperature, the gelation smoothly progressed. The resulting ion gel was then dried at 60 oC for regeneration to obtain a cellulose film with BMIMCl, which showed flexible property. This flexibility was owing to the crystalline/amorphous mixture of cellulose in the film. Furthermore, the DSC result of the film showed a new endothermic peak at around 150 oC, suggesting the occurrence of phase transition at the temperature. Accordingly, the film showed thermal processability above the temperature, indicating its thermoplastic property.

AGFD 29 Development of a two-step process for the production of D-tagatose from whey permeate Shouyuan Cheng, Sergio Martinez-Monteagudo, Sergio.MartinezMonteagudo@sdstate.edu. Dairy and Food Sci., South Dakota State Univ., Brookings Lactose is the most underutilized dairy ingredient. Current applications of lactose are insufficient to use the recovered lactose from the manufacture of dairy products (cheese, Greek yogurt, and protein concentrate). As an ingredient, lactose offers technological challenges (poor solubility and low sweetness strength) and health concerns (malabsorption and digestive problems). It is critical to develop technological approaches that can help to expand lactose utilization. The objective of this work is to develop process for producing a mixture of natural sweeteners derived from lactose using a two-step process. Aqueous lactose was converted into a sweetening syrup via enzymatic hydrolysis followed by catalytic isomerization over MgO/SiO2. Firstly, the enzymatic hydrolysis using β-galactosidase was performed at room temperature, and it converted 95.77 ± 0.67% of lactose into glucose and galactose. Secondly, the hydrolysed lactose solution was catalytically isomerized at 100°C for 2 h in presence of MgO/SiO2 containing different MgO loading ratios (10, 20, 30, and 40 wt.%). The prepared MgO/SiO2 catalysts were characterized by BET, XRD, FTIR, CO2-TPD, and TEM. The highest isomerization yield of glucose and galactose to produce fructose and D-tagatose (26.8±0.5 and 17.5±0.5%, respectively) was obtained with 20% of MgO/SiO2. The overall process (enzymatic hydrolysis followed by isomerization over MgO/SiO2) converted 99.3±0.2% of lactose into a sweetening syrup made of glucose (~30.48%), galactose (~33.51%), fructose (~16.92%), D-Tagatose (~10.54%), lactulose (~3.62%), and unidentified byproducts (~0.69%). A reaction mechanism for the formation of a sweetening syrup from lactose via two-step process was proposed. The outcomes of this research present an opportunity for expanding the utilization of lactose.

AGFD 30 Novel biobased and biodegradable thermoplastic polymer Silvia D. Luebben, luna3turchese@gmail.com. Sustainable Chemicals LLC, Golden, Colorado Poly(2,5-dihydroxy-1,4-dioxane) (PDHDO) is a novel renewable thermoplastic polymer made from non-food source plant feedstock. It has a biomimetic structure similar to that of cellulose. PDHDO is biodegradable and is expected to be a replacement for polyethylene (PE). The monomer can be obtained in high purity and large quantities from the fast pyrolysis of lignocellulosic feedstock at a cost that has been estimated to be competitive with that of ethylene. PDHDO is expected to hydrolyze back to the monomer in the environment and the degradation product
is expected not to present issues of toxicity, persistency or bio-accumulation.

AGFD 31 Development of new vegetable oil-based antimicrobial polymers  Kun Huang, kun.huang@usda.gov, Helen Ngo, Xuetong Fan, Richard Ashby, Robert Moreau. Eastern Regional Research Center, Agricultural Research Service, USDA, Wyndmoor, Pennsylvania  Microbial infection and resistance to traditional antibiotics and biocides is one of the most important problems in biomedical and Food Sci. disciplines, particularly in medical devices, health care hygiene, and textiles. Antimicrobial polymers are gaining interest from both academic research and industry due to their potential to provide prolonged efficacy, non-volatile and non-migratory properties, compared to the conventional biocides. However, many of these antimicrobial polymers have been made or modified from petroleum monomers or polymers. In the present study, a new type of bio-based polymer has been synthesized and its antimicrobial properties have been evaluated against both Gram positive and Gram negative bacteria. This research will render vegetable oils based materials appreciable new properties, which can also help to explore more diverse end uses for these abundant agriculture products.

AGFD 32 Modified tung oil-based fatty acid esters used as diesel additives to give improved lubricity Zengshe Liu2, kevin.liu@ars.usda.gov, Jing Li1, Gerhard Knothe2, Brajendra Sharma3, Jiangchung Jiang. (1) Inst. of Chemical Industry of Forestry Products, Nanjing, China (2) National Center for Agricultural Utilization Research, ARS-USDA, Peoria, Illinois (3) Illinois Sustainable Tech. Center, Univ. of Illinois, Urbana-Champaign  Modern ultra-low-sulfur diesel (ULSD) fuels require additives in order to have sufficient lubricity. We reported here the synthesis of new additives starting with tung oil fatty acid methyl ester (eleostearic acid methyl ester, EAME). The synthesis starts by forming the maleation compound (EAME/MA) of EAME and the resultant EAME/MA reacts with methanol or butanol to form the esters products, EAME/MA/ME and EAME/MA/BU respectively. Both the EAME/MA/ME and EAME/MA/BU compounds effectively enhanced the lubricity of ULSD, even low additive levels. In the high-frequency reciprocating rig (HFRR) lubricity tests the wear scar and friction of ULSD was reduced by 40% and 46-47%, by the additives, even at only 500 ppm concentration. This is 20-40 times lower than the level of ordinary biodiesel typically used, 1-2%. Addition of EAME/MA/BU at a level of 1000 ppm into oils such as 0150H GP1 Base Oil and 166 POA, also gave significant wear scar values were reduction of 25% and 26%, respectively.

AGFD 33 Effects of water addition and microwave on natural deep eutectic solvents (NADES) and their extraction properties Analia V. Gomez2, Atanu Biswas1, Carmen C. Tadin2, Huai N. Cheng3, hn.cheng@ars.usda.gov. (1) Nat’l Center for Agricultural Utilization Research, USDA Agricultural Research Service, Peoria, Illinois (2) Chem. Eng. Dept., Univ. of Sao Paulo, Escola Politecnica, Brazil (3) Southern Regional Research Center, USDA Agricultural Research Service, New Orleans, Louisiana  One of the common processes employed in food preparation and manufacturing is the extraction of specific components from agro-based materials. Although many extraction methodologies are known, continued improvements are still desirable. A recent new development is the use of natural deep eutectic solvents (NADES) for extraction. In this work, we studied NADES/water combinations and found them to be viable alternatives to conventional solvents for extraction of polar ingredients in foods. Moreover, we found microwave heating to facilitate the preparation of NADES/water solvents, decreasing the heating time by ¼ or more. Selected NADES/water systems were characterized with respect to viscosity, refractive index, electrical conductivity, water activity, and NMR. In addition, we utilized the microwave-assisted process to carry out the extraction of non-starch polysaccharides in over-ripe or rejected bananas. NADES/water solvents were shown to be more effective than conventional solvents (H2O and ethanol) for this extraction. The microwave process was found to be efficient, save time, and decrease energy usage. Furthermore, the NADES/water solvents are eco-friendly, inexpensive, chemically inert, and biodegradable. Thus, the combination of NADES/water/microwave is a promising “green” method that can provide improved extraction in food applications.

AGFD 34 Novel protein-lipid composite nanoparticles as delivery systems of hydrophilic nutraceutical compounds Lingyun Chen, lingyun.chen@ualberta.ca, Guangyu Liu, Zhigang Tian. Univ. of Alberta, Edmonton, Canada  Nanoparticle encapsulation of nutraceuticals faces challenges to overcome for it to be readily applied in the food industry, such as low encapsulation efficiency for hydrophilic compounds and poor stability once in gastrointestinal tract. This research introduces a new protein-lipid composite nanoparticle with an inner aqueous compartment to load hydrophilic nutraceuticals. This delivery system showed efficient encapsulation of vitamin B12 (69 %) and controlled release behavior in simulated gastrointestinal media. An in vitro cell evaluation demonstrated nanoparticles could internalize into Caco-2 cells via energy-dependent endocytosis and significantly increase the uptake and transport efficiency of vitamin B12 in this model. In vivo, the developed vitamin B12 loaded nanoparticle showed increased serum vitamin B12 levels upon oral administration in rats. A 14-day in vivo toxicity study showed no evidence of toxicity in rats implying the safety of the developed nanoparticles in long term use. Overall, the results of this study show the great potential of developed nanoparticles in increasing the absorption of vitamin B12 upon oral administration.

AGFD 35 Formation and characterization of zein-oleic acid oleogels Graciela W. Padua, gwpadua@uiuc.edu. Food Sci. and Human Nutrition, Univ. of Illinois, Champaign  Oleogels were obtained from oleic acid zein dispersions in 70% ethanol. Oleogels were formed upon standing of dispersions or by evaporation-induced self-assembly. Terminal phase diagrams were constructed to define sol-gel transition lines. Gel characterization was based on the viscoelastic parameters, G’ and G” . The effect of sonication on gel formation rate was also evaluated from G’ and G” values. The decrease in particle size of zein/oleic acid dispersions after sonication was observed by polarized light microscopy. USAX was used to evaluate the microstructural parameters, radius of gyration (Rg) and Porod exponent (P) of zein-oleic acid in 70% ethanol. Rg and P values revealed the gel structure consisted of three hierarchical structural levels, where the primary units were rod-shaped zein molecules. At the second structural level, rods self-assembled into 2D sheets. Such interactions were seemingly enhanced by oleic acid. At the third structural level, flat sheets self-assembled into 3D structures, believed spherical. Zein-oleic acid oleogels are intended as nutrient dense foods/food ingredients carrying simultaneously a variety of nutrients and bioactive components. These novel foods/food ingredients will be developed keeping in mind their nutritional value and facile processing for the convenience and eventual personalized foods markets.

AGFD 36 Preparation and characterization of zein and gum arabic binary nanocomplexes in aqueous ethanol Cuixia Sun, cxsunphd@sjtu.edu.cn, Jingru Song, Yapeng Fang. Dept. of Food Sci. and Eng., School of Agriculture and Biology, Shanghai Jiaotong Univ., China  Zein is biodegradable hydrophobic protein and is
conventionally prepared as dispersible nanoparticles with the antisolvent precipitation method. The process involves dissolving zein in 55-90% aqueous ethanol and then shearing the stock solutions into deionized water. The objective of the present work was to develop a new way to produce zein-based nanoparticles based on the finding that gum Arabic (GA) was able to dissolve in 0-90% aqueous ethanol. Results from dynamic light scattering show that the size distribution of zein or GA alone in 70% aqueous ethanol was multimodal but shifted to a monomodal peak centered below 400 nm after mixing 70% aqueous ethanol of zein with that of GA within a range of pH from 7.0 to 12.0, indicating the formation of zein-GA binary nanocomplexes. The mean hydrodynamic diameter (Dh) of nanocomplexes was further affected by the amount of GA. The binary nanocomplexes with equal masses of zein and GA had a Dh of 203.2±1.27 nm and had the minimum polydispersity index of 0.07 at pH 8.0. The images of transmission electron microscopy show that the core-shell microstructure was formed for zein-GA binary nanocomplexes. This was further confirmed in scanning electron microscopy that showed zein as a core was surrounded by GA as a shell. In addition, the incorporation of GA resulted in significantly secondary structural changes of zein. The fluorescence intensity of zein was obviously decreased due to the fluorescence quenching in the presence of GA. The findings may provide a new insight for the process of fabricating zein-based nanoparticles, which would have potential applications such as constructing delivery systems for bioactive compounds.

AGFD 37 WITHDRAWN

AGFD 38 Effects of polysaccharides incorporating into sodium caseinate-high melting point fat microparticles to the survival of probiotic bacteria during simulated gastrointestinal digestion and storage Huan Liu1, liu_huan2011@hotmail.com, Shaoping Nie1, Joshua Gong2, Steve W. Cui2, Fang Zhong3, Qi Wang2. (1) State Key Lab. of Food Sci. & Tech., Nanchang Univ., China (2) Guelph Research and Development Center, Agriculture and Agri-food Canada (3) School of Food Sci., Jiangnan Univ., Wuxi, China Probiotics have received increased interest owing to their potential to confer a range of health benefits to humans. Commercial probiotics are often sensitive to adverse conditions during processing, storage and transition through the gastrointestinal tract, thus protection is required for their application. In our previous study, we reported that sodium caseinate (NaCas) can effectively protect probiotic bacterial cells Lactobacillus zeae LB1 from heat inactivation during spray drying in the presence of high melting point fat (HMF). However, the survival of the probiotic bacteria encapsulated in NaCas-HMF based microparticles was still questionable during simulated gastrointestinal digestion and storage, thus further enhancement is needed for their potential application. The objective of the current research was to improve the gastric resistance and storage properties of probiotic bacteria L. zeae LB1 in NaCas-HMF based microparticles by incorporating different polysaccharides. Probiotic bacteria were spray dried in NaCas solutions containing HMF combined with one of: maltodextrin, pullulan, gum ghatti (GG) or gum arabic (GA). Probiotic bacteria only showed good survival (≧50%) after spray drying in microcapsules formulated with GG or GA. Addition of GA and GG to NaCas showed a positive effect on the in vitro gastric resistance of probiotic bacteria, whereas maltodextrin and pullulan exerted a negative influence. Among the formulations tested, microparticles made from a blend of NaCas and GA showed the highest glass transition temperature (Tg), corresponding to the best survival of probiotic bacteria during storage for up to 16 weeks in a water activity range of 0.11-0.76. The presence of two Tgs in the NaCas-pullulan matrix suggested that phase separation was occurring, which could partially account for its poor protection capacity. Encapsulated probiotic bacteria in all matrices showed good release properties in the presence of pig intestinal digesta and release from microparticles was complete in less than 1 h. The current study demonstrates that NaCas-HMF combined with GA may provide effective protection to probiotic bacterial cells not only during spray drying, but also during storage and in vitro digestion. Our results also confirm the importance of glass transition temperature of the encapsulation matrix and the initial water activity of the microcapsule in determining the survival of encapsulated bacteria during storage.

AGFD 39 Synthesis and characterization of alkylated caseinate, and its structure-curcumin loading property relationship in water Yaqiong Zhang1, yqzhang2006@sjtu.edu.cn, Fangyi Yao1, Liu Jie2, Liangli Yu3. (1) Inst. of Food and Nutraceutical Sci., School of Agriculture and Biology, Shanghai Jiao Tong Univ., China (2) Beijing Tech. & Business Univ., China (3) Univ of Maryland, College Park Alkylated caseinates (Cn-caseinates) containing selected C8-C16 alkyl groups were successfully synthesized through a two-step reaction between the protein and fatty acids. The substitution degree (SD) of the alkyl groups was 5.2-72.9%, which depended on the feed molar ratio of reactants and the fatty acid chain length. The SD value was positively associated with the surface hydrophobicity index (S0) of the Cn-caseinate. Among the tested Cn-caseinates (n = 0, 8, 12, 14 and 16), C16-caseinate showed the best self-assembly and curcumin-loading properties in water. With the increase in the SD of palmitoyl group, the critical micelle concentration (CMC) of C16-caseinate decreased from 5.15 to 3.77 mg/L and the encapsulation efficiency of curcumin-loaded C16-caseinate assemblies increased from 31.16% to 69.87%, respectively. Transmission electron microscopy evidenced the desirable assembly appearance of spherical shape. In addition, the assemblies had good redispersibility and storage stability at 4 °C for 6 weeks.

AGFD 40 Development of cereal prolamin based nanoparticles as oral drug delivery system Yue Zhang2,1, yue.zhang@unl.edu. (1) Food Sci. & Tech., Univ. of Nebraska-Lincoln (2) Food Sci. and BioTech., Zhejiang Gongshang Univ., Hangzhou, Zhejiang, China Oral drug delivery systems are of great interest to enhance the aqueous solubility, stability, intestinal absorption of drugs and nutrients. Prolamin, the major cereal storage protein, is of special interest among these delivery system materials, due to their wide availability, low allergenicity and unique physical properties such as high hydrophobicity. However, most prolamin based delivery systems have been built using zein from maize. Due to the growing demand of plant protein delivery materials, it would be meaningful to explore new prolamin source from other cereals and compare their encapsulating properties with zein. In addition, prolamin nanoparticles usually have poor dispersibility and stability against pH and ionic strength, required simple but effective modification to improve their physical properties. Therefore, in this study, we aimed to 1) prepare delivery system using proteins from other cereal sources, especially from agro-industrial by-products, 2) characterize the encapsulation properties of them, 3) improve the physical properties of prolamin based nanoparticles by complexion with other biopolymers. Prolamins from two cereal grains (maize and proso millet) and one food industrial by-product (brewer's spent grain, BSG) were extracted and employed to develop nanoparticles. Polysaccharides including gum arabic and sodium alginate were used to complex with prolamins and fabricate composite nanoparticles with better pH/ionic stability. Curcumin, as model drug molecules, was encapsulated into these composite nanoparticles. And the release profiles of curcumin-loaded composite particles in simulated oral, gastric and intestinal fluids were studied. Zein nanoparticles showed smaller particle size and higher stability than other prolamin based nanoparticles but similar encapsulation efficiency. Curcumin encapsulated in millet prolamin nanoparticles presented a slower
release rate using an in vitro gastrointestinal model. The potential of using different protein fractions from BSG has been studied. The findings in this study are useful for fabricating, optimizing and selecting prolamin-based delivery systems.

AGFD 41 Multidisciplinary strategy for the investigation of legume derived multifunctional peptides Carmen Lamm1, carmen.lammi@unimi.it, Raffaele Pugliese2, Carlotta Bottali1, Gilda Aiello1, Anna Arnoldi1. (1) Pharmaceutical Sci., Univ. of Milan, Italy (2) ISBReMIT, Fondazione IRCCS Casa Sollievo della Sofferenza., San Giovanni Rotondo (FG), Italy Over the years, numerous bioactive peptides have been identified in protein hydrolysates from various foods with anticancer, anti-inflammatory, hypotensive, hypocholesterolemic, anti-diabetic, antioxidant, antibacterial, and immunomodulatory activities. All these findings clearly support the idea that food proteins do not only supply nutrients, but also provide numerous health benefits through their impact on specific biochemical pathways. In fact, most of these activities are due to peptides encrypted in the parent protein sequences, which are released by digestion, absorbed intact by intestinal cells, and are transported to their target organs, where they exert their biological activity. In this dynamic field, multifunctional peptides represent an emerging area with numerous potential applications. This definition applies to peptides that have the capacity to impart more than one physiological benefit by affecting different targets. Using a multidisciplinary approach, we have singled out some soybean and lupin-derived peptides with hypocholesterolemic hypotensive and anti-diabetic activities that are also absorbed at intestinal levels. More in details, their bioactive behavior has been evaluated combining techniques performed in silico, in vitro on human purified recombinant enzyme, in situ on human cells (HepG2 and Caco-2), and ex vivo on human serum samples.

After oral administration, the first physiological barrier encountered by food-derived peptides is the intestinal brush border. This means that a main limitation in the use of bioactive peptides is represented by their instability due to active proteases expressed by the apical domain of intestinal cells. In this context, we have developed and optimized a reliable method to investigate their stability and metabolism using differentiated CaCo-2 cells. Finally, in order to overcome this critical issue, we have developed the first food peptide-derived bioactive hydrogels.

AGFD 42 Effect of whey peptides on metabolism and insulin signaling in muscle and fat cells Kenneth D’Souza2,3, Angella Mercer2, Hannah Mawhinney3, Thomas Puliniikkunnil2,3, Chibuike Udenigwe1, eudenigw@uottawa.ca, Petra C. Kienesberger2,3. (1) Univ. of Ottawa, Canada (2) Dalhousie Medicine New Brunswick, Saint John, Canada (3) Dalhousie Univ., Halifax, Nova Scotia, Canada Rationale: Adipose tissue and skeletal muscle dysfunction are hallmarks of obesity and insulin resistance. Bioactive peptides derived from food sources including milk and dairy products have gained interest for their role in obesity and insulin resistance. However, it remains unclear whether and how whey impacts adipose muscle metabolism and insulin function. Hypothesis: Bioactive whey peptides have a positive metabolic and insulin-sensitizing effect on adipocytes and muscle cells. Methods: Whey peptide mixture was generated via the hydrolysis of whey protein with pepsin and pancreatin. 3T3-L1 pre-adipocytes were incubated with 2.5 mg/ml bovine serum albumin (BSA) or whey peptides during differentiation. The effects on whey peptides on differentiation and insulin signaling were examined through immunoblotting and on lipid metabolism through lipidomics and lipolysis assays. Insulin resistant C2C12 myotubes were co-incubated with BSA or whey peptides for 16 h followed by insulin signaling analysis and lipidomics. Results: In 3T3-L1 cells, whey peptides increased expression of the master-regulators of adipogenesis, C/EBPα and PPARγ and was associated with increased diacylglycerol (DAG) and triacylglycerol (TAG) levels. Paradoxically, expression of the lipolytic enzymes, HSL and ATGL, were also markedly increased by whey peptides, which corresponded with increased lipolytic capacity under basal and isoproterenol stimulated conditions. Insulin signaling was unchanged in insulin resistant adipocytes incubated with whey peptides. In C2C12 myotubes, whey peptides protected from palmitate-induced insulin resistance, possibly by exerting a potent anti-inflammatory effect. Furthermore, lipidomic analysis showed that whey peptides decrease levels of the lipotoxic lipid DAG and increase levels of TAGs. Conclusions: Whey peptides promote a pro-adipogenic phenotype in adipocytes, but do not alter adipocyte insulin sensitivity. In myotubes exposed to an obese-diabetic milieu, whey peptides ameliorate insulin resistance, potentially by reducing inflammation and accumulation of lipotoxic species.

AGFD 43 Functionality and bioactivity of edible bioplastics derived from yellow pea proteins Caleb Acquah1, cacquah@uottawa.ca, Elisa Di Stefano1,2, Yujie Zhang2, Marc Dube2, Chibuike Udenigwe1. (1) School of Nutrition Sciences, Univ. of Ottawa, Canada (2) Dept. of Chemical and Biological Eng., Univ. of Ottawa, Canada This study investigated the use of yellow pea protein isolate (YPI) and protein concentrate (YPC) as alternative sustainable sources of commercial biomaterials. Composite film from a blend of whey protein isolate (WPI) and YPI in the ratio 1:1 was also studied. Hydrophobicity of protein precursors (% w/w) for casting of biofilms increased by 55-70% after heating at 85 °C, indicating thermal-induced unfolding of the protein structure. Biofilms formulated from WPI and YPI had a thickness of ~0.23 mm whereas that derived from YPC had a thickness of ~0.20 mm. Structural analysis before and after casting of the biofilms using FTIR spectroscopy showed five new absorption peaks from 800 cm-1 to 1100 cm-1 associated with newly formed C-C and C-O bonds in the biofilms. Preliminary secondary structural analysis revealed that protein precursors were plasticised via hydrophobic and hydrophilic interactions with glycerol as the plasticiser. The films had a contact angle of <90° demonstrating that the bioplastics had hydrophilic surfaces (YPC < YPI < Blend < WPI). Pattern of light transmission through the biofilms, estimated in the ultraviolet region varied with values for WPI > YPC > Blend > YPI. Moisture content, mechanical and thermal resilience of the films formulated from YPI, YPC and blend were comparable to those of WPI films. In addition, static digestion of YPI and YPC biofilms in simulated oral-gastric-intestinal fluids led to increased free amino group and the release of inhibitors of α-glucosidase and dipeptidyl peptidase IV, which are directly involved in endogenous glucose regulation. The findings demonstrate, for the first time, that yellow pea proteins can be a competitive precursor of edible and biodegradable biofilms, with a dual function in packaging and health promotion.

AGFD 44 Role of plastein structure in biomolecular interactions of peptides Istanyi D. Nwachukwu1, nwachukuld@myumanitoba.ca, Shixiang Yao3,1, Caleb Acquah1, Chibuike Udenigwe2. (1) School of Nutrition Sci., Univ. of Ottawa, Canada (2) Univ. of Ottawa, Canada (3) College of Food Sci., Southwest Univ., Chongqing, China Plastein, a product of protease-induced peptide aggregation is thought to be important due to, among other things, the potential of its modified peptide structure to contribute to health-promoting functions, including hypolipidaemic properties. In this study, papain-derived bovine serum albumin (BSA) hydrolysate and plastein solutions were studied at low sample concentrations (0.1%, w/v) in order to evaluate the properties of enzyme-induced peptide aggregation and role of posttranslational modifications during plastein formation. Data from this study confirms a role for hydrophobic and electrostatic interactions in peptide aggregation as supported by the decrease in turbidity (absorbance at 460 nm) of the
BSA plastein in both a surfactant (SDS) and a high ionic strength (NaCl) solutions compared to aqueous environments. The evaluation of surface charge distribution also showed a significant reduction of zeta potential (from -31.6 mV to -10.8 mV) upon plastein formation, as well as increased particle size of the plastein (5510 nm) compared to that of the hydrolysate (79 nm). The changes in the surface structure are important in determining biomolecular interactions with plastein peptides. Shotgun-based peptidomics workflow revealed that 19% and 15% of peptides in the BSA hydrolysates and plastein, respectively, were modified by deamidation and pyroglutamylation. Thus, it is probable that the increased hydrophobicity associated with these peptide modifications did not play a significant role in peptide aggregation during plastein reaction. Taken together, the modified surface properties of plastein, such as its increased surface hydrophobicity, could be important factors in determining its binding affinity for hydrophobic biomolecules e.g. bile acids, and thus in its use for the design of food-based formulations for the management of conditions such as dyslipidemia.

AGFD 45 Impact of dietary γ-glutamylvaline (EV) against TNF-α induced inflammatory response in adipocytes via the activation of CaSR and PPAR-γ pathways  Yoshinori Mine, yoshii12@me.com. Dept of Food Sci., Univ Guelph, Canada The calcium-sensing receptor (CaSR), has been documented for its role in the regulation of adipocyte proliferation and adipose tissue dysfunction, and represents a promising target for anti-inflammatory therapeutic approaches. In the previous study, we found the dietary peptide, gamma-L-glutamyl-L-valine (γ-EV), acts as the agonistic of CaSR to suppress tumor necrosis factor (TNF)-α-induced inflammatory responses in intestinal epithelial cells. Therefore, we investigated the anti-inflammatory effect of γ-EV on mouse adipocytes and explore the role of γ-EV-activated CaSR in the regulation of cellular homeostasis using the mouse 3T3-L1 cell line in vitro model. The pretreatment with γ-EV suppressed the production of pro-inflammatory cytokines, i.e. IL-6; MCP-1, while enhancing the expression of PPARγ and adiponectin. Elevated expression of Wnt5a was detected in γ-EV treated cells, suggesting the involvement of the Wnt/β-catenin pathway. In addition, phosphorylation of β-catenin was shown to be significantly inhibited by TNF-α, but restored when cells were pretreated with γ-EV. Concentrations of serine phosphorylated IRS-1 were shown to be lower in γ-EV treated cells, indicating γ-EV may also prevent inflammation in the context of insulin resistance. These findings suggest γ-EV-induced CaSR activation not only prevents TNF-α-induced inflammation in adipocytes but also modulates the crosstalk between Wnt and PPARγ pathways. The synergistic effect on PPARγ and adiponectin as well as the alteration on Wnt5a expression with γ-EV treatment give the evidence that γ-EV plays a significant role in metabolism of adipocytes by the activation of CaSR induced Wnt noncanonical pathway.

AGFD 46 Bioactive peptides in cured meats and its health relevance  Fidel Toldra1, ftoldra@iata.csic.es, Marta Gallego1, M-Concepcion Aristoy1, Milagro Reig2, Leticia Moral1, (1) Food Sci., Inst. de Agroquimica y Tecnologia de Alimentos (CSIC), Paterna, Valencia, Spain (2) Instituto de Ingenieria de Alimentos para el Desarrollo, Universitat Politècnica de Valencia, Spain Cured meats are highly produced and consumed worldwide. Depending on the type of processing, such meats may experience a more or less intense hydrolysis of muscle proteins releasing large amounts of diverse peptides that not only affect taste and flavor but also the bioactivity. The purpose of this work was to determine the presence of bioactive peptides in dry-cured ham having antioxidant and angiotensin I-converting enzyme (ACE-I) inhibitory activity with potential cardiovascular health benefits. Many antioxidant peptides were detected being SNAAC the most active peptide with IC50 value of 75.2 µM in DPPH radical scavenging assay, and 205 µM in ferric-reducing antioxidant power analysis. Another relevant antioxidant peptide was AEEEYDPL, that was calculated to be present at 0.148 fg per g of dry-cured ham, even though it is partially degraded during gastrointestinal digestion. The antihypertensive effect of dry-cured ham extract, rich in bioactive peptides <1700 Da, was assayed in vivo using spontaneously hypertensive rats. The results showed that systolic blood pressure (SBP) was significantly decreased in 38 mm Hg after 8 h of ingestion (p<0.05) and it returned to values similar to the control after 24 h. The extract was analysed by mass spectrometry in tandem revealing the presence of >2500 peptides containing the ACE inhibitory sequences Pro–Pro–Lys, Pro–Ala–Pro, and Ala–Ala–Pro. Such sequences are mainly present in peptides derived from tropomin-T, and myosin heavy and light chains. Further, several peptides with ACE inhibitory activity were identified after simulated in vitro gastrointestinal digestion of the extract like KAAAP (IC50 19.8 µM), AAPALAP (IC50 14.4 µM), KPVAAP (IC50 12.4 µM), IAGRP (IC50 25.9 µM), KPGRP (IC50 67.1 µM), TGLKP (IC50 51.57 µM), KAAAATP (IC50 25.6 µM) and AAATP (IC50 100 µM) among others. As an example, peptide PTPVP was tested in spontaneously hypertensive rats, resulting in a decreased SBP of 25.6 mmHg (<0.01) after 6 h of ingestion. An assay with humans revealed that daily intake of 80 g dry-cured ham did not impair blood pressure even though its high salt content. In summary, muscle proteins are extensively hydrolysed by endo- and exo-peptidases during the processing of dry-cured meats resulting in the generation of numerous peptides with relevant antioxidant and angiotensin I-converting enzyme (ACE-I) inhibitory activity that may prevent cardiovascular diseases.

AGFD 47 Transition metals: Multifaceted catalysts of lipid oxidation and degradation of food quality  Karen M. Schaich, schaich@sebs.rutgers.edu. Dept of Food Sci., Rutgers Univ., New Brunswick, New Jersey Metals have long been recognized as perhaps the most ubiquitous catalysts of lipid oxidation in foods, and chelators are routinely added for control. Even so, metal catalysis of lipid oxidation in foods remains poorly understood, especially in terms of effects on oxidation pathways and product distributions, food quality, and development of potentially toxic compounds. Despite the importance of metals in lipid oxidation, for more than 20 years little research has been focused on problems created by metals, perhaps because lipid oxidation was also ignored during the same period. Now as foods are being reformulated with essential polysaturated fatty acids, concern about oxidation has again come to the forefront, along with urgent need to analyze products in multiple pathways beyond hydroperoxides. Hence, this is an opportune time to revisit the role of metals in lipid oxidation, examining their multiple catalytic mechanisms beyond decomposition of hydroperoxides and their generation of products that don't match simple autoxidation. This paper will present an overview of mechanisms by which metals catalyze lipid oxidation, emphasizing how different metals and mechanisms alter lipid oxidation kinetics and product distributions. These altered oxidation patterns will then be connected to effects on food quality for consumers and to new challenges to analytical capabilities in quality control and research. Important aspects of metal catalysis of oxidations needing up-to-date research will be identified.

AGFD 48 Role of iron in meat pigment and quality  Fereidoon Shahidi, fshahidi@gmail.com. Biochem Dept, Memorial Univ of Newfoundland, St. John's, Canada The role of iron in the chemistry and quality characteristics of meat is of much interest to both the industry and consumers. The color of meat is due to the presence of myoglobin and to a lesser extent residual hemoglobin present, and this varies with the age and species of animal as well as the type of muscle. The color of meat changes in both fresh and processed meat
upon storage or process condition as both the state of iron (ferric vs. ferrous) and state of globin and coordination with other molecules such as oxygen or nitric oxide influence the color which its intensity depends on the amount of myoglobin present in the original sample. The iron, in the free form, is also a prooxidant and as such leads to quality deterioration of meat unless it is chelated. The presentation will provide a cursory account of different aspects dealing with the quality of meat in the fresh, heat processed and cured state.

AGFD 49 Effects of copper-based fungicides on Pennsylvania hop quality Benjamin Chrisfield1, bzc5304@psu.edu, Beth Gugino2, Helene Hopfer1, Ryan Elias1. (1) Food Sci., Penn State, State College (2) Plant Pathology and Environmental Microbiology, Penn State, Univ. Park Copper-based fungicides are highly relied upon in both conventional and organic hop production; however, copper (II) is known to destroy many components related to hop aroma quality. While this phenomenon has been examined to a limited degree in long-established hop yards in Europe and the Western U.S., it has not been investigated in the burgeoning hops industry of the Northeast U.S., where increased humidity, rainfall, and disease pressure pose a greater obstacle in the production of high-quality hops. Herein, we present the results of a field trial conducted at Penn State’s Research Hopyard, wherein we examined the influence of copper-based fungicide field application on hop aroma quality in Cascade hops. Copper fungicide applications consisted of a copper hydroxide-based fungicide in combination with a copper-free fungicide while control hops received only the copper-free fungicide. Analysis of α- and β-acids, as well as essential oil profiling, revealed no differences between fungicide treatments. Beers dry-hopped with copper-treated or control samples were evaluated for sensorial differences by beer consumers (n=92) using triangle tests designed to discern differences in aroma and taste. Participants were unable to differentiate between beers based on orthonasal aroma alone (p=0.10) but were able to distinguish between treatments upon consumption (p=0.02) indicating a difference in basic taste or retronasal olfactory perception. Perceived differences may be due to the hop-variety thiol content of the beers. These thiols impart desirable aromas such as black currant or grapefruit but are labile to oxidation by copper (II). While this copper/thiol interaction has been characterized within food systems, considerably less attention has been paid to the connection between field treatments and finished food quality. Differences in hop-derived thiol concentrations, reported here, were analyzed in hops and beer samples to determine the potential effects of fungicide treatment on thiol content.

AGFD 50 Heavy metal speciation in agricultural soils Sophie M. Uchimiya, sophie.uchimiya@ars.usda.gov. CUR, USDA-ARS, New Orleans, Louisiana Chemical speciation of heavy metals in agricultural soils is controlled by the following master variables: pH, ionic strength, available binding ligands/surfaces, and solubility-limiting phases. Some surface sites (e.g., kinks, steps, and other defect sites of (hyd)oxides and phyllosilicates) and organic ligands (e.g., hexa- and tetra-dentate chelating agents) are reactive, while others are kinetically inert, towards transition metals. The chemical speciation, in turn, will control the fate (e.g., sorption-desorption, mobility, and redox reactivity), and ultimately, the bioavailability and accumulation of heavy metals in food crops. This presentation will first illustrate how the “master variables” impact different heavy metals of concern differently, following the Irving-Williams series, Jahn-Teller distortion, and reaction energetics (inner- vs. outer-sphere binding involving d-electrons). Particular emphasis will be given on the influence of native soil organic matter and a popular soil additive, biochar. Biochar amendment in reclamation (arms range) soils will be used as an example to illustrate how the thermochemical manipulation of surface functional groups (particularly low pKa carboxyl) leads to desirable or undesirable outcome of anthropogenic carbon inputs. Finally, recent publications on the bioaccumulation of heavy metals and metallic nanoparticles will be explored to understand the underlying roles of chemical speciation.

AGFD 51 Fate of silver nanoparticles in lettuce wash water as impacted by chlorine and organic matter Gayathri Gunathilaka1, gunathil@msu.edu, Jianzhou He2, Hui Li3, Wei Zhang2, Elliot Ryser1. (1) Dept. of Food Sci. and Human Nutrition, Michigan State Univ., East Lansing (2) Dept. of Plant, Soil and Microbial Sci., Michigan State Univ., East Lansing Increased use of engineered nanoparticles (ENPs) in agriculture may lead to the contamination of fresh produce along with potential health risks. Therefore, a better understanding of agriculturally-relevant ENP behaviour upon exposure to chemical sanitizers commonly used in produce processing is key to evaluating and developing strategies for their removal. This study aimed to examine the temporal changes of silver nanoparticles (AgNPs) when exposed to commercially applicable chlorine concentrations in simulated lettuce wash water. Aggregation and dissolution of AgNPs (5 mg/L) at three different chlorine concentrations (2, 50 and 100 mg/L) were evaluated in the presence and absence of dissolved lettuce extract (DLE, 0.1%), with 5 mg/L AgNPs in deionized water used as the control. Particle size (diameter, nm), zeta potential (mV) and dissolved Ag concentration (mg/L) were measured initially and then after 2, 6, 12, 24 h and 4, 7 and 10 days at 4°C. Particle size increased with time at all chlorine levels tested in the presence (89 to 168 nm) and absence (49 to 431 nm) of DLE as compared to the control (58 to 60 nm) (P < 0.05) indicating greater aggregation of AgNPs with chlorine and DLE. Lower dissolved Ag concentrations and increasingly negative zeta potentials were found in the presence of chlorine (0.01 to 0.03 mg/L and -95 to -39 mV) and DLE (0.01 to 0.14 mg/L and -28 to -32 mV), as compared to the control (0.54 to 0.8 mg/L and -10 to -20 mV) (P < 0.05). These results indicate that the fate of AgNPs is greatly impacted by both chlorine and organic matter in lettuce wash water. A clear understanding of these interactions as well as sorption of AgNPs to leafy greens is needed to optimize wash water conditions for effective removal of ENPs from fresh produce.

AGFD 52 Interaction of leafy vegetable romaine lettuce (Lactuca sativa L. var. Longifolia) with coexisting of ZnO nanoparticles and divalent heavy metals (Cd and Pb) with and their in planta accumulation Hamidreza Sharifan, hsharifan@tamu.edu, Janie Moore. Biological and Agricultural Eng., Texas A & M Univ., College Station Cadmium (Cd) and Lead (Pb) are extremely toxic to humans even at trace concentrations. Elevated levels of both heavy metals in agricultural soil due to various industrial activities have led to the hyperaccumulation of them in a variety of dietary plant tissues and food products, which raised public concerns for the food safety. Due to advances in nanoTech. -facilitated agrichemicals, engineered nanoparticles are substantially entering into agricultural systems. Coexistence of such nanoparticle with heavy metals in soil can alter the plant uptake through a different mechanism. However, the change of this uptake pattern is very critical for the leafy vegetable, which is a rich source of bioactive compounds, essential minerals, and dietary fibers for humans. The goal of this study was to understand the mutual effects of ZnO nanoparticles and coexisting divalent heavy metals Pb2+ and Cd2+ on their uptake and accumulation by Romaine lettuce (Lactuca sativa L. var. Longifolia) in a hydroponic system. Romaine seedlings were exposed to four treatments (1.0 mg L−1 Cd2++100.0 mg L−1 Pb2+, 1.0 mg L−1 Cd2++100.0 mg L−1 Pb2+ + 100 mg L−1 ZnO-ENPs, 100 mg L−1 ZnO-ENPs and a control with no chemical exposure) for 14 days. At termination, shoots were gently separated from the roots, and the concentrations of Pb, Cd, and Zn in all plant tissues were quantified by ICP-MS. The results indicated the active interactions between ZnO- ENPs and coexisting
AGFD 53 Procyanidin B2 attenuates metabolic syndrome by promoting TFEβ nuclear translocation and restoring redox status Hongming Su, hongmingsu@zju.edu.cn, Wei Chen. Food Sci. and Nutrition, Zhejiang Univ., Hangzhou, China Procyanidin B2 (PB2), a polyphenolic compound existing in berry fruits, grape seed and apple peel, is reported to exert multiple health-promoting effects. However, the effect of PB2 on metabolic syndrome and its molecular mechanism remain largely unknown. In the present study, we established free fatty acids (FFAs)-induced cell model and high-fat diet (HFD)-induced mice models to investigate the effect of PB2 on fat accumulation and oxidative stress. Our results indicated that PB2 provided protection against fat accumulation and its associated oxidative stress by inhibiting excessive ROS and superoxide anion radicals, blocking loss of mitochondrial membrane potential and restoring glutathione content in FFAs-induced cell model. Mechanistically, PB2 facilitated lipid degradation by promoting transcription factor EB (TFEB) nuclear translocation, which is a master regulator of lysosomal function. In silico molecular docking study suggested a possible binding position of PB2 with TFEB. Moreover, PB2 contributed to the amelioration of metabolic disorders including obesity and hyperglycemia in HFD-induced obese mice. It was confirmed that PB2 prevented HFD-induced fat accumulation by inhibiting lipogenesis-related gene expression (PPARγ, C/EBPα and SREBP-1c), reducing pro-inflammatory cytokines levels (IL-6 and TNF-α) and increasing antioxidant enzymes activity (GPx, SOD and CAT). In consistent with in vitro results, PB2 restored TFEβ protein expression and upregulated TFEβ target genes involved in the lysosomal pathway (Lamp1, Mcoln and Uvrag) in HFD-induced mice. Collectively, our results demonstrated that PB2 attenuated metabolic syndrome through activation of TFEβ-mediated lysosomal pathway and restoration of redox status, which suggested a previously unrecognized molecular mechanism of PB2 on ameliorating HFD-induced metabolic disorders. This study implicates a potential nutrition intervention strategy for metabolic syndrome by modulation of TFEβ pathway, and PB2 could be a novel agent for the prevention and treatment of metabolic syndrome.

AGFD 54 WITHDRAWN

AGFD 55 Identification of a human gut bacterial strain with anti-inflammatory and anti-cancer properties Yukun Sun, yunkunsun@umass.edu, Ermin Zhao, Min Gu, Hang Xiao. Dept. of Food Sci., Univ. of Massachusetts Amherst The human body is an ecosystem that hosts a variety of microorganisms and a majority of those are colonized in human gastrointestinal tract (GIT). Some of these microbes were considered as probiotics such as genus bifidobacterium and lactobacillus, showing beneficial effects on human GIT disorders. We isolated a strain of bacteria from feces of a healthy male adult that was identified as Bifidobacterium pseudocatenulatum UMA14 based on the gene sequencing. To determine the potential health effects, the bacterial secretion of the strain was subjected to cell culture models to establish the potential anti-inflammatory and anti-cancer effects. The results showed that adding the bacterial secretion to lipopolysaccharide (LPS)-stimulated RAW264.7 macrophages lead to a significant inhibition on the nitric oxide production and NF-κB signaling. Moreover, the bacterial secretion inhibited the growth of human colorectal carcinoma (HCT116) cells, and the inhibition was associated with increased apoptosis. Overall, our results demonstrated the anti-inflammatory and anti-cancer effects of Bifidobacterium pseudocatenulatum UMA14 isolated from human gut, and future studies are warrant to further elucidate the in vivo efficacy of the bacterial strain.

AGFD 56 Gut microbiota-mediated protective effects of whole strawberry against colonic inflammation Yanhui Han, yanhuihan@umass.edu, Hang Xiao. Food Sci., UMASS, Amherst Whole strawberry contains various bioactive components such as vitamins, flavonoids, phenolic acids, anthocyanins, and fiber, which exhibits various health benefits. Our research demonstrated that whole strawberry in the diet inhibited dextran sulfate sodium (DSS)-induced colitis in mice, which was evidenced by the ability of whole strawberry in reducing disease activity index, preventing the colon shortening, and alleviating the colonic tissue damages in the colitic mice. To elucidate the anti-inflammatory mechanism of strawberry in the colon, metabolomics analysis and next generation sequencing were conducted on colonic samples. The results showed that colitic mice had severe microbiota dysbiosis and aberrant purine metabolism with excessive uric acid accumulated in the colon, while whole strawberry treatment alleviated microbiota dysbiosis and decreased colonic levels of uric acid in the colitic mice. Furthermore, a fecal transplant study demonstrated that the gut microbiota dysbiosis directly caused the accumulation of uric acid in the mouse colon, as well as colonic inflammation in mice. Dietary supplementation of uric acid in mice confirmed that excessive uric acid in the colon promoted colonic inflammation, and dietary whole strawberry effectively reduced colonic uric acid levels and inhibited colonic inflammation in the uric acid-fed mice. Overall our results demonstrated a novel anti-inflammatory mechanism: whole strawberry alleviated microbiota dysbiosis, which in turn prevented colonic inflammation by inhibiting microbiota dysbiosis-induced accumulation of uric acid in the colon.

AGFD 57 Anti-inflammatory and anti-cancer effects of free and bound polyphenols from Laminaria japonica, a widely consumed seaweed Yifan Gao, yifangao@umass.edu, Lingxiao Yi, Yiping Yang, Yanhui Han, Hang Xiao. Food Sci., Univ. of Massachusetts, Amherst Accumulating evidence supports the notion that polyphenols from plant-based foods may produce protective effects against the development of various chronic diseases. The nature of polyphenols in Laminaria japonica, a widely consumed seaweed is poorly understood. This study was aimed to characterize the anti-inflammatory and anti-cancer potential of the polyphenol extracts of Laminaria japonica. Using a combination of different solvent extraction and chemical treatments such as alkaline hydrolysis, two major polyphenol fractions, namely free polyphenols (FP, extractable by organic solvents) and bound polyphenols (BP, non-extractable by organic solvents unless being released from fibers by alkaline hydrolysis first) were obtained. The anti-inflammatory and anti-cancer potential of the polyphenol fractions were determined in lipopolysaccharide (LPS)-treated RAW 264.7 macrophages and human colon cancer cells HCT 116, respectively. The results showed that the quantity and chemical nature of the FP and BP were largely different. Both FP and BP showed dose-dependent inhibition on the LPS-induced production of nitro oxide in macrophages, and also the growth of the human colon cancer cells, but with different inhibitory potency. These effects were associated with the inhibition of the inflammatory signaling and the induction of cellular apoptosis. Our results for the first time demonstrated the difference between FP and BP of Laminaria japonica in terms of their chemical nature and potential biological functions.

AGFD 58 Absorption and metabolism of curcumin in different type of nanoemulsion Haiyan Luo, hluo@foodsci.umass.edu, Zhengze Li, zhengzeli@umass.edu, David McClements, Eric A. Decker, Hang Xiao. Food Sci., Univ. of Massachusetts Amherst

divalent heavy metals, and the extent of their mutual interactions might alter based on the ZnO-ENPs properties and applied concentrations.
Curcumin, a widely used spice in food has been associated with many health benefits, but its health-promoting potential is limited by its poor bioavailability. This is due to the fact that curcumin is poorly absorbed, and absorbed curcumin is subject to extensive biotransformation. However, the oral bioavailability of bioactive molecules could be greatly increased by engineered lipid nanoparticles (ELNs). After ingestion, these ELNs could be disassembled and reassembled into various types of biological lipid nanoparticles, e.g. mixed micelles and chylomicrons, as they pass through the gastrointestinal tract (GIT). Controlling the initial composition of ELNs could be used to alter the properties of mixed micelles and chylomicrons formed in GIT, in turn, influence the solubility, absorption and metabolism of nutraceuticals in GIT. In current project, we evaluated the influence of ELNs with different carrier oil types on the bioavailability of encapsulated curcumin. To better understand the bioavailability of curcumin, the metabolic fate of curcumin in the monolayer enterocyte model was established. Our results demonstrated that after being absorbed by the enterocytes from the apical side of the monolayer, curcumin underwent phase I metabolism to yield three metabolites. Curcumin and these phase I metabolites then were subject to phase II metabolism to yield their corresponding conjugated phase II metabolites in the enterocytes. Curcumin and these metabolites were then transported across enterocytes to the basolateral side of the monolayer. Curcumin was encapsulated in ELNs i.e. nanoemulsions made of different carrier oils (such as corn oil, olive oil, medium chain triglyceride (MCT) and long chain triglyceride (LCT)), and then subjected to simulated gastrointestinal digestion before it was exposed to the enterocyte monolayer. I was found that nanoemulsions profoundly influenced the absorption and metabolism of curcumin in the enterocytes. The oil-based nanoemulsion was more effective at enhancing trans-enterocyte transport of curcumin than nanoemulsions made of corn oil, MCT, and LCT. Moreover, the metabolism of curcumin was greatly reduced by nanoemulsions made of corn oil, olive oil, MCT, and LCT, which could have retained the bioactivities of curcumin. These results have important implications in the rational design of lipid nanoparticle-based delivery systems to enhance health benefits of nutraceuticals such as curcumin.

**AGFD 59 Piceatannol protects human retinal pigment epithelial cells against hydrogen peroxide mediated oxidative stress and apoptosis through PI3K/Akt signaling pathway** Yiming Hao, haoyiming95567@126.com, Ziyuan Wang, Jie Liu, Jing Wang. Food Sci. & Tech., Beijing Tech. and Business Univ., China  The aim of this study was to explore the protective effect and its underlying mechanism of piceatannol on hydrogen peroxide (H2O2)-induced retinal pigment epithelium (RPE) cells damage. RPE cells (ARPE-19 line) were pretreated with piceatannol and then exposed to 300μM H2O2. Piceatannol treatment significantly inhibited H2O2-induced RPE cells death and ROS generation by 64.4% and 75.0%, respectively. Results of flow cytometry showed that H2O2-induced ARPE-19 cells apoptosis was also ameliorated by piceatannol supplementation, along with decreased relative proteins expression of Bax/Bcl-2, Cleave-Caspase-3 and Cleave-PARP. Moreover, piceatannol treatment could induce NF-E2-related factor 2 (Nrf2) signaling activation, which was evidenced by increased transcription of anti-oxidant genes, glutamate-cysteine ligase catalytic subunit (GCLc), SOD and HO-1. Knockdown of Nrf2 through targeted siRNA alleviated piceatannol-mediated HO-1 transcription, and almost abolished piceatannol-mediated cytoprotection. Further analysis showed that PI3K/Akt pathway was involved in cytoprotective effect of piceatannol. LY294002 (PI3K inhibitor) dramatically reversed the preventive effect of piceatannol against H2O2-induced RPE cells oxidant damage.

**AGFD 60 Dietary intake of king oyster mushroom (Pleurotus eryngii) ameliorated dextran sulfate sodium-induced colitis in mice** Hengjun Du1, hengjundu@gmail.com, Biao Yuan1, Yanhui Han1, Min Gu1, Qihui Hu2, Hang Xiao1. (1) Dept. of Food Sci., Univ. of Massachusetts Amherst (2) Dept. of Food Sci. and Eng., Nanjing Univ. of Finance and Economics, China  Whole food-based strategies to prevent disease and promote human health are promising and potentially effective due to potential synergistic interactions among different bioactive components within the whole foods. This study aimed to improve colon health by using Pleurotus eryngii (P. eryngii, king oyster mushroom), a widely cultivated edible mushroom, to inhibit inflammatory bowel disease (IBD). Our results showed that dietary administration of freeze-dried whole P. eryngii (WPE, 1 and 3% w/w in the mouse diet, oral doses reasonably achievable in humans) alleviated colonic inflammation in the dextran sulfate sodium (DSS)-treated colitis mice. Specifically, WPE decreased disease activity index, prevented colon shortening, alleviated the colonic tissue damages. The abundance of pro-inflammatory cytokines (IL-1β, IL-2, IL-6, IL-17, and IFN-γ) was markedly ameliorated by WPE treatment in the colonic mucosa of DSS-treated mice. Sequencing the 16S rRNA genes of gut microbiota demonstrated that WPE in the diet significantly mitigated the dysbiosis of gut microbiota induced by DSS treatment, a case in which it increased the abundance of potentially beneficial bacteria and attenuated the abundance of potentially harmful bacteria. Furthermore, the levels of short-chain fatty acids in the cecum of colitis mice were significantly increased by WPE. Overall, our results for the first time demonstrated the anti-inflammatory and microbiota-modulating effects of WPE and illuminated its potential as a functional food to prevent inflammation-related disorders and promote colonic health in humans.

**AGFD 61 Plasticizer di-(2-ethylhexyl) phthalate (DEHP) in vegetables and fruits Xu-Liang Cao, xu-liang.cao@Canada.ca. Health Canada, Ottawa  Phthalates have become ubiquitous environmental contaminants due to their widespread applications in polyvinyl chloride (PVC) products (as plasticisers) and in consumer and personal care products. Some phthalates are also being used in food packaging, such as di-(2-ethylhexyl) phthalate (DEHP) in PVC gaskets of lids for glass jars. Phthalates are of increasing concern to humans due to the potential for exposure and the findings of adverse effects from toxicology studies in animals. Recently, total diet food samples of various categories including dairy, meat, poultry, fish, cereal, vegetable, fruit, beverage were analysed for 20 phthalates including DEHP for exposure assessment under the Government of Canada’s Chemicals Management Plan. Among the findings, relatively high levels of DEHP were found frequently in samples of vegetables and fruits, for example, 899 ng/g in ratabagas, 713 ng/g in peas, 676 ng/g in mushroom, 675 ng/g in cucumber, 657 ng/g in lettuce, 600 ng/g in apples, 383 ng/g in bananas, 324 ng/g in cherries etc. Sources of DEHP in the vegetable and fruit samples are not clear. Phthalates including DEHP could be introduced during preparation by suppliers to retailers where vegetables and fruits are washed with water containing detergent to remove soil. Packaging could contribute DEHP for some vegetable and fruit samples, such as the plastic wraps used for fresh cucumber and mushroom, can coatings for the composite of peas and cherries, and gaskets used in the lid for bottled pickles for the composite of cucumber. However, most of the vegetables and fruits were not packaged and they were simply placed in polyethylene (low- or high density) bags which are not expected to be plasticised with DEHP since they are naturally flexible. Although DEHP in these vegetable and fruit samples could also be from environmental contamination (air, water and/or soil), the most likely sources of DEHP in vegetable and fruit samples could be from the agricultural practices since the use of DEHP plasticized PVC film in greenhouse and the use of DEHP plasticized PVC mulch film for
AGFD 62 Espresso from first principles: Route to highly reproducible cup quality  
Christopher H. Hendon, chendon@uoregon.edu. Chemistry and Biochemistry, Univ. of Oregon, Eugene  
Numerous physical and chemical processes play a determining role in cup quality, ranging from agricultural practices, to roasting and brewing[1,2,3,4]. This talk canvases the landscape of our groups coffee research to date, focussing on the production of espresso-based beverages, and how we can systematically improve both the flavor reproducibility and coffee efficiency using a mixture of mathematics, chemistry, and physics[5]. We present a microkinetic model that helps predict flavor reproducibility, while illuminating a route to systematically reducing coffee waste.

AGFD 63 Effect of organic selenium supplementation in cattle on mozzarella cheese quality and antioxidant activity  
Zhihuan Liu1, Yingping Xiao2, Jianxin Liu1, Daxi Ren1, dxren@zju.edu.cn. (1) College of Animal Sci., Zhejiang Univ., Inst. of Dairy Sci., Hangzhou, China (2) Zhejiang Academy of Agricultural Sci., Inst. of Quality and Standard for Agro-products, Hangzhou, China  
Selenium (Se) is an essential micronutrient and extremely important to human and animal health. Our previous study has proved that feed Se-Met supple could improve the Se content in milk and cheese. However, whether Se-yeast is as well as Se-Met, and the effect of high Se content on cheese quality such as antioxidant activity is unclear. Therefore, in this study, three group of milk samples were collected after two months feeding, control, Se-Met and Se-Yeast group supply (0.3 mg Se/kg DM). The Se concentrations in the milk of Se-Met, Se-Yeast and control groups were 61.2, 49.5 and 28.7 µg/L, respectively. Mozzarella cheese was made by this Se-enriched milk, the Se content in mozzarella cheese was 390 µg/kg for Se-Met, and 344 µg/kg for Se-Yeast. Both of them were meet the EU standard, which is more than 16.5 µg/100g and thus met the criteria of the claim “high in” Se and health claims related to Se. Similar cheese composition and quality was found among the three groups except the color, the Se-enriched cheese has lower L* and higher b* than the control. Antioxidant activity of cheese was evaluated by DPPH, reducing power and ABTS. For all three indicators, Se-enriched cheeses showed higher values than control (P<0.05). Results of this study showed that both Se-Met and Se-Yeast suppletions could increasing milk and cheese Se content, improving the antioxidant activity of the cheese, and hardly affected cheese quality except the color. Feed organic Se supply is a potential way to improve the human Se intake for the place Se deficiency.

AGFD 64 Enzyme inhibition, antioxidant, and insecticidal activities of flavonoids and fixed oil from Albizia zygia (J. F. Macbr)  
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Albizia zygia (Leguminosae) is a gum producing tree and wide spread in tropical Africa. It has secondary metabolites of medicinal importance. This study investigates the enzyme (urease and α-glucosidase) inhibition, antioxidant and insecticidal activities of the crude extract and isolates. Terpenoids (lupeol and Betulin) and flavonoids (4',7-dihydroxyflavanone, 3',4',7-Trihydroxyflavone, 4',5,7-trihydroxy-3',5'-methoxyflavone and 5,7,4'-trihydroxy-3',5'-dimethoxyflavone) were isolated from A. zygia and were shown to possess significant enzyme inhibition (urease and α-glucosidase) and antioxidant activities, when activities were compared with thiourea, 1-deoxyxojirimycin and butylated hydroxylamine used as standards in the three assays. 4',7-dihydroxyflavanone (21.5 ±0.32), 5,7,4'-trihydroxy-3',5'-dimethoxyflavone (31.2 ± 0.10) and the fixed oil (32.9 ± 0.56) were the most active in the antioxidant assay. The fixed oil obtained from A. zygia was dominated with hexahydrofarnesyl acetone, palmitic acid, 2,4-dihydroxysteryl ester, oleic acid, and oleic acid, methyl ester. This study therefore justifies the use of A. zygia in the treatment of tumour and oxidation related diseases.

AGFD 65 Potential evaluation of Ganoderma formosanum extract against PM2.5-induced ROS generation  
Shiyao Chen1, floraaaachen@gmail.com, Yuhin Chan2, Kuan-Chen Cheng1,2, (1) Inst. of Food Sci. & Tech., Nat’l Taiwan Univ., (2) Inst. of BioTech., Nat’l Taiwan Univ., Taipei  
Ganoderma formosanum, a traditional medicinal mushroom, has been used in Asian for more than 2000 years. Extraction of Ganoderma formosanum possesses diverse bioactivities, such as anti-inflammatory, antitumor, immunomodulatory and skin whitening functions. Skin is the biggest organ in a human body, also it is the first and most important defense barrier to the external contaminants. Multitudes of chemicals can be absorbed into skin, so long-term exposure to the ambient pollutants will result in toxicity. Particulate matter (PM) is a common index of air quality, which can be divided into fine particulate matter (PM2.5) and coarse particulate matter (PM10), according to its aerodynamic diameter. Epidemiological studies have proven that fine particulate matter (PM2.5) exerts negative effects and is unable to be blocked by our defensive system. Previous studies indicated that PM brings about the generation of intracellular reactive oxygen species (ROS). ROS, including superoxide and hydroxyl radical, is a natural byproduct of cell oxidative phosphorylation, and a persistent imbalance between ROS generation and elimination can result in tissue impairment. The study discusses the potential of protection against PM2.5-induced ROS generation and cell viability with extraction of Ganoderma formosanum submerged fermentation mycelium in vitro human keratinocyte (HaCaT cell), meanwhile assesses the toxicity of PM2.5 to animals by using zebrafish in vivo model. Our results show that PM2.5 treatment promotes the intracellular ROS level and decrease cell viability both in a dose-dependent manner. The same effect can also be observed in zebrafish model, and PM2.5 will damage its cardio-development, which causes the reduce of heart-beating rate. Pretreatment of Ganoderma formosanum extraction ameliorates intracellular ROS generation and apoptosis. Taken together, these findings imply that antioxidant activities of Ganoderma formosanum extraction may play an important role in the protection of PM-caused cell damage.

AGFD 66 Screening of yeasts from fruits for grape wine production  
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Yeasts with higher aromatic compounds were selected from fruits in Taiwan for winemaking. The optimal fermentation condition of producing aroma were obtained by the response surface methodology. In this study, Taiwan fruits such as apple, banana, fig, longan, sugar apple, carambola, etc. were selected as screening materials, and a selective pressure medium supplemented with chloramphenicol, 20% sugar, 8% ethanol and pH 5 was used as a screening platform. The yeasts which can adapt to the brewing environment were isolated and purified. The aroma components were analyzed by GC-MS after cultivation, and the strains with better aroma-producing ability were screened and identified based on ethyl acetate and phenylethyl alcohol production. Afterwards, the physiological and biochemical characteristics were analyzed. Compared with the type strain BCR 22779, the new strain Hanseniaspora uvarum C2 can use sucrose and xylose as carbon sources. Then, the influence of agitation speed, fermentation temperature and initial glucose concentration on ethyl acetate production were tested to obtain the optimal aroma producing
conditions by the response surface methodology. 130 ppm ethyl acetate were obtained by Hanseniaspora uvarum C2 fermentation at 22 oC and 80 rpm with 20% initial glucose concentration, which is significantly higher than the previous condition. Finally, in small-scale winemaking trials, the wine fermented with Hanseniaspora uvarum C2 based on optimal aroma producing condition was judged to be of superior quality than the one with previous condition.

AGFD 67 Chemical compositions of commercial chrysanthemum tea samples and their anti-inflammatoy and antioxidant properties

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Seventeen commercial chrysanthemum tea samples (Chrysanthemum morifolium and Coreopsis tinctoria) extracted with hot-H2O and 75% methanol were comparatively examined for their chemical compositions using UPLC/Q-TOF-MS analysis. For the first time, 6, 8-C, C-diglucosylapigenin and eriodicycol-7-O-glucoside were detected in the Snow chrysanthemum, and acetylmarein was detected in HangJu, GongJu and HuaiJu. The radical scavenging and anti-inflammatory activities of their extracts were also investigated in vitro. The hot-H2O extract of KLM 1 had the greatest total phenolic content (TPC), and relative DPPH (RDSC) and oxygen radical absorbance capacity (ORAC) values of 12.72 mg GAE/g, 105.48 and 1222.50 µmol TE/g, respectively. Furthermore, all the hot-H2O extracts suppressed the mRNA expressions of IL-6, IL-1β and COX-2, and H2O2-induced intracellular ROS production in cultured ARPE-19 cells. The results from this research may be used to promote the consumption of chrysanthemum as a functional tea.

AGFD 68 Immobilized of laccase for ginkgolic acid degradation

Hung-yueh Chen, yuwyueh@gmail.com, Kuan-Chen Cheng, Yuwen Ting. Food Sci. & Tech., Nat’l Taiwan Univ., Taipei Ginkgo biloba leaf extract possesses many active ingredients whereas with ginkgolic acid, which leads to serious allergies and toxicity, could contribute to an excessive expansion of capillaries. The purpose of this study aims to immobilize laccase on the nylon carrier using electrospinning and to degrade the ginkgolic acid within G. biloba leaf extract by enzyme hydrolysis. An enzyme immobilization system for degradation of ginkgolic acid in G. biloba leaf extract was established. Laccase which was immobilized onto the nylon 6,6 nanofiber membrane with multi-walled carbon nanotubes (LNFWMWCNTs) exhibited a significant efficiency for the catalyzed of ABTS then nylon 6,6 pellet. The optimum temperature and pH for ABTS catalysis was 40oC and 5, results revealed that the endurances of LNFWMWCNTs to pH and temperature were improved. Operational reusability and storage stability was confirmed for more than 40 reactions and 2 days. The kinetic parameters, including rate constant (K), the time (t50), the time (tcomplete), Km and Vmax were determined, which were 0.07 ± 0.01 min−1, 8.97 ± 0.55 min, 45.45 ± 2.79 min, 0.51 ± 0.09 mM and 0.05 ± 0.00 mM/min*mg, respectively. This study demonstrates the potential of laccase immobilized system in enhance the enzyme activity and the endurances about environmental factors, to remove ginkgo acid in G. biloba leaf extract.

AGFD 69 Evaluation of Ganoderma formosanum extract against PM2.5-induced ROS generation and cell damage

Yun An Hsu1, aghsu0417@gmail.com, Yu Hin Chan1, Kuan-Chen Cheng1,2. (1) Inst. of BioTech., Nat’l Taiwan Univ., Taipei (2) Food Sci. & Tech., Nat’l Taiwan Univ., Taipei Fine particulate matter (PM2.5) is a type of suspended air pollutant with a diameter of 2.5 µm, which make it possible to pass through the respiratory tract and travel deep into alveolar tissue. Studies have indicated that long-term exposure to PM2.5 could reduce pulmonary function, increase morbidity and mortality of lung cancer and exacerbate asthma and COPD. One of the potential mechanisms of the impact from PM2.5 on the pathogenesis of diseases is oxidative stress. Oxidative stress will impair the antioxidant system and reduce the antioxidant abilities of cells by affecting antioxidant enzymes then cause cell death by ways of apoptosis, autophagy or others. Ganoderma is one of the most valued Chinese traditional medicines and G. formosanum is an endemic species of Ganoderma in Taiwan. Its bioactivities about free radical scavenging and immunostimulatory ability have been demonstrated, hence we used human lung fibroblast MRC-5 to investigate the effect of G. formosanum extracts against PM2.5-induced ROS generation and its mechanism. The results showed that cell viability was decreased with increased ROS generation both in a dose-dependent manner after exposed to different concentration of PM2.5. After 24hrs pretreatment, butanol fraction (BuOH) of G. formosanum ethanol extract (GFE) significantly increased the cell viability of MRC-5 after exposed to PM2.5. Furthermore, WST-1 assay also showed no cytotoxicity of butanol fraction under 200 ppm. Moreover, the effect of GFE-BuOH on decreasing ROS generation was also demonstrated in zebrafish. As a result, our data indicated that GFE-BuOH fraction could alleviate PM2.5-induced cell death and ROS generation, accordingly, this study provided a potential therapeutic treatment to improve lung injury caused by PM2.5 exposure.

AGFD 70 Insulin regulates the expression and translocation of GLUT8 to increase glucose uptake in bovine mammary epithelial cells

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Glucose is the prime precursor for lactose synthesis, and the availability of glucose in bovine mammary gland plays a crucial role in milk production of dairy cows. In the present study, the effects of insulin on glucose uptake and the underlying regulatory mechanisms were investigated in MAC-T [a bovine mammary epithelial cell (BMCEs) line] cells. MAC-T cells were treated with different levels of insulin (0, 250, 500, 750, 1000 ng/mL) for varying time points (2, 12, 24 and 48 h) after a 24 h serum starvation. Compared with the control group (0 ng/mL insulin), cell viability was overall enhanced by the addition of insulin, with the highest viability at 500 ng/mL insulin at most of time points. Addition of 500 ng/mL insulin significantly increased glucose uptake at all time points (P < 0.05). Also, the mRNA and protein abundance of GLUT8 were both significantly enhanced (P < 0.05) after 12 h of insulin treatment and reached the highest level at 24 h. Furthermore, insulin remarkably stimulated the translocation of GLUT8 from cytoplasm to the plasma membrane. In summary, the results suggested that insulin-induced glucose uptake in BMCEs was likely mediated through enhancing the expression and translocation of GLUT8.

AGFD 71 Trans-10, cis-12 conjugated linoleic acid reduced the activity of nSREBP1 in bovine mammary epithelial cells via altering SREBP1 and INSIG1 expression

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Trans-10, cis-12 conjugated linoleic acid (CLA) has been identified as an intermediate of rumen fatty acid biohydrogenation causing milk fat depression (MFD) in the dairy cows. The expression of sterol response element transcription factor 1 (SREBF1, the master lipogenic regulator) was reduced in CLA- and diet-induced MFD dairy cows. To investigate the mechanism of
Reducing SREBP1 activity by trans-10, cis-12 CLA, it was added in bovine mammary epithelial cells (MAC-T cell line). Results showed that trans-10, cis-12 CLA had no difference in the expression of precursor SREBP1 (psSREBP1), but significantly reduced the level of mature nuclear SREBP1 (nSREBP1) at a dose-manner. Compared with control, trans-10, cis-12 CLA (150 nM) significantly downregulated the expression of ACACA, FASN, and SCD1, and upregulated the mRNA abundance of ACS2, CD36. A lower SCD1 level was observed in the cells incubated with trans-10, cis-12 CLA. No differences were found in mRNA abundance of PPARG, INSIG1 and SCAP. However, it caused a lower protein abundance of SCAP. MG-132 (The inhibitor of 26S proteasome activity) treatment failed to overcome trans-10, cis-12 CLA reducing ACACA, FASN, and SCD1 and upregulating CD36 mRNA abundance in cells, indicating that 26S proteasome pathway do not involved in diet-induced milk fat depression. The protein abundance of pSREBP1 was decreased in trans-10, cis-12 CLA and MG-132 treated cells, but there was no difference in the expression of INSIG1. In summary, the trans10, cis12 reduced the activation of SREBP1 at least partly via altering SCAP protein abundance.

AGFD 72 Study on fatty acid profile, flavour, and quality of mozzarella cheese made from a high omega-3 milk produced by lactating cows fed with flaxseeds diet  
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A new mozzarella cheeses was made from different cow milk sources including milk containing high omega-3 fatty acids that produced by lactating cows fed a diet containing flaxseeds in a previous feeding study. Fatty acid profiles and major quality parameters including nutrient concentration, texture, colour, flavours of the high omega-3 cheese and the control cheese were compared. It was found that the high omega-3 cheese was 4-fold and 2.5-fold higher (P<0.01) in alpha-linolenic fatty acid (ALA) and cis 9, trans 11 conjugated linoleic acid (CLA c9, t11) respectively higher compared to the control cheese, which were consistent with the differences between the raw milk sources. The cheese major fatty acid compositions in both groups were not changed (P>0.1) during a 60-day storage period. The differences in the fatty acid profiles especially in ALA between the groups resulted in lower n-6/n-3 ratio (P<0.01), as well as well as indexes of atherogenic and thrombogenic in high omega-3 cheese compared to the control. When comparison on quality characters of cheese it was found that high omega-3 cheese had larger (P<0.05) a* colour value but less (P<0.05) chewiness value compared to the control. The analysis on flavours by an electronic nose indicated significant but less (P<0.05) chewiness value compared to the control. The proximate analysis results revealed that moisture, ash and crude fibre contents were highest in Telfairia occidentalis (80%,13.48% and 14.77% respectively). Crude protein was the highest in Vernonia amygdalina (13.38%). Ociomum gratissimum had the highest amount of crude fat and carbohydrate contents (14.93% and 53.74% respectively). The phytochemical analysis showed that the Ociomum gratissimum (scent leaves) contained the highest amount of alkaloids and tannins (16.02% and 12.07%) respectively. Vernonia amygdalina (Bitter leaves) contained the highest amount of saponins (14.69%) while Telfairia occidentalis contained the highest amount of flavonoids and total phenols (7.99% and 10.37%) Ten fatty acids were identified in the vegetable samples (five saturated and five unsaturated fatty acids). Ociomum gratissimum contained the highest amount of Oleic acid, Linoleic acid and Linolenic acid (8.96±0.01, 0.25±0.01 and 20.23±0.01) respectively. Telfaria occidentalis leaves contained the highest amount of Palmitoleic acid (3.35±0.01) while Vernonia amygdalina leaves contained the highest amount of Elaidic acid (3.62±0.01) Alkaloids, flavonoids, tannins and saponins are known to be pharmaceutically useful. Polysaturated fatty acids have health benefit especially in the treatment and prevention of cardiovascular diseases. This study has shown that Ociomum gratissimum, Vernonia amygdalina and Telfaria occidentalis vegetables could be exploited for nutritional, pharmacological and industrial purposes.

AGFD 74 Effect of ethylene content in EVOH films on activation energies of diffusion of organic migrants and polymer modeling parameters  
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Migration models used as tools in calculating additive and contaminant migration from food contact materials are designed conservatively for regulatory compliance testing to provide a safety margin for consumers. The generally recognized Piriinger diffusion model requires a polymer-specific parameter, AP, to describe the basic diffusion behavior of a polymer in relation to its migrants. Ethylene vinyl alcohol (EVOH) is a random copolymer of ethylene and vinyl alcohol used as a high-oxygen barrier within multilayer flexible packaging. However, AP values for EVOH films of any ethylene content are not currently available. EVOH monolayer films of two ethylene contents, 44 mol% and 32 mol%, were studied using toluene as a surrogate migrant. Toluene has been used in solvent-based printing ink formulations on the outer layers of food packaging. Diffusion coefficients (DP), permeability coefficients, and solubility coefficients of toluene were determined by an isostatic permeation method at 90 °C, 100 °C, 110 °C, and 121 °C. Results showed that higher ethylene content in EVOH 44 mol% film allowed increased migrant mobility within the polymer due to its lower Tg (53 °C) and closer proximity to its Tm (165 °C) than EVOH 32 mol%. DP values for EVOH 44 mol% were determined in the range of 1.3 × 10-10 to 1.9 × 10-9 cm²/s, while DP values for EVOH 32 mol% were slower by approximately one order of magnitude. The activation energies of diffusion (EA) for toluene in EVOH 44 mol% and EVOH 32 mol% films determined from the Arrhenius plots of the experimental DP values were 100.9 kJ/mol and 130.3 kJ/mol, respectively. Higher EA values result in lower diffusion coefficients at a specific temperature. Mean AP values estimated for EVOH 44
AGFD 75 Immobilization of reporter bacteriophage PP01 on electrospray PHB fibers for Escherichia coli O157: H7 detection  Sim Yee Chen, simyee@ualberta.ca, Melissa Harrison, Dominic Sauvageau, Anastasia Elias. Univ. of Alberta, Edmonton, Canada

Bacteriophage (phage) immobilization on substrates is important for many biocontrol and pathogen detection applications. We propose using electrospray biopolymer (polyhydroxybutyrate, (PHB)) nanofibers as substrate due to their large specific surface area and biocompatibility. Electrospray PHB fibers were fabricated for immobilization of a reporter phage for the detection of Escherichia coli O157: H7. In this study, the E. coli O157:H7-specific lytic phage PP01 was genetically engineered to express luciferase, providing a bioluminescence signal upon detection of its host. The phage was immobilized through physical attachment by immersing electrospray fibers in PP01 suspensions. The surface morphology of the fiber was studied using scanning electron microscopy (SEM) and water contact angle (WCA) measurements. In addition, phase-staining and fluorescence microscopy were employed to investigate phage binding on the polymeric fiber substrate. We have shown that immobilized phages on electrospray fibers displayed higher infectivity than that of phages on plasma treated flat film. The infectivity of attached phages was confirmed through plaque and infection dynamic assays. We then demonstrated that the immobilized phages can be used to detect E.coli cells at a concentration of 102 CFU/ml within 4 hours. This work presents potential use of phages as biosensor and antimicrobial packaging.

AGFD 76 Identification of aroma compounds in frozen surimi made from silver carp (Hypophthalmichthys molitrix) by normal phase chromatography fractionation and gas chromatography/offactometry Yueqi An1,2, anyu@oregonstate.edu, YanPing L, Qian2, Shanbai Xiong1, Michael C. Qian3. (1) Food Sci. & Tech., Huazhong Agricultural Univ., Corvallis, Oregon (2) Food Sci., Oregon State Univ., Corvallis (3) Oregon State Univ, Corvallis

Surimi-based products have received more and more appreciation as nutritious and tasty food. Frozen surimi, a mixture of myofibrillar proteins which obtained from the deboned fish fillet, is the main material to manufacture surimi-based products. The basic understanding of aroma compounds in frozen surimi will be useful for the production of surimi-based products. In this study, aroma compounds from silver carp (Hypophthalmichthys molitrix) frozen surimi were isolated by solvent-assisted flavor evaporation (SAFE) and then concentrated to 1 mL by distillation. The aroma extract was fractionated by silica gel based normal phase chromatography. A series of pentane/diethyl ether (100:0, 98:2, 95:5, 90:10, 50:50, 0:100) was used to fractionate the aroma compounds. Gas chromatography-mass spectrometry/offactometry (GC-MS/O) was used to identify aroma compounds on both DB-wax and HP-5 columns for each fraction. The normal phase chromatography fractionation technique separated compounds into groups based on their polarity. The results showed that alkanes were collected in the first fraction (100% pentane), which did not have much odor but showed huge peaks. Aldehydes and alcohols mainly came out in the second fraction (98% pentane: 2% diethyl ether) and the third fraction (95% pentane: 5% diethyl ether). With the increasing diethyl ether presents, acids, ketones, and lactones were eluted in the fourth and the fifth fractions, which contained 10% and 50% diethyl ether respectively. Totally, eighty-five aroma compounds were successfully identified in silver carp frozen surimi, including thirty-three aldehydes, fifteen alcohols, ten ketones, seven acids, six sulfur-containing compounds, four phenolics, three lactones, three esters, one N-containing compound, and three other compounds. (Z)-4-Decenal, (E,E)-2,4,6-nonatrienial and (E,Z,Z)-2,4,7-tridecatrienal were first identified in surimi, which had strong aroma described as “live fish and river water”. Other aroma-active compounds identified in silver carp surimi were hexanal (grassy odor), (Z)-4-heptenal (fishy odor), (E)-2-nonenal (fatty odor), (E,Z)-2,6-nonadienal (cucumber odor), (E,E)-2,4-decadienal (fatty odor), 1-octen-3-ol (mushroom odor), 1-octen-3-one (mushroom odor), 2-methylbutanoic acid (cheesy odor), dimethyl disulfide (garlic odor) and dimethyl trisulfide (fishy odor).

AGFD 77 Uptake of cadmium and arsenic by radishes grown in bat guano amended soil and remediation using modified natural zeolites Sabrina Carrillo, sabrinanorton@csus.edu, Susan Crawford. California State Univ. Sacramento Organic home gardening is a booming multimillion-dollar market that encourages gardeners to incorporate natural soil modifiers into their garden soil to bolster their yearly harvest. The addition of regionally sourced bat guano and guano containing additives is frequently utilized to maintain soil pH and overall nutrient content. Unfortunately, the rapid metabolic processes of insectivorous bats makes them susceptible to heavy metal accumulation within their body fat and feces. Containing roughly 2g of cadmium/kg soil (ppb), the use of bat guano as a soil amendment raises concerns due to the metal contamination potential it presents. Certain crop vegetables such as leafy greens, rice, grapes and radishes, accumulate heavy metals in the edible portions of the plant which represents a pathway into the human food chain. Environmental remediation techniques have used natural zeolite ion exchange properties to remove metal contaminates from aqueous and soil environments to help reduce human exposure. This study aims to determine the extent of cadmium and arsenic uptake into radish leaves and roots when grown in organic soil fertilized with bat guano and bat guano containing soil modifiers. Results from aqueous adsorption experiments and plant studies using natural and modified natural zeolite materials as remediation amendments targeting the reduction of cadmium and arsenic uptake from contaminated soil are presented.

AGFD 78 Development of a biocontrol agent using rice husk biochar with Bacillus sp. IA Takashi Ano, tano@waka.kindai.ac.jp, Shohei Ebe, Tatsuya Ohike, Masahiro Okanami. BioTech., Kindai Univ., Kinokawa, Wakayama, Japan

Rice plant is one of the most common food crops cultivated in numerous countries. Over 150 million tons of rice hulls are expected to be produced around the world. Therefore, effective utilization of rice hulls is very important for both treatment of an agricultural waste material and creating sustainable agriculture. Rice husk biochar (RHB) is produced by low-temperature pyrolysis of rice hulls, and has been used as a soil amendment for the better drainage properties and air permeability. Another advantage in RHB addition has been considered to increase the plant growth promoting microbes. We had focused on the relationships between microorganisms and RHB and tried to isolate the microorganisms whose growth is promoted in the presence of RHB. In a previous study, we successfully isolated Bacillus sp. strain IA, whose growth was promoted on agar plate supplemented with RHB than the growth on the plate without RHB. Furthermore, strain IA’s growth, sporulation and an antibiotic production were promoted by the addition of RHB to the liquid culture medium. These results suggested that a combination of strain IA and RHB will be an effective biocontrol agent. This study aimed to develop a biocontrol agent combined with strain IA and RHB. To evaluate an ability for a plant protection, cucumbers were grown in soil with strain IA and then a phytopathogenic fungus Rhizoctonia solani K1 was inoculated onto the soil. As a result, the soil with strain IA showed a reduction of the disease level of cucumber than that without strain IA. To develop a low-cost biocontrol agent, we attempted cultivation of strain IA using rice bran, which is an agricultural waste material from rice plant. A medium, combined with RHB and rice bran, was
developed and used for the cultivation of strain IA. As a result of
cultivation, strain IA could grow in the medium with a combination
of RHB and rice bran to the level of 108 cfu per 1 g of RHB. This
study showed possibility that the combination of strain IA, RHB and
rice bran will be an effective and a low-cost biocontrol agent to
control plant diseases.

AGFD 79 Comparing tomato seed flour and oil as potential
value-added products Elena R. Bailoni1, ebailoni@termail.umd.edu, Uyory Choe3, Yanfang Li1,2, Boyan
Gao1,2, Liangli Yu1,2. (1) Nutrition and Food Sci., Univ. of
Maryland, College Park (2) Shanghai Univ., China (3) Univ. of
Maryland, Hyattsville Phenolic content and radical scavenging
capacities of ingredients are important for their usefulness as a source
of antioxidants. Two tomato seed flours and two tomato seed oils
were tested for phenolics and radical scavenging capacity to
investigate their potential as value-added products. Tomato seed flour
samples had significantly higher amounts of total phenolic content
and higher radical scavenging capacities than tomato seed oil
samples. Both ingredients, but especially tomato seed flour, showed
potential for use as a value-added product that can reduce waste and
increase profits for tomato production and processing business while
improving human health.

AGFD 80 Study on fatty acid profile, flavor, and quality of
mozzarella cheese made from high omega-3 milk produced by
lactating cows fed with flaxseeds diet Daxi Ren1, Chong Wang3,
Chenxing Liu1, Xuedong Wang1, Jianxin Liu1, Maolong He2,
maolong.he@lucta.com, Haifeng Wang1, haifengwang@zju.edu.cn.
(1) Zhejiang Univ., Hangzhou, China (2) Lucta (Guangzhou)
Flavours Co. Ltd, Guangzhou, China (3) Zhejiang A&F Univ.,
Hangzhou, China A new mozzarella cheese was made from
different cow milk containing high omega-3 fatty acids. It was found
that the high omega-3 cheese had 4-fold and 2.5-fold higher (P<0.01)
alpha-linolenic fatty acids (ALA) and cis9, trans 11 conjugated
linoleic acids, respectively, than the control cheese, findings that
were consistent with the differences between the raw milk sources.
The cheeses’ major fatty acid compositions for both groups were not
changed (P>0.1) during a 60-day storage period. The differences in the fatty acid profiles resulted in a lower n-6/n-3 ratio (P<0.01) and
lower atherogenic and thrombogenic indexes in the high omega-3
cheese compared to the control. The high omega-3 cheese had better
(P<0.05) a* color but less (P<0.05) chewiness compared to the
control. In conclusion, the study introduced a cheese made from high
omega-3 fatty acid milk that was able to retain the healthy functional
characters of the fatty acid profile.

AGFD 81 Enhanced bacterial cellulose production using response
surface methodology for Komatactobacter intermedius Chih-Chan
Chou2, zerry1994@gmail.com, Kuan-Chen Cheng1. (1) Food Sci.
& Tech., Nat’l Taiwan Univ., Taipei (2) Graduate Inst. of BioTech.,
Taipei, Taiwan Bacterial cellulose (BC) is a biopolymer with
extraordinary material properties such as high tensile strength, high
water holding capability and high bio-compatibility, thus possesses
great potentials for diverse applications. This study aims to enhance
BC productivity of an indigenous cellulose producing bacteria
Komatactobacter intermedius BCRC 910677 via response surface
methodology (RSM) optimized medium. Fructose and peptone were
used as carbon and nitrogen source as it both show good productivity
compares to other carbon and nitrogen sources in our initial test. For
RSM study, Box-Behnken design (BBD) is applied for experimental
design as the three factors, namely fructose concentrations, peptone
concentrations and pH values were tested in search of the optimized
medium composition for BC production. The final center point for
the RSM study is located at 40g/L fructose, 50 g/L peptone and pH6,
this set of condition resulted a current highest yield (3.706 g/L) is
much higher compares to BC produce by the same strain with
Hestrin-Schramm (HS) medium (<2.000 g/L) under a 6 day culture,
indicating that modification of medium with optimized composition
is a promising strategy to increase BC productivity.

AGFD 82 Bakkenolides and caffeoylquinic acids from the aerial
portion of Petasites japonicas and their bacterial neuraminidase
inhibition Hyun Sim Woo, whs0428@bdna.or.kr, Hae Jin Cho, Yu
Jin Oh, Yeong-Su Kim, Dae Wook Kim, dwking@bdna.or.kr. Forest
Plant Industry Dep., Baekduaadegan National Arboretum, Bonghwa
gun , Korea (Republic of) Bacterial neuraminidase (NA) are
important enzymes in the control of pathological process, including
microbe binding that lead to infection. The methanol extract from
Petasites japonicas (PJ) showed potent inhibition against NA. The
bioactivity-guided fractionation of this methanol extract results in the
isolated of four compound. The chemical structures of the isolated
compounds were determined as bakkenolide B (1), bakkenolide D
(2), 1,5-dicaffeoylquinic acid (3), and 3-O-cafeoylquinic acid (4) by
1D and 2D NMR analysis and its NA activity and kinetic were
further investigated. Of the isolated 1,5-dicaffeoylquinic acid
exhibited the most potent NA inhibitory activity with IC50 values of
1.2 ug/ml. Kinetic studies using Lineweaver-Burk and Dixon-plots
revealed that two caffoylquinic acid were competitive inhibitors,
whereas bakkenolide exhibited non-competitive inhibitory
characteristics. In conclusion, this study is the first to demonstrate
that the phytochemicals of PJ display potent inhibitory activities
against NA.

AGFD 83 Effective application of anode solution in microbial fuel
cell to agriculture Yuji Fukumoto
18337710012w@waka.kindai.ac.jp, Shouhei Ebe, Tatsuya Ohike,
Masahiro Okamani, Takashi Aso. BioTech., Kindai Univ.,
Kinokawa, Wakayama, Japan In recent years, microbial fuel cells
(MFC) have drawn attention as a solution to energy problems. MFC
is a device that produces electric power by harvesting electrons
generated on an electrode when a microorganism decomposes an
organic substance. In addition, by using organic substance in
wastewater as a nutrient source for microorganisms, MFC can
simultaneously perform wastewater treatment and electricity
production. However, the effective use of anode solution of MFC has
never been studied, and we tried to produce useful materials using
MFC. Among the microorganisms that produce useful substances
such as enzymes, plant hormones and antibiotic substances, we
focused on Bacillus subtilis RB14, which produces antifungal
substance iturin A. B. subtilis RB14 forms thick biofilm, and the clear
relationship between biofilm formation and antifungal substance
production was observed. When the B. subtilis RB14 was put into the
autoclavable MFC, electricity and antibiotic production by B. subtilis
RB14 has been observed. Although, antifungal substance was
produced after the 2nd day of culture, increase of the voltage was
observed around the 9th day, and then the voltage was continuing to
increase until about 170 mV. This seems to be the first experiment
that electricity generation and antibiotic production were done by
MFC. In order to investigate the application of the anodic solution
containing antifungal substances produced by B. subtilis RB14, the
solution was sterilized by filtration and, the solution showed clear
suppressive effect against plant pathogen Rhizoctonia solani K1,
which infects a lot of plant species and causes many diseases
including damping off. The results suggest that anode solution of
MFC can be used for agriculture application to make suppressive
soil, which can suppress plant pathogens. Plant experiments with
inhibitory effects of anode solution on plant pathogens in soil and
optimization of culture conditions for the antibiotic production and
electricity generation using B. subtilis RB14 and other useful
microbes are now in progress.
AGFD 84 Isolation of anticancer constituents from Cucumis propheta var. propheta var. through bioassay-guided fractionation
Abdulhman Alsayari, alsayari@kku.edu.sa. Dept. of Pharmacognosy, College of Pharmacy, King Khalid Univ., Abha, Saudi Arabia
Background: Cucumis propheta var. propheta var. is used in Saudi folk medicine for treating liver disorders and grows widely between Abha and Khamis Mushait City, Saudi Arabia.
Methods: Bioassay-guided fractionation and purification were used to isolate the main active constituents of Cucumis propheta var. propheta var. fruits. These compounds were structurally elucidated using NMR spectroscopy, mass spectral analyses and x-ray crystallography. All fractions, sub-fractions and pure compounds were screened for their anticancer activity against six cancer cell lines. Results: The greatest cytotoxic activity was found to be in the ethyl acetate fraction, resulting in the isolation of five cucurbitacin compounds [E, B, D, F-25 acetate and Hexanocurcurbitacin D]. Among the cucurbitacins that were isolated and tested cucurbitacin B and E showed potent cytotoxicity activities against all six human cancer cell lines. Conclusion: Human breast cancer cell lines were found to be the most sensitive to cucurbitacins. Preliminary structure activity relationship (SAR) for cytotoxic activity of Cucurbitacins against human breast cancer cell line MDA-MB-231 has been reported.

AGFD 85 Interactions between casein and sodium phosphate salts in processed cheese using surface-enhanced Raman spectroscopy
Ana P. Barth1,2, barth.anap@gmail.com, Yanqi Qu2, Caroline B. Karaziack1, Walkiria H. Viottol1, Lili He3. (1) Food Tech., Univ. of Campinas, Sao Paulo, Brazil (2) Food Sci., Univ. of Massachusetts, Amherst (3) Food Sci., Univ. of Massachusetts-Amherst
Sodium polyphosphate (NaPP) salts are widely used in the dairy industry. In processed cheese manufacture, these salts lead to hydration and partial dispersion of casein improving the protein emulsification. The effect of NaPP salts over physicochemical properties of processed cheese is well-established. However, the interactions between NaPP’s and casein are not fully understood. Raman spectroscopy has been used for molecule identification and structural characterization, but low sensitivity in highly concentrated samples is the main drawback. Surface-enhanced Raman spectroscopy (SERS) is a combination of Raman spectroscopy and nanoTech. that can enhance the weak Raman signals improving its structural information. In this contribution, Raman Spectroscopy and SERS were used to investigate the interactions between NaPP salts and casein by comparing the signals in a casein control solution with the signals in model solutions and processed cheese. For the model solutions, three different polyphosphate salts – disodium pyrophosphate (DSP), tetrasodium pyrophosphate (TPSP), and pentasodium tripolyphosphate (STPP) – were mixed with calcium caseinate (10.5 wt% in water) in a dry matter (DM) content of 2.3% at pH 6.5, before and after heat treatment (90°C). The processed cheeses were made with calcium caseinate (10.5 wt%), 65% of humidity, butter oil (23 wt%) and one NaPP salt mentioned above at 2.3% DM at pH 6.5. The samples were analyzed by Raman and SERS, being silver nanoparticles (AgNP) the SERS substrate. As expected, SERS enhanced the peak intensities when compared to the conventional Raman. Our results suggest that the heat treatment affects the interactions between casein and phosphates. The band at 900 cm-1 assigned to phosphate was more intense in caseinate solutions before heat treatment than in samples submitted to heat treatment or in the processed cheese. TSPP presented the most distinct behavior in the caseinate solutions. The processed cheeses made with TSPP and STP showed peaks between 1300 to 1500 cm-1 that were not observed in processed cheese made with DSP. These results suggest that TSPP and STP may interact with casein via hydroxyl (OH) groups. Changes in peaks intensities at 1505, 1440 and 533 cm-1 are assigned to other conformational changes of the protein backbone. We demonstrated that SERS is a powerful technique to explore structural changes in proteins that help to understand the function of specific ingredients in food processing.

AGFD 86 Pectin extraction from lemon peels and characterization
Ani Rukhadze2, ani_rukhadze@yahoo.com, Sandro Mestvirishvil2, smestvirishvili@yahoo.com, Nino Kokashvili1. (1) Ivane Javakhishvili Tbilisi State Univ., Georgia (2) San Diego State Univ., Tbilisi, Georgia
Pectin is a natural polysaccharide, present in plant cell walls. Pectin is mainly used in food industry and beverages as a gelling and stabilizing agent. However, its biosorption abilities suggest an alternative use of it as a harmless chelating agent of heavy metals. Pectin’s ability to bind to heavy metals is remarkable since unlike other chelators, it does not show any side effects on human health, therefore can be used as a medication during heavy metal intoxication. The usage of pectin is emphasizing the low cost and an easy way to deal with reduction of factories’ contaminated effluent. In research we were using simple steps for extraction of pectin from lemon peels. Acid hydrolysis (pH–2-3, temperature 70-80°C) and extraction was done on lemon peels, from which one type of sample was fresh peeled and other two were previously dried at different temperatures, 40°C and 60°C. The most convenient and high yielding way of retrieving pectin was found in the sample of lemon peels dried at 40°C. The least yielding were citrus peels dried at 60°C. The structures of pectin samples were studied by FTIR and will be tested on NMR and AAS spectroscopy methods. It is also planned to investigate thermal properties of the samples by using DSC analysis at the temperature range 20°C - 350°C. This research will encourage citrus factories to use their waste citrus peels as a raw material for pectin extraction and suggest industries an alternative way in treating wastewater.

AGFD 87 Hazard characterization of commercial products of dark brown sugar in Taiwan using fluorescence spectroscopy
Yu-Yu Lin1, Gow-Chin Yen2,1, Jer-An Lin1, phd.j.a.lin@gmail.com. (1) Graduate Inst. of Food Safety, National Chung Hsing Univ., Taichung, Taiwan (2) Dept. of Food Sci. and BioTech., National Chung Hsing Univ., Taichung, Taiwan
Dark brown sugar (DBS) has been widely used as a flavoring agent in Taiwan. Recently, some studies suggest that Maillard reaction products (MRPs), such as acrylamide that has great potential to damage health, are found in large amount in DBS. Therefore, it is interesting to clarify the amount of MRPs that are harmful to health in DBS. Fluorescent advanced glycation end products (AGEs) have been identified as the representatives of harmful MRPs in food and biological system. In the present study, fluorescence spectroscopy was employed to estimate the levels of fluorescent AGEs in commercial DBS products, including the molasses-made (group A, n = 8), the handmade by charcoal heating (group B, n = 8), the handmade by vacuum heating (group C, n = 3), the additives-added (group D, n = 3), and the undefined (group E, n = 8), as well as to characterize the health risk of these products. The results showed that the intensity of AGE-specific fluoroces (Ex. 366 nm/Em. 422 nm for vesperlysine A and B; Ex. 345 nm/Em. 405 nm for argpyrimidine; Ex. 335 nm/Em. 385 nm for pentosidine, Ex. 370 nm/Em. 448 nm for lysylpyrropyridine; Ex. 335 nm/Em. 400 nm for argpyrimidine) of group B were significantly lower than that of groups A and C (p < 0.05). This suggested that the time-temperature integration in the course of DBS production may be a critical factor for determination of fluorescent AGE content in DBS. Notably, discriminant analysis indicated that DBS products of groups A to E can be correctly categorized using excitation–emission matrix (EEM) from 3D fluorescence scanning. In conclusion, fluorescence spectroscopy can be used to estimate AGE content of DBS and to discriminate DBS.
products of different processing, which would be utilized for hazard characterization and authentication of DBS products.

**AGFD 88 California elderberries: Model for the utilization of hedgerow crops as a source of value-added compounds for improving agricultural sustainability** Katie Uhll, kruhl@ucdavis.edu, Sonja Brodt2, Katie Fyhrie3, Alyson E. Mitchell1. (1) Food Sci. & Tech., UC Davis (2) Agriculture and Natural Resources, UC Davis (3) Cloveleaf Farms, Davis, California California elderberries (Sambucus cerulea) are native, drought-resistant, and an important hedgerow crop (protective barriers for crop fields that also contribute to pollinator health). Other varieties of elderberries such as Sambucus nigra are known for high levels of phenolic compounds and have been used historically as medicinal plants. California elderberry hedgerows may be a value-added crop for farmers. In order to understand the composition of California elderberries, ripe fruits from four farms ranging from three to twenty-three years old were harvested in July 2018. Elderberries were extracted in acidified methanol and analyzed by high performance liquid chromatography with quadrupole time-of-flight mass spectrometry (HPLC-QTOF). Compound identification was achieved by comparison of sample mass spectra to standards and literature spectra. The predominant phenolic compounds identified include: rutin (quercetin-3-rutinoside); quercetin 3-glucoside; p-coumaric acid 4-glucoside; gallic acid; chlorogenic acid; catechin; and epicatechin. The anthocyanins identified in the elderberries include: cyanidin-3-O-sambubioside; cyanidin-3-glucoside; cyanidin-3-rutinoside; cyanidin-3,5-diglucoside; and cyanidin-3-sambubioside-5-glucoside. The average level of total phenolics in among the hedgerows was 5.28 ± 0.77 mg gallic acid equivalents/kg and ranged from 4.20 to 6.59 mg GAE/kg. The average level of total monomeric anthocyanins in a hedgerow was 384.01 ± 110.82 mg cyanidin-3-glucoside equivalents/kg, with a range from 171.25 to 567.03 mg cyanidin-3-glucoside equivalents/kg. Results indicate more variation within and between hedgerows for levels of total monomeric anthocyanins than for total phenolics. Possible causes for these variations may include soil type and amount of irrigation. These results help support the use of unutilized hedgerow crops, such as elderberries, as a source of value-added materials to improve agricultural sustainability.

**AGFD 89 Chemical composition of cold-pressed blackberry seed flour and its free radical scavenging and anti-inflammatory capacities** Uyory Choel1, uchoe@umd.edu, Yanfang Li1, Boyan Gao2, Jianghao Sun3, Pei Chen4, Liangli Yu5. (1) Univ. of Maryland, Hyattsville (2) UC Davis (3) Agriculture and Natural Resources, UC Davis (4) USDA, Beltsville, Maryland (5) Unij of Maryland, College Park The cold-pressed blackberry seed flour was extracted with 50% acetone and was evaluated for their phytochemical compositions, free radical scavenging capacities and anti-inflammatory capacities. UHPLC-MS analysis detected thirteen compounds in the blackberry seed flour extract with sanguin H6 as the primary component. Blackberry seed flour extract had RSDC, ORAC, HOSC and ABTS scavenging capacities of 362, 304, 2531 and 267 μmol trolox equivalent (TE)/g, respectively. In addition, blackberry seed flour extract suppressed LPS induced IL-1β mRNA expression in the cultured J774.A.1 mouse macrophages. The results suggest blackberry seed flour’s potential health benefits.

**AGFD 90 Triterpenoids from Acanthopanax trifoliatous attenuate inflammation in macrophage cells and tetradeoxyphloroglucolate-treated mice** Min Chen1, Ying Qin1, Hang Ma2, Xi Zheng3, Renping Zhou3, Shili Sun4, Yiqi Huang1, Qing Duan1, Panpan Wu1, Xuetao Xu1, Wenfeng Liu1, Zhaojun Sheng1, Kun Zhang1, Dongli Li1, wyuchemldl@wyu.edu.cn. (1) School of BioTech. and Health Sciences, Wuyi Univ., Jiangmen, Guangdong, China (2) College of Pharmacy, Univ. of Rhode Island, Kingston (3) Rutgers, The State Univ. of New Jersey, Piscataway (4) Tea Research Inst., Guangdong Academy of Agricultural Sci., Guangzhou, China Acanthopanax trifoliatous (L.) Merr. is an edible medicinal plant from Southeast Asia region where it is commonly consumed as a tonic food. Published studies support anti-inflammatory effects of A. trifoliatous, but its mechanisms of action and active constituents remain unclear. Herein, the anti-inflammatory effects of two triterpenoids, namely, impressisic acid (IA) and acanthenoxigenin A (AA), from A. trifoliatous were investigated using in vitro and in vivo models. In murine macrophage RAW264.7 cells, AA and IA (at 50 μM) reduced lipopoly saccharides (LPS)-induced production of nitrooxide by 76.5% and 39.0%, respectively. In addition, AA and IA down-regulated activation of NF-κB and decreased the release of inflammatory mediators (iNOS, COX-2, TNF-α, and IL-6) and tumorigenesis-associated factors (MMP-9 and VEGF) in RAW264.7 cells. Furthermore, in a tetradeoxyphloroglucolate (TPA)-treated mice model, AA and IA attenuated mouse ear edema and pathological damages and reduced levels of cytokines including iNOS, COX-2, TNF-α, and IL-1β. Data from our study support that AA and IA are promising anti-inflammatory agents and may contribute to the overall anti-inflammatory effect of A. trifoliatous.

**AGFD 91 Acid-triggered gastric-floating emulsion gel for sustained release** Xingnian Liu, Ling Wang, Hong S. Liang, Jing Li, lijingfood@mail.hzau.edu.cn, Bin Li. College of Food Sci. & Tech., Huazhong Agricultural Univ., Wuhan, China The O/W Pickering emulsion was prepared by using calcium carbonate particles and sodium alginate. The particle size of calcium carbonate and concentrations of calcium carbonate and sodium alginate were important for the properties of emulsion. After the emulsion entered the stomach, it was triggered by acid to form a emulsion gel and floated in the stomach. The effects of this emulsion system on the encapsulation and sustained release of lipid soluble components were studied. The effects of the addition of lipid soluble components on the particle size, storage stability and rheological properties of the emulsion were investigated, and the release performance of the gastric-floating system was explored in vitro.

**AGFD 92 Metabolic profiling of leaf secondary metabolites in Japanese citrus cultivars under stress conditions** Tetsuya Matsukawa, tmsatu@waka.kindai.ac.jp, Shinichiro Kajiyama. Biology-Oriented Science and Tech., Kindai Univ., Kinokawa-shi, Wakayama-ken, Japan Citrus family is one of the most commercially important fruit crops and well known as an important source of nutrient and bioactive compounds. However, the physiology especially on the stress condition of this plant family has not been fully understood yet. Our previous studies demonstrated that metabolic profiles of primary and volatile compounds in several Citrus species were changed after stress treatments, and the manner of response against stresses were demonstrated to be different among Citrus species. However, changes in non-volatile secondary metabolites such as flavonoids and phenolics, well known as defense compounds, during defense responses are still unknown. In the present study, we performed comprehensive analysis of non-volatile secondary metabolites in leaves of four Japanese Citrus plants (C. unshiu, C. kinokuni, C. grandis, and C. hassaku) using LC-QTOF system. As stress treatments, we performed wounding as well as plant hormone treatments with jasmonic acid and salicylic acid which are well-known as an environmental stress response signal. The leaf metabolites were extracted with MeOH after stress treatments, and the extracts were applied to TripleTOF 5600+ (AB SCIEX) combined with Shimadzu LC-20A system. The resulting peak data was applied to orthogonal partial least squares-discriminant analysis using SIMCA ver. 13.0.3 (Umetrics, Sweden). As a result, the responses against wounding, total fifty-one stress-response peaks
were detected, and among them, three peaks were commonly detected in all of the species tested. These results suggest that these three compounds are common biomarkers candidates in Citrus plants for stress responses. In the presentation, we will show details of changes in metabolite profiles and discuss the similarities and differences in four species.

**AGFD 93 Antioxidant activities and constituents of leaves and fruits of a Japanese persimmon (Fudegaki)** Michiko Yasuda-Torii1, yasuda@sugiyama-u.ac.jp, Miku Inuzuka1, Kaho Furuhashi1, Akihisa Nagata2. (1) School of Life Studies, Sugiyama Jogakuen Univ., Nagoya, Aichi, Japan (2) JA Aichi-mikawa, Koto-cho Nukata-gun, Aichi, Japan “Fudegaki (Fudegaki persimmon)” is a type of incomplete sweet persimmon. It has a higher sugar content than other persimmons. The leaves and fruits of other persimmons have been well studied, whereas those of Fudegaki have not. We investigated the antioxidant activities, polyphenol contents, and ascorbic acid contents of leaves and fruits of Fudegaki. Leaves were harvested from Koto-cho, Nukata-gun, Aichi prefecture (where this persimmon predominates) at the beginning of May. The harvested leaves were steamed and dried, and 100 mg samples were extracted with 25 mL of distilled hot water at 100°C for 10 minutes. The extract was filtered through filter paper. Near-infrared spectroscopy examination was performed to categorize the Fudegaki fruits into sweet, half-astringent, and astringent groups. The fruits were extracted with 80% ethanol or acetone. Antioxidant activities were examined by α, α-diphenyl-β-picrylhydrazyl (DPPH) radical scavenging assay, total polyphenol contents were determined using the Folin–Ciocalteau method, and ascorbic acid was measured using the hydradzine colorimetric method. Leaf extracts showed 52.6% DPPH free radical scavenging activity. Total polyphenol compounds and ascorbic acid content was 67.1 µg/mL equivalent to catechin content and 4.15 µg/mL, respectively. Total polyphenol content of fruits in the sweet, half-astringent, and astringent groups extracted with 80% ethanol was 71.3 mg, 101.5 mg, and 333.3 mg equivalent to gallic acid/100 mg fresh fruit, respectively. When acetone was used for the extraction of fruit, the total polyphenol equivalent to gallic acid/100 mg fresh fruit was 5.4 mg, 5.1 mg, and 3.4 mg for the of sweet group, half-astringent group, and astringent group, respectively. Total polyphenol content of the ethanol extracts was higher than that of acetone extracts in all groups. DPPH radical scavenging activity was 589.8, 1195.3, and 4070.1 µmol equivalent to Trolox/100 mg fresh fruit in the sweet group, half-astringent group, and astringent group, respectively. The results demonstrate that the leaves and fruits of Fudegaki include polyphenols and compounds with DPPH radical scavenging activity.

**AGFD 94 Comparison of volatile compounds in garlic extracts according to different extraction methods** Eun Ji Jang1, Eun Ji Jang1, Jin Choi, sjchoi@swu.ac.kr. Div. of Applied Food System, Food Sci. & Tech., Seoul Women's Univ., Korea (Republic of) Garlic (Allium sativum L.) has been used as a condiment for diverse cuisines mainly due to its own characteristic flavor as well as biological activities. In food industry, garlic extracts are used to secure the storage stability and prevent the quality degradation that occurs during distribution. The profiles of volatiles in garlic extracts, which affect the organoleptic properties, can be varied depending on extraction methods during processing. The objectives of this study was to compare volatile compounds in garlic extracts according to different extraction methods, such as water extraction (WE), hot water extraction (HW), enzymatic hydrolysis (EH) and reverse osmosis (RO). Volatile compounds were analyzed using gas chromatography-mass spectrometry (GC-MS) combined by solid phase micro-extraction (SPME). A total of 34 volatile compounds, including 4 alcohols, 6 aldehydes, 1 esters, 1 ketones, 1 phenols and 21 sulfur-containing compounds, were identified in garlic extracts produced by different extraction methods. In water and hot water extractions, 3-prop-2-enylsulfanylprop-1-ene and 3-prop-2-enylidinsulfanylprop-1-ene occupied the highest proportion. On the other hand, 3-prop-2-enylidinsulfanylprop-1-ene and 3-prop-2-enylsulfanylprop-1-ene occupied the highest proportion in the enzymatic hydrolysis and reverse osmosis extractions. In addition, the differences in volatile compounds of various garlic extracts according to extraction methods were investigated using partial least squares discriminant analysis (PLS-DA). On PLS-DA score plot of volatile compounds, raw-crushed garlic (control) samples were clearly discriminated from garlic extracts samples by PLS component 1. (Z)-1-Methyldinsulfanylprop-1-ene, 3-prop-2-enylsulfanylprop-1-ene and 3-prop-2-enylidinsulfanylprop-1-ene and 3-ethyl-3,6-dihydridithiine were mainly related to the discrimination. Among garlic extracts produced by different methods, RO samples were, in particular, separated from WE, HW and EH samples by PLS component 2. The major metabolites related to the separation were 2,5-dimethylhexane, 2,5-diol, (Z)-2-enal and 2-ethyl-4H-1,3-dithione and 3-prop-2-enylidinsulfanylprop-1-ene.

**AGFD 95 Relationships between protein composition and texture of tofu** Ruqi Chen1, Sam K. Chang1, schang@fsnhp.msstate.edu, Anna Gillen2, Pengin Chen4, Bo Zhang3, Yan Zhang5. (1) Mississippi State Univ., Pascagoula (2) USDA, Stoneville, Mississippi (3) Virginia Tech, Blacksburg (4) Univ. of Missouri, Portageville Producing desirable texture is important in manufacturing tofu. However, it is still not fully understood which components of soybean storage proteins determine the tofu firmness. This study’s objective was to determine the correlations of proteins, particularly A3 subunit, with the firmness of tofu made from 22 soybean varieties planted across three locations. In this study, twenty-two soybean varieties and eight checks from USDA soybean germplasm collection were planted in three different locations (Mississippi, Virginia and Missouri) in 2017. For each variety from each location, pressed tofu and filled tofu were made in duplicate. The textural parameters, including firmness, brittleness and elasticity were measured by TA.XT.PLUS texture analyzer. Percentages of 7S, 11S, 11S+7S, A3 subunit and ratio of 11S/7S were calculated by densitometry after SDS-polyacrylamide gel electrophoresis. Pearson’s correlation coefficients between the protein components and tofu firmness and yield were determined. Across locations, for both pressed tofu and filled tofu, a strong correlation between firmness and A3 subunit content was observed (r=0.79, p 0.05), but A3 subunit did not show any correlation with brittleness and elasticity. 11 S content only correlated with filled tofu firmness (r=0.65, p 0.05). Similarly, 11S/7S ratio only exhibited correlation with filled tofu firmness (r=0.65, p 0.05). 7 S content did not show any correlation with tofu firmness for both pressed and filled tofu. For pressed tofu, firmness and A3 subunit content were found to negatively correlate with the yield (r=0.61, p 0.05). Locations had no significant effect on the firmness of filled and pressed tofu. The current study confirmed the A3 peptide’s positive relationship with tofu firmness and may be used as a basis for soybean breeding and as a criterion to predict the tofu firmness made from a particular variety of soybean.

**AGFD 96 Characterization of food additive silica nanoparticles in commercial products** Soon-Jin Choi, sjchoi@swu.ac.kr. Div. of Applied Food System, Food Sci. & Tech., Seoul Women's Univ., Korea (Republic of) Food additive silica (SiO2) has been widely used as an anti-caking agent. Recent rapid development of nanoTech. has led to produce nano-sized silica, although silica nanoparticles (NPs) are not intended to be used as a food additive. NPs possess novel properties different from bulk-sized materials, which may...
cause unfavorable effects on humans. In this study, we characterized the physicochemical properties of commercially available food additive silica from various manufacturers, such as particle size distribution and zeta potential values. Quantitative analysis, followed by physicochemical characterization of silica in commercial food products from international brands were performed. The cytotoxicity of food additive silica was also evaluated in human intestinal cells. The results show that the primary particle sizes of all silica particles were less than 100 nm, but they were found to be aggregated in aqueous solution or food matrices. No significant effects of silica particles on cell proliferation, membrane damage, and oxidative stress were found. Quantitative analysis results reveal that the contents of silica in food products were varied and different pre-treatment methods were necessary depending on food type. These findings will provide practical information about the safety aspect of food additive silica.

AGFD 97 Charge-switchable starch magnetic microparticles for highly effective separation of a broad range of bacteria Ke Luo, nageuk@gmail.com, Ki-Baek Jeong. Sang-Mook You, Hazeel Joy Adra, Jian Ryu, Young-Rok Kim. Kyung Hee Univ., Yongin, Gyeonggi-do, Korea (Republic of) Polymeric magnetic particles (PMPs) have become a powerful tool for the separation and concentration of microorganisms from a heterogeneous liquid matrix with their intrinsic paramagnetic properties. Nevertheless, their functionalization using recognition elements, such as antibodies, aptamers, and phages, are very expensive and not suitable for the analysis of polymicrobial samples. Here we report a fairly simple and low-cost approach for the fabrication of starch magnetic microparticles (SMMPs) through the rearrangement of short chain glucan (SCG) produced by enzymatic debranching of waxy maize starch. The surface of SMMPs were readily functionalized with chitosan through electrostatic attraction and hydrogen-bonding interaction. The chitosan-coated SMMPs (CS@SMMPs) showed great capture efficiency (>90%) for bacteria regardless both of Gram-positive and Gram-negative. Interestingly, we found that the surface charge of Gram-negative bacteria varied depending upon the composition of lipopolysaccharide (LPS), which is responsible for the fact that CS@SMMPs show greater capture efficiency for Gram-positive bacteria compared to that of Gram-negative bacteria at the same pH-level. We further demonstrate that CS@SMMPs have a good stability for capturing bacteria throughout over two successive recycling, making them promising candidates for practical implementation not only for rapid capturing and removal of bacterial pathogens from an aqueous environment, but also for the sample preparation giving aid to bacterial detection and identification.

AGFD 98 Alpha-hederin nanopore for single-molecule detection Kibaek Jeong, nabluedust@naver.com, Ke Luo, Young-Rok Kim. BioTech. and Dept. of Food Sci. and BioTech., Kyunghee Univ., Yong-in, Korea (Republic of) Nanopore Tech. has been widely utilized to investigate biomolecules in a single-molecule level with high-throughput characteristic. Biological nanoparticles have been regarded as powerful tool for identifying the structure of biomolecules such as DNA, proteins, and polymers in a single molecule level. However, the performance of biological nanopore is limited since the sensing region of biological nanoparticles is predetermined by their physical dimension including the shape of nano channel. Herein, inspired by the cytotoxic mechanisms of saponin derivative, alpha-hederin, we exhibit a self-assembled nanopore that can be formed spontaneously in lipid membrane. We demonstrate the pore-forming mechanisms of alpha-hederin in cholesterol-rich lipid membrane and strategy to control the pore-forming rate by lipid partitioning method. Based on the small diameter and effective thickness of the alpha-hederin nanopores, we anticipate that the alpha-hederin nanopore has the potential to discriminate tiny structure of biomolecules such as peptides, polymer, and single-stranded DNA that are remained to be elucidated in biomedical applications with high sensitivity based on its geometrical advantages.

AGFD 99 Solid-state fermentation for development of functional Chenopodium formosanum product Tse-Yu Chien2, Hung-yueh Chen3, Kuan-Chen Cheng1, kchchung@ntu.edu.tw. (1) Food Sci. & Tech., Nat’l Taiwan Univ., Taipei (2) Food Sci. & Tech., Nat’l Taiwan Univ., Taoyuan (3) Inst. of Food Sci. & Tech., Nat’l Taiwan Univ., Taipei Djulis (Chenopodium formosanum) is a native pseudocereal plant in Taiwan. Apart from their abundant dietary fiber, minerals and essential amino acids, Djulis grains are rich in phenolic acids and flavonoids, which are vital bioactive compounds primarily responsible for their antioxidant capacity. Studies have shown that the fermentation of filamentous fungi could release more free phenolics, enhance antioxidant activity, and reduce the content of anti-nutritional factors in food. The aim of this study was to apply solid-state fermentation (SSF) to enhance the bioactive and functional potential of Djulis grains. In this study, the heat-treated grains were inoculated with Rhizopus oligosporous spores suspension (5% (v/w), 106 spores/ml), which were packed in sterile petri dishes and cultured in the condition of 30°C and 80% relative humidity for 4 days. The final product was cake-shaped with uniform mycelium distribution. Under the optimum condition for antioxidant activity; factors like temperature, carbon source and inorganic salt addition were designed to be 350°C, 3% (w/w) and 3% (w/w), respectively. The optimized product was evaluated by proximate, nutritional and texture profile analysis. The antioxidant capacity and functional content such as the total phenol content (TPC), total flavonoids content (TFC), γ-aminobutyric acid (GABA) of the product were significantly enhance via SSF, which demonstrated its potential as a Taiwanese fermented product.

AGFD 100 Nutritional analysis and study of shiitake mushrooms focusing on the dietary fiber content Ji Yoon Lee1, mythanks@naver.com, Ju Hee An1, So-Jung Kim3, Dongwon Seo2. (1) Center for Food and Bioconvergence, SNU, Seoul, Korea (Republic of) (2) Food Analysis Center, Korea Food Research Inst., Wanju-gun, Jeolla-buk-do, Korea (Republic of) (3) Commercialization support team, GIMB, Ulijin-gun, Gyeongsangbuk-do, Korea (Republic of) Although dietary fiber has been recognized as an unnecessary ingredient due to its non-digestible nature in the body, it has recently received much attention due to its role in contributing to the fermentation of body microorganisms in the large intestine. Current food consumption trends are emphasized on improving the health and environmental health function and this kind of food consumption is also growing rapidly. Shiitake mushroom is a typical food of this kind and also one of the Koreans’ favorite food. Dietary fiber is referred to hard indigestible carbohydrate polymer by human digestive enzymes, Dietary fiber has various roles in human body such as bowel activity, cholesterol regulation, postprandial blood glucose increase inhibition. Dietary fiber is likely to do the roles in the disease prevention and treatment such as cancer, diabetes, constipation, high blood pressure so it has been to be referred to the sixth nutrients as important as other nutrients. The A.O.A.C. method of the dietary fiber were used in each country and Korea uses A.O.A.C.991.43 as a standard. Dietary fiber analysis involves several steps such as sample preparation, enzyme digestion, filtration, and weighing, which is likely to cause experimental deviations. To verify the measurement method of dietary fiber, we repeatedly tested eight times using SRM 3233 and compared the values and deviations with literature values. After that, we analyzed the various nutritive components of Shiitake mushrooms focused on dietary fiber contents in various cooking method. Those are consumed through a variety of heat treatment rather than being raw, we studied the nutrient change.
due to a variety of heat treatment methods. The water soluble and insoluble dietary fiber values of shiitake mushroom were obtained by using a device that automated standardized A.O.A.C.991.43. Mushrooms are consumed in raw or cooked form and processed into dried form for long-term storage. Component variation is also an important part when using dried and stored mushrooms for cooking. Shiitake mushrooms were divided into fresh mushrooms and pillar mushrooms, and the main nutrients were measured by changing the cooking method to raw, poached and dried. According to the cooking method, dietary fiber content was varied from 7.5% to 45.1%, and water soluble dietary fiber was 1.0 ~ 4.3% and insoluble dietary fiber was 6.1 ~ 41.2%.

AGFD 101 Significant 19 amino acid analysis using three eggs and determination of LOD and LOQ  Sojung Kim1, sojung@ginb.or.kr, Dongwon Seo2, Ji Yoon Lee3. (1) commercialization-support team, Gyeongbuk Inst. for Marine Bioindustry(GIMB), Jukbyeon-myeon, Uljin-gun, Korea (Republic of) (2) Food Analysis Center, Korea Food Research Inst., Wanju, Junchuk, Korea (Republic of) (3) CFB, SNU, Seoul, Korea (Republic of). Amino acid, the basic units of proteins, play an important role in the metabolic processes of living organism. The amino acid is a compound that has both a basic amino group (-NH2) and the acidic carboxyl group (-COOH). Recent, analysis of trace amino acid in physiological have received more attention. Because the analysis of these compounds could provide fundamental and important information for medical, biological, and clinical fields. Among the eggs we can eat, the most representative kinds of eggs, duck eggs, and quail’s eggs. Eggs are largely divided into shells, whites and yolk (yellow sulfur), which are also called complete foods because they contain a lot of excellent protein. The constituent unit material of proteins is amino acids, which are mainly used in human construction and are also rarely used as energy sources. This study compared the content of 19 kinds(Aspartic acid, serine, glutamic acid, glycine, histidine, threonine, arginine, alanine, proline, tyrosine, valine, methionine, lysine, isoleucine, leucine, phenylalanine, taurine, tryptophan) of amino acids of 3 kinds of eggs in food. Precision and reproducibility of assay value were expressed with %RSD(relative standard deviation) and Z-score. LOD(limits of detection) is the lowest concentration of a sample which can still be detected by the analysis method. LOQ(limit of quantification) is the lowest concentration which can still be quantitatively detected with accuracy and an acceptable precision. The samples were analyzed by dividing the egg, quail egg, duck egg, egg white and ovary, and the boiled rice in the cooking room. Precision and reproducibility of assay value were expressed with %RSD(relative standard deviation). As a result of the analysis, According to the egg types, the amino acids were high in order of eggs, duck eggs, and quail eggs. The yolk showed a higher amino acid content than the egg white. There was no big difference depending on the way eggs were cooked (cooked, raw).

AGFD 102 Comparison of mineral contents in raw and boiled poultry eggs by ICP-OES and ICP-MS Dongwon Seo1, dwseo@kiri.re.kr, Soyoung Kim1, Jisu Park1, So-Jung Kim3, Ji Yoon Lee2. (1) Food Analysis Center, Korea Food Research Inst., Wanju, Junchuk, Korea (Republic of) (2) Seoul National Univ., Seoul, Korea (Republic of) (3) Gyeongbuk Inst. for Marine Bio-Industry, Uljin-gun, Korea (Republic of). Eggs have long been consumed and their flavor components were evaluated. In this study, determination of ash and mineral contents in the poultry eggs (quail, chicken and duck), such as raw and boiled egg yolk, raw and boiled egg white. Standard Reference Material (SRM) 1849a was purchased from National Inst. of Standards & Tech. in USA. The samples were provided by Rural Development Administration in Korea. The sample was digested with 8 mL of HNO3 and 2 mL of H2O2 using the microwave. This solution was cooled and diluted with deionized water. Instruments of minerals analysis were inductively coupled plasma (ICP) with optical emission spectrometry (OES) for macro-minerals (Ca, Fe, Mg, P, K, Na, Zn, Cu, Mn) and the ICP with mass spectrometer (MS) for micro-minerals (Se and Mo). This method provided good correlation (r=0.9997), limit of quantitation (<0.19 mg/kg) and accuracy (<8.19 %) within the test ranges. In case of Ca contents, raw egg yolk of quail, chicken and duck were 137.0, 146.2 and 134.1 mg/100g and boiled egg yolk were 157.4, 157.2 and 141.1 mg/100g, respectively. Raw egg white were 3.2, 7.5 and 5.1 mg/100g and boiled egg white were 8.3, 9.5 and 7.6 mg/100g, respectively. Therefore, it is expected that the ash and mineral contents could be used as nutritional food ingredient database for national health promotion.

AGFD 103 Analysis of chemical diversity in Lilium japonicum population using floral scent composition Mizuki Fujisawa1, 18337100117j@waka.kindai.ac.jp, Tetsuya Matsukawa1, Toshiharu Akino4, Shigeru Arai2, Yoshishiro Takikawa3, Shinichiro Kajiyama1. (1) Biology-Oriented Science and Tech., Kindai Univ., Kinokawa, Wakayama, Japan (2) Omiwa Shrine, Sakurai, Nara, Japan (3) Inst. of Advanced Tech., Kindai Univ., Kinokawa, Wakayama, Japan (4) DBFS, Kyoto Inst.d of Tech., Kyoto, Japan (5) Sasayuri (Lilium japonicum) is wild lily indigenous to Japan and distributes in western Japan. This plant has been used as an ornamental, edible and medicinal plants. Moreover, Sasayuri has also been considered as a sacred flower and used as a symbol in a ritual to ward off diseases. Thus, this plant is one of the most important plant species in Japanese culture. However, the population and habitat of this plant have decreased due to animal damage, over harvesting and long life cycle of this plant, and therefore, the physiological and biochemical knowledge about this plant is quite limited. The morphology of Sasayuri is a highly diverse, but the chemical characteristics of this plant species are still unknown. In this study, we performed the comprehensive analysis of flavor components of Sasayuri collected from different habitats to assess the chemical diversity of this plant, and evaluate the correlation of floral scent and morphological characteristics such as leaf shapes and pollen and flower colors. Plant materials were collected from ten different areas in Japan and are grown and maintained at the Omiwa Shrine in Nara Prefecture. The flavor components were collected by overnight solid phase extraction in plastic bags, followed by GC/MS analysis and principal component analysis. As a result, 22 compounds were identified as flavor components of Sasayuri. Among these compounds, linalool and its oxides were suggested to be the major flavor components in Sasayuri. Principal component analysis showed that floral scent of Sasayuri collected at Kinki and south Chubu region was different from that of flowers collected at other habitats. In addition, leaf shapes of Sasayuri collected at Kinki and south Chubu were also different from others.

AGFD 104 Purification and identification of a putative sperm chemotactant in the liverwort Marchantia polymorpha L. Yumiko Yamasaki1, 18337100117j@waka.kindai.ac.jp, Miho Takemura2, Tetsuya Matsukawa1, Katsuyuki Yamato1, Shinichiro Kajiyama1. (1) Biology-Oriented Science and Tech., Kindai Univ., Kinokawa-shi, Wakayama-ken, Japan (2) Res. Inst. Bioresources Biotechnol., Ishikawa Pref. Univ., Nonoichi, Japan. The liverwort Marchantia polymorpha is one of the most useful model plants for molecular and genetic experiments, due to efficient transformation techniques available and its haploid-dominant lifecycle. When grown under white light supplemented with far-red light, thalli form male and female reproductive organs, andtheridioaphores and archegoniophores, respectively. Similar to animals, M. polymorpha uses motile sperm for fertilization, and the sperm is attracted by the substance(s) released by the egg and/or the cells in its vicinity. This phenomenon, usually called as chemotaxis, has been well studied in mainly marine
animals such as sea urchin and starfish, and their sperm-attracting substances, sperm chemotactants, have been identified. However, the sperm chemotactant of M. polymorpha is still unknown. In this study, we performed the activity-guided isolation and the structural identification of the sperm chemotactant candidate from M. polymorpha archegoniophores. The plant materials were soaked in acetone for 1 week, and resulting supernatant was used as a crude extract. The crude extract was then applied to normal phase column chromatography. Eluted fractions were applied to the chemotaxis assay using sperm freshly collected from male plants. Active fractions were subsequently applied to reverse phase column chromatography, followed by preparative HPLC. Finally, a single peak which showed sperm-attracting activity was obtained, suggesting that this compound is a promising candidate of the sperm chemotactant of M. polymorpha. The identification of the isolated compound is now in progress, and in the presentation, we discuss details in the characteristics of the compound.

AGFD 105 WITHDRAWN

AGFD 106 Protein Eng. of recombinant L-ribose isomerase from Actinotalea fermentans ATCC 43279 to alter its thermostability Tsuei-Yun Fang, tyfang@mail.ntou.edu.tw, Yu-Jiun Liou. National Taiwan Ocean Univ., Keelung L-Ribose isomerase (L-RI) catalyzes the reversible aldose-ketose isomerization between L-ribulose and L-ribose. L-ribose is an aldose which is not often found in nature. It can be used as a precursor material for antiviral and anticancer drugs. The gene of Actinotalea fermentans ATCC 43279 L-RI (Af-RI) was overexpressed in Escherichia coli BL21 Star (DE3). The purified recombinant enzyme demonstrated its optimal activity at 45°C and pH 8, and its half-life at 50°C was 58 min. To enhance the thermostability of Af-RI by protein Eng., four residues (L69, P78, V139, and F141) on the interface of enzyme tetramers and the mutations from the study of Geodermatophilus obscurus DSM43160 have been chosen for mutagenesis (D135, A221). In addition, the peptide derived from the acidic tail of a-synuclein (ATS) has been fused to the C-terminal of Af-RI to evaluate the effect of fusion on the thermostability of ATS-fused Af-RI (Af-RI-ATS). L69Q, P78K, P78R, P78T, V139T, F141Y, D135G, A221W, R132Q/D134G/D135G, P220Q/A221W, and Af-RI-ATS were successfully constructed and expressed in E. coli BL21 Star (DE3). The relative activities of the crude extracts containing wild-type, F141Y, R132Q/D134G/D135G, and P220Q/A221W were 100%, 77.6%, 58.4%, and 26.9%, respectively. However, other mutations and ATS fusion caused severe loss of enzyme activities. After incubating enzymes at 50°C for 10 min, the residual activities of wild-type and F141Y were 27% and 38.4%, respectively. The specific activity of purified F141Y Af-RI was 25.1 U/mg, which was comparable to 26.6 U/mg of wild-type enzyme; the half-life of F141Y Af-RI at 50°C was 66.5 min, which was 8 min longer than that of the wild-type enzyme. Although most of the mutations on the interface of Af-RI tetramers cause severe loss of activity, F141Y Af-RI possesses good activity and enhanced thermostability and has potential to be used in L-ribose production.

AGFD 107 Paper-based radial flow immunoassay for the detection of Escherichia coli O157:H7 using surface-engineered gold nanoparticles Jian Ryu, riania0112@gmail.com, Ke Luo, In-Hye seol, Ki-Baek Jeong, Hazzel Joy Adra, Young-Rok Kim. Food Sci., Kyung Hee Univ. Graduate School, Suwon, Korea (Republic of) Paper-based colorimetric assay has become a promising diagnostic tool in the field of food industry due to their unique properties that can rapidly identify pathogenic bacteria on site with naked eyes. A novel radial flow immunoassay (RFIA) employing gold nanoparticles (AuNPs) as a chromatic agent with well-oriented antibody on the surface was developed for the detection of Escherichia coli O157:H7. 4-repeated Gold binding polypeptide-tagged protein G (4X-GBP-SPG) fusion protein was employed as a bifunctional linker that render well-oriented immobilization of antibodies on the surface of AuNPs based on the specific affinity of GBP and SPG to the gold and Fe portion of antibody, respectively. The resulting immuno-AuNPs were shown to have an excellent ability to capture the target bacteria, E. coli O157:H7. Colorimetric signals were generated on nitrocellulose membrane by the radial flow of test solution containing the target bacteria, E. coli O157:H7, labeled with the immuno-AuNPs. In the absence of target bacteria the immuno-AuNP spread radially by capillary action. When target bacteria were present at solution, the immuno-AuNPs were capture by the bacteria and their radial diffusion was limited, forming a small inner ring. The intensity of colorimetric signals in small inner ring were dependent on the concentration of target bacteria. The developed RFIA successfully detected E. coli O157:H7 with a detection limit of 102 CFU and 103 CFU in PBS and milk sample, respectively. The quantification of target bacteria could be achieved by analyzing the intensity of colorimetric signal using Image J program. This paper-based detection system would provide an effective means of monitoring the presence of food-borne pathogens on site with naked eyes.

AGFD 108 Molecular self-assembly of chitosan/starch-based nanoparticles for drug delivery system Hazzel Joy Adra1, hazzeadra@gmail.com, Ke Luo2, Da-Hee Lee1, Kibaek Jeong3, Jian Ryu4, Young-Rok Kim2. (1) Food Sci., Kyung Hee Univ. Graduate School, Suwon, Korea (Republic of) (2) Kyung Hee Univ., Yongin, Gyeonggi-do, Korea (Republic of) (3) BioTech. and Dept. of Food Sci. and BioTech., Kyunghee Univ., Hwa-Seong, Korea (Republic of) (4) kyung hee Univ., Yongin, Korea (Republic of) Green synthesis of polymeric biodegradable nano- or microparticles has drawn increasing attention in the field of medicine as drug delivery system (DDS) since it has the ability to transport drugs with the minimal but optimum dosage. Starch, a major source of carbohydrates from plants is biocompatible material, that can be utilized as DDS but its molecular self-assembly results in a highly aggregated and polydisperse particles limiting its biomedical applications. However, green methods for fabrication of starch nano- or microparticles often lead to difficulty in ensuring the monodispersity of formed particles with respect to size and shape, which is an important criterion as DDS. In this study, monodisperse starch nano- or microparticles (SPs), in combination with chitosan, a cationic polymer that effects as polymeric stabilizer, were fabricated via molecular self-assembly using short chain glucans which were enzymatically obtained from waxy maize starch. We found that chitosan mediates the particle formation via electrostatic interaction, which rendered an effective separation of homogenous nucleation and growth of SPs, eventually leading to the formation of monodispersed SPs and increased product yield over 70% from natural starch. By modulating the enzyme concentration and debouching time, we were able to prepare a highly monodisperse CS-SPs from 200 nm to 5 µm. Furthermore, the potential of CS-SPs as a carrier system form oral delivery of bioactive compounds were demonstrated using model guest molecules, which is ideal for drug carriers targeting the negatively charged gastric epithelial lining for better bioabsorption since CS-SPs showed a net positive surface charge.

AGFD 109 WITHDRAWN

AGFD 110 Bio-based antioxidants for lubricant additives Yue Cao, yuecao@ucr.edu, Kathryn E. Uhrich. Univ. of California Riverside While numerous oil-soluble antioxidants (particularly hindered phenolic compounds and diphenylamine derivatives) have
been employed to protect lubricant formulations against oxidative degradation, naturally occurring antioxidants have remained largely unexplored as lubricant antioxidants owing to their limited oil-solubility originated from hydrophilic nature. In this work, we explore the use of naturally occurring antioxidants in lubricants, particularly in the high-temperature environment of engine lubrication. The objective is to develop alternatives to the traditional lubricant antioxidants routinely used in oil blends by modifying hydrophobic antioxidants to enhance oil solubility, creating an unexplored bio-based class of lubricant antioxidant additives. To meet this objective, two aspects were addressed: i) enhanced oil solubility and ii) stability to elevated temperatures. To ensure performance at elevated temperatures, we focused on antioxidant moieties that can potentially withstand higher temperatures, such as compounds based on ferulic acid and salicylic acid. Specifically, we modified solubility by altering the structure of the hydrocarbon end-groups to increase oil solubility. Alkyl chains play a key role in material properties including solubility, intermolecular interactions as well as thermal properties. In formulation test, the bio-based antioxidant additives exhibited excellent performances compared to traditional commercial additives, demonstrating their potential application as the next generation antioxidant for lubricants.

AGFD 111 Difference in the aroma profiles of mealworm (Tenebrio molitor) according to cooking methods Hoon Jun Seo, Da Hye Kim, In Hee Cho, inheecho@wkku.ac.kr. Food Sci. and BioTech., Wonkwang Univ., Iksan, Korea (Republic of) Edible insects, especially mealworm (Tenebrio molitor), have been more and more considered as an acceptable food source since FAO (2013) encouraged insect consumption for some reasons; good amino acids and unsaturated fatty acids profiles, high in calcium, iron, and zinc, fewer greenhouse gases, and low and unsaturated fatty acids profiles, high in calcium, iron, and zinc, fewer greenhouse gases, and low-capital investment for harvesting/reearing. However, there is still some concern on eating insects due to mainly poor flavor qualities as well as the appearance of hatred. The aims of this study were to profile aroma composition of raw mealworm and determine the difference in the aroma composition of mealworm according to cooking methods (boiling, roasting, and frying). A total of 51 aroma compounds, including 4 pyrazines, 4 piperidines and pyrrolidines, 3 aldehydes, 6 ketones, 2 sulfides, 5 alcohols, 4 esters and acids, and 23 aliphatic hydrocarbons, were identified in mealworm. Quantitatively, aliphatic hydrocarbons were the main compounds in raw mealworm, whereas pyrazines, piperidines, and pyrrolidines were newly produced during roasting and frying. Also, the aroma profiles from mealworm based on the cooking methods were discriminated in score plots by combining PC 1 (39%) with PC 2 (32%). In particular, the major compounds contributing to the PC 1 dimension were trimethyl pyrazine, dimethyl sulfide, 1-butylpyrrolidinone, 2-heptanone, 4-ethyl octane, 2,2,7,7-tetramethyl octane, and nonane. In addition, 4-methyl nonane, 2,5-dimethyl pyrazine, benzaldehyde, 1-octen-3-ol, and 2-ethyl-5-methyl pyrazine were the main components of PC 2.

AGFD 112 Accumulation of P3HB by Methylocystis parvus MK using methane gas produced from anaerobic digestion of rice straw Moonkyung Kim, strikinggirl@sknu.ac.kr, Byung-Chul Kim, Yongju Choi, Kyounhghil Nam. Seoul National Univ. Civil Environ Eng, Seoul, Korea (Republic of) Anaerobic digestion is known to have environmental and economic benefits (i.e., energy recovery, biomass reduction) and has been widely used for valorization of carbon resources and their conversion into renewable energy (i.e., methane gas). This study focused on additional biological conversion of methane gas into more valuable and easily portable renewable energy, a biopolymer. The role of poly(hydroxyalkanoates) (PHAs) as a carbon and energy reserve material in bacteria has been previously reviewed by numerous researchers. One of the major advantages is the ability to store large quantities of reduced carbon without significantly affecting the osmotic pressure of the cell. PHAs are biodegradable and biocompatible bioplastics, which can be produced by a variety of bacteria and can function as intracellular storage polymers for carbon and energy. For anaerobic digestion of rice straw, semi-continuous reactors were operated for 300 days and the effect of pretreatment of rice straw and the mixing intensity of the reactor were investigated for higher production of methane gas. Biogas containing 53 ± 2% methane, 41 ± 2% carbon dioxide, and 5% nitrogen was produced consistently from anaerobic digestion of rice straw. In sequence, fed-batch methane utilizing reactors were operated to biologically convert methane gas into biopolymers. Methylocystis parvus MK, a type II methanotroph, was isolated from digested sludge by subculture and identified by 16S rRNA hybridization analysis. M. parvus MK can accumulate P3HB under nutrient deficient conditions, and highest P3HB of 3.05 ± 0.21 mg/mg cell dry weight was accumulated under phosphorous deficiency condition with the molecular weight of 57,154 Da (Table 1). The accumulated P3HB was verified using FT-IR, TGA, 1H-NMR, 13C-NMR, and GC-MS. The kinetic and stoichiometry of growth and P3HB accumulation showed the maximum specific growth of 0.035 ± 0.005/h and the maximum specific rate of CH4 utilization of 0.018 ± 0.002 g CH4/g TSS h under phosphorous deficiency condition. This study covers the perspective biological option for converting rice straw via anaerobic digestion into biogas (i.e., methane) and methane gas into a P3HB via microorganisms, which can be applied to the carbon capture Tech.

AGFD 113 Studying plant-insect interactions with solid phase microextraction: Screening for airborne volatile emissions response of soybeans to the soybean aphid, Aphis glycines Matsumura (Hemiptera: Aphididae) Lingshuang Cai1, lingshuang.cai@FMC.com, Jack E. Koziel2, Matthew E. O’Neal3. (1) FMC Agricultural Solutions, FMC Corporation, Newark, Delaware (2) Agricultural and Biosystems Eng., Iowa State Univ., Ames, Iowa (3) Entomology, Iowa State Univ., Ames, Iowa Insects trigger plants to release volatile compounds that mediate the interaction with both pest and beneficial insects. Soybean aphids (Aphis glycines) induces soybean (Glycine max) leaves to produce volatiles that attract predators of the aphid. In this research, we describe the use of solid-phase microextraction (SPME) for extraction of volatiles from A. glycines-infested plant. Objectives were to (1) determine if SPME can be used to collect soybean plant volatiles and to (2) use headspace SPME-GC-MS approach to screen compounds associated with A. glycines-infested soybeans, grown in the laboratory and in the field, to identify previously known and potentially novel chemical markers of infestation. A total of 62 plant volatiles were identified, representing 10 chemical classes. 39 compounds had not been found in previous studies of soybean volatile emissions. 3-hexen-1-ol, dimethyl nonatriene, indole, caryophyllene, benzaldehyde, linalool, methyl salicylate (MeSA), benzene ethanol, and farnesene were considered herbivore-induced plant volatiles (HIPVs). For reproductive field-grown soybeans, three compounds were emitted in greater abundance from leaves infested with A. glycines, cis-3-hexen-1-ol acetate, MeSA and farnesene. In summary, SPME can detect the emission of HIPVs from plants infested with insect herbivores.

AGFD 114 Metabolic profiling of secondary metabolites in phorbol ester containing and deficient Jatropha curcas seeds Kosuke Matsukubo, mkubo.kosuke0614@gmail.com, Tetsuya Matsukawa, Shinichiro Kajiyama. Biology-Oriented Science and Tech., Kindai Univ., Kinokawa, Wakayama, Japan Jatropha curcas which belongs to Euphorbiaceae family has been used as a folk medicine in Latin America, the place of origin. In recent years, the plant has attracted much attention as a rich source of oil suitable for biodiesel fluid. Moreover, this plant is drought tolerant and pest resistant, and thus J. curcas is an attractive source material for biodiesel production. However, there is a need for further research to fully explore its potential as a biodiesel feedstock. To this end, we aimed to investigate the metabolic profiling of secondary metabolites in phorbol ester containing and deficient Jatropha curcas seeds. The results of this study will provide valuable insights into the metabolic responses of Jatropha curcas seeds to phorbol ester treatment, which can be used to develop strategies for optimizing biodiesel production.
curcas is one of the most promising biofuel crops. However, Jatropha curcas contains varieties of toxic substances, and therefore, assessment of the risks of toxins and/or detoxification of toxic components are important for massive commercial uses. Among toxic substances in J. curcas, phorbol esters (PES), potent tumor promoters, are major toxic compounds in their seeds. PES are a family of naturally occurring diterpenes widely distributed in Euphorbiaceae family. It has been suggested that PES are biosynthesized from casbene via casbene synthase, however, details in following biosyntheses are still unknown and knowledge about the biosynthesis of PES must be necessary for breeding non-toxic cultivars. PE-deficient varieties have been also reported in wild J. curcas, but there are few reports about evaluation of the non-toxic varieties. In the present study, we performed comprehensive analysis of metabolites in seeds of PE-containing varieties (toxic) and PE-deficient varieties (non–toxic) using LC-MS/MS system. The seed extracts were applied to LC-MS/MS analyses. The resulting peak data were applied to multivariate analyses. In the presentation, we will show details of difference in metabolite profiles and discuss the similarities and differences in two varieties.

AGFD 115 Comparative transcription and experimental analysis of photosensitive and non-photosensitive eggplant to identify genes involved in dark regulated anthocyanin biosynthesis Yang Liu, liuyangtl@sjtu.edu.cn, Huoying Chen, Yongjun He. Shanghai Jiaotong Univ., Shanghai, China Solanum melongena (eggplant) is one of a few vegetables rich in anthocyanins. Light is a key environmental factor in regulation of anthocyanin biosynthesis. In our previous study, we identified 869 genes involved in light-induced anthocyanin synthesis by RNA-seq of photosensitive eggplant ‘Lanshan Hexian’ after bag removal. However, in field production, low light conditions often lead to poor coloration of photosensitive eggplant peel, which seriously affects the quality. Through bagging screenings, we obtained non-photosensitive eggplants that still have decent amount of synthesized anthocyanin after bagging. In order to explore the molecular mechanism of dark-regulated anthocyanin synthesis in non-photosensitive eggplant, the genes of the pericarp were sequenced and their transcriptions at 0h, 0.5h, 4h, and 8h were analyzed after bag removal. It was found that the genes with significant changes were mainly enriched in circadian rhythms, flavonoid biosynthesis, and anthocyanin synthesis pathways. Further comparison of the sequencing data with those of photosensitive eggplant for the same time period reveals that anthocyanin synthesis genes had different expression trends. Based on the expression trends of the structural genes, it was discovered that 26 transcription and light signal transduction factors may be involved in the dark regulation of anthocyanin synthesis in non-photosensitive eggplant.

AGFD 116 Volatile sulfur compounds exudated from roots of garlic plants and their activities toward the germination of spore of fungus Sclerotium cepivorum YanPing L. Qian1, yan.ping.qian@oregonstate.edu, Michael C. Qian2, Jeremiah Dung3. (1) Crop and Soil, Oregon State Univ., Corvallis (2) Oregon State Univ, Corvallis (3) Hoticulture, Oregon State Univ., Corvallis. White rot of onion and garlic, caused by the soilborne fungus Sclerotium cepivorum, is a worldwide threat to Allium production. The disease is extremely serious on these crops, and once a field is infested, it will remain so for many years since sclerotia of the fungus remain dormant indefinitely in the absence of Allium plants. Once infested, the fields are often forever abandoned from further onion or garlic production. The white rot pathogen propagates by the production of sclerotia on the roots of decayed host plants. Sclerotia spread in a mass movement of soil or water, on animals, and especially on infested plant parts. Once introduced into an area, S. cepivorum can gradually spread through contaminated equipment or planting materials, and the production of garlic and onions in the entire region is threatened. White rot is a disease limited to Allium crops. The fungus only colonizes on Allium plants and sclerotia germinate only in response to exudation by Allium roots. The California Early and California Late garlic varieties were grown in a greenhouse, and the volatile compounds in the soil were monitored by GC-MS during the growth period. It was found that diallyl disulfide (DADA) was the major compound exudated from garlic roots. DADS and other volatile sulfur compounds were further investigated for their activities toward the germination of the dormant sclerotia. Results showed that DADS and other volatile sulfur compounds could stimulate sclerotia germination.

AGFD 117 Identification of volatile compounds of blended coffee bean and application of principal components analysis Yang Dong Lee1, yblee@pknu.ac.kr, HyeonJae Kim2, chaos159@naver.com, Donglee Hong1, Jeongwan Yu3. (1) Pukyong National Univ., Busan, (2) Korea (Republic of) (2) PuKyong National Univ., Busan, Korea (Republic of) (3) Pukyong National Univ., Busan, Korea (Republic of) Coffee is explosively consumed in Korea and it probably due to the fact that 3-Ethylthio)propanal acted as a specific stimulator of sclerotia germination.

AGFD 118 Aroma characterization of oolong teas using ITEX dynamic headspace and SPME arrow coupled with gas chromatography-mass spectrometry Yan-Cheng Lin1, Wen-Chang Chang1, Shiming Li2, Min-Hsiung Pan3, Chi-Tang Ho4, Chih Y. Lo1, chihyu27@hotmail.com. (1) National Chiayi Univ., Chiayi City, Taiwan (2) Huanggang Normal Univ, Huanggang, China (3) National Taiwan Univ., Taipei (4) Food Sci., Rutgers Univ., New Brunswick,
New Jersey  Tea is the most popular beverage all over the world. Many studies have shown that the unique polyphenols in tea leaves, such as catechins in green tea and theaflavins in black tea, have proven health benefits. Furthermore, the unique aroma of the Oolong teas produced from various manufacturing processes has drawn much attention from consumers. By applying the following analytical techniques, distinguishable acids were found by ITEX dynamic headspace and aldehydes, alcohols, easers and nitrogen containing compounds were found through SPME Arbow technique. The comparative studies between fresh brews and commercial ready to drink Green Tip Oolong and White Tip Oolong tea were investigated. The characteristic flavors, such as fresh scent and fruity note represented for each Oolong tea were also discussed.

AGFD 119 Newly recognized phosphine resistance mechanisms in the rice weevil, Sitophilus oryzae  Kyoeongnam Kim, kn1188@knu.ac.kr, Hwang-Ju Jeon, Sung-Eun Lee. Kyungpook Nat’l Univ., Daegu, Korea (Republic of). Phosphine (PH3) resistance in stored-product insect pests has been reported worldwide, including Korea, where Sitophilus oryzae has developed resistance to PH3 because of its severe use. Here, two PH3-resistant S. oryzae strains, designated as moderate resistant (MR) and strong resistant (R), were used to understand the development of PH3 resistance in these insects. The C99 values for the MR and R strains were approximately 2.8- and 29.4-fold higher than that for the control strain (S), respectively. The activity ratio of cytochrome c oxidase (COX), a potential PH3-target site, increased according to the resistance level. The IC50 values of the ethyl formate (EF)-inhibited COX activities were 2.82, 3.71, and 4.55 mM for the S, MR and R strains, respectively. The Lineweaver-Burk plots of the EF-inhibited COX activities indicated an uncompetitive mode of inhibition for the S strain and noncompetitive modes for the resistant strains. The RT-qPCR analysis showed significant up-regulation of cat, wnt7, wnt11, and gh48 and down-regulation of jhi, casp, and gh31 in the R strain. The expressions of the fatty acid biosynthesis enzymes, acetyl-CoA carboxylase and fatty acid synthase, and energy metabolism enzymes, COX2 and succinate dehydrogenase were significantly down-regulated in both resistant strains. The next-generation sequencing of the mitochondrial DNA revealed missense mutations in nad4, nad5, and nad6 and point mutations in cox1 and cox2. To our knowledge, this is the first report of the mutations related to PH3 resistance. Taken together, S. oryzae resistance to PH3 was definitely acquired by the overall transformation of energy metabolism to overcome PH3 toxicity.

AGFD 120 Noble biomarkers in Eisenia fetida induced by CuO nanoparticles  Hwang-Ju Jeon, jeonhj@knu.ac.kr, Kyoeongnam Kim, Sung-Eun Lee. Kyungpook Nat’l Univ., Daegu, Korea (Republic of). Engineerered copper oxide nanoparticles (CuO NPs) can adversely affect terrestrial organisms via the release of metal ions. In the present study, acute toxicity of CuO NPs using a filter paper assay was conducted. Three concentrations of bulk CuO and CuO NPs, 3.15, 31.5 and 315 mg/cm2, were treated to earthworms for 3 days. The results exhibited no mortality in the CuO NPs-treated earthworms, while 40% mortality was found in the CuO bulk-treated earthworms at the concentration of 315 mg/cm2. After exposure to the CuO NPs, acetylcholinesterase activity in E. fetida was significantly inhibited in a concentration-dependent mode and CuO NPs inhibited stronger than CuO bulks (Fig. 1a). The remaining activities of two detoxifying enzymes, carboxylesterase (Fig. 1b) and glutathions S-transferase (Fig. 1c), were determined and carboxylesterase activity in the CuO NPs-treated E. fetida was dramatically enhanced, while there was no changes in the earthworms treated with CuO bulks. Glutathions S-transferase activity was significantly elevated in E. fetida exposed to all tested CuO compounds. Low-molecular weight proteins less than 16 kDa using SELDI-TOF MS was analyzed in earthworms treated by three different CuO NPs. Twenty six differentially expressed proteins were found after exposure to CuO NPs and the expression patterns of 11 proteins were up-regulated and 15 proteins were down-regulated (Table 1). Among them, a 5,696.5-m/z protein was dramatically reduced after the treatment of CuO NPs and a 13,456-m/z protein was reduced with increasing CuO NPs concentration (Fig. 2). Two proteins with 9,868.4 and 13,124-m/z were significantly enhanced with increasing CuO NPs concentration (Fig. 2). Principal component analysis (PCA) of the SELDI-TOF MS results showed variability in the protein expression in response to CuO NPs treatment in E. fetida (Fig. 3). To our knowledge, it is the first study to suggest low-molecular weight protein biomarkers to metal oxide NPs on the terrestrial organisms using SELDI-TOF MS.

AGFD 121 Green energy generation in a metal-organic framework implemented in electrochemical reactors and microbial fuel cells  Hwang-Ju Jeon, jeonhj@knu.ac.kr, Kyoeongnam Kim, Sung-Eun Lee. Kyungpook Nat’l Univ., Daegu, Korea (Republic of). With advances in the energy industry, there is an increasing demand for energy-producing technologies that cause less environmental pollution and guarantee greater efficiency. Higher demand for energy leads to higher greenhouse gas emissions, because up to now, economies have developed based on the use of fossil fuels. The development and adoption of renewable energies that can replace fossil fuels is increasing, and research is underway to solve this problem of greenhouse emissions globally. However, this is difficult due to the unpredictability and irregularities of production and purity. To overcome these disadvantages, water decomposition using electrochemical methods and hydrogen production using microorganisms is studied. To increase the efficiency, the shapes of the catalyst and the reactor, and the nutrients of the electrolytes and microorganisms, controlled as variables. Catalysts used as electrodes include precious metal catalysts, general metals, alloy metals, and metal-organic frameworks (MOFs). Precious metal catalysts have neglected thus far due to the limited resources, high price, and low efficiency of the common precious metals. Instead, alloyed metals and MOFs are to replace precious-metal-based catalysts, because these are resistant to heat and are relatively cheap; thus, they can overcome the problems of low efficiency and those encountered at high temperatures and pressures. Using alloyed metals and MOFs have solved the problems of such problematic reaction conditions: they function at room temperature and normal pressure to yield efficient hydrogen production. In this study, we evaluated conducted an experiment with a microbial electrolysis cell (MEC) and NiMo alloy metal to analyze electrochemical hydrogen production using MOFs. High current density and production have been detected in previous studies, and we have analyzed the results of the research, including experimental methods, synthesis methods, characterization, and hydrogen production efficiency.

AGFD 122 Saudiarabicain A–E, macroyclic diterpenoids from Euphorbia saudiarabica  Abdullatif J. Bin Muhsinah1, Abdalrahman Alsayar3, Navindra P. Seeram4. (1) Pharmacognosy, King Khalid Univ., Abha, Asir, Saudi Arabia (2) Dept. of Biomedical and Pharmaceutical Sciences, Univ. of Rhode Island, Kingston (3) pharmacognosey, king Khalid Univ., Abha, Saudi Arabia (4) Biomedical and Pharmaceutical Sciences, Univ. of Rhode Island, Charlestown Methanol extracts of aerial parts of the previously uninvestigated Euphorbia saudiarabica afforded five new macroyclic-lathyrane diterpenoids, named saudiarabicain A–E (1–5). Saudiarabicain A and B represent an unusual type of lathyrane diterpenoid. The structures of the compounds were determined by analysis of extensive NMR and mass spectroscopic data, and their
AGFD 123 Extraction and biological evaluation of polysaccharides from Niudali (Millettia speciosa champ.) roots. Xiaodan Tang, Li1,2,3, xiaodan_tang@uri.edu, Yongming Lu3,4, Donglig Li1,2, Naivinda P. Seeram3, Hang Ma1,2,3. (1) School of BioTech. and Health Sciences, Wuyi Univ., Jiangmen, China (2) International Healthcare Innovation Inst. Jiangmen, China (3) Bioactive Botanical Research Laboratory, Dept. of Biomedical and Pharmaceutical Sciences, College of Pharmacy, Univ. of Rhode Island, Kingston (4) School of Life Sciences, Anhui Univ., Hefei, China. Our laboratory initiated a program to screen bioactive natural products from medicinal plants and/or functional foods grown in the south of the Nanling Mountains region. One of these medicinal plants, Niudali (Millettia speciosa Champ.), is used as a folk medicine for many disorders including diabetes, high blood pressure, and joint dysfunctions. In the current study, a Millettia speciosa polysaccharide fraction (MSP) was extracted and purified from the root of Niudali and its bioactivities were evaluated using a panel of in vitro bioassays including antioxidant, anti-tumor, anti-inflammatory, and anti-aging. MSP showed antioxidative activity in the free radical scavenging (DPPH) assay. At concentrations of 50–2000 µg/mL, MSP scavenged 36.7–52.1% free radicals. In addition, MSP (at concentrations from 500 and 1000 µg/mL) inhibited the activity of tyrosinase enzyme by 56.6% and 54.4%, respectively. In the current study, we aim to elucidate the structures of MSP and further evaluate its biological activities.

AGFD 124 Effects of particle size on protein extraction from catfish by-products. Yan Zhang, yzhang@fnshp.mstate.edu, Sam K. Chang. Coastal Research and Extension Center, Mississippi State Univ., Pascagoula. How particle size of catfish by-products affects protein recovery, yield and composition has not been investigated. This study’s objective was to investigate the effect of particle size of ground catfish by-products on protein extraction. The by-products were ground with a LEM #32 grinder: first ground two times with a coarse plate, then two times with a 10 mm plate and finally, the mince was further ground 2, 3, 4, and 5 times with a 4.5 mm plate. The four mince grinding practices were designated as grinding method 1 to 4, respectively. The particle size distribution of catfish mince was determined by stacked sieves of different openings: 4, 2, 1, and 0.5 mm. The mince was extracted at pH 11 for 30 min (water to mince ratio=4:1) at 4°C with continuous stirring. The slurry was centrifuged at 12,000 rpm for 20 min, and then the supernatant was adjusted to pH 5.5 to precipitate the myofibrillar proteins. After centrifugation, the myofibrillar protein (precipitate) and sarcoplasmic protein (supernatant) were obtained and analyzed. Grinding methods significantly affected the particle size distribution of the mince. All grinding methods could render the particle size below 4 mm. From grinding method 1 to 4, the 2-4 mm fraction decreased significantly from 13.44 to 6.19%, the 0.5-1 mm fraction increased from 8.39 to 10.14%, and the < 0.5 mm fraction increased from 61.91 to 64.99%, respectively. Grinding method 1 resulted in the highest myofibrillar protein recovery of 30.1%, but the other three grinding methods did not show significant differences in the myofibrillar protein recovery. For the sarcoplasmic protein fraction, all grinding methods gave similar recovery of 16% on a dry basis. The results increased our understanding of the protein extraction and composition from catfish by-products and contributed to the future utilization of the extracted protein.

AGFD 125 Ochratoxin A analysis in wine and grape juice using LC-fluorescence detection with nanosponge solid phase extraction clean-up. Michael Appell1, michael.appell@gmail.com, Kervin O. Evans2, Michael A. Jackson2, David L. Compton2. (1) Mycotoxin Prevention and Applied Microbiology, USDA-ARS, Peoria, Illinois (2) Renewable Products Tech., USDA/NCUR, Peoria, Illinois. One of the most common techniques to quantify ochratoxin A contamination in fruit beverages is liquid chromatography analysis using fluorescence detection (LC-FLD). A new method was developed to improve the detection of ochratoxin A in wine and grape juice using a novel beta-cyclodextrin polyurethane polymer for solid phase extraction clean-up prior to LC-FLD. Thermolytic polymer synthesis with methylene bis-diphenyl diisocyanate produced a crosslinked polymer suitable for ochratoxin A binding. The polypeptide moieties were observed by FT-IR spectroscopy and experimental spectra correspond with PM6 semi-empirical calculated spectra. Atomic force microscopy analysis identified features of the beta-cyclodextrin polyurethane polymer on the nanoscale. The LC-FLD method coupled with nanosponge solid phase extraction clean-up achieved a limit of detection for ochratoxin A of 0.2 ng/mL and quantitative detection between 20 ng/mL to 0.5 ng/mL.

AGFD 126 Phospholipid quantitation in whey matrices by HILIC-UPCL-ELSD: Industry developed, validated, and applied method for determining phospholipid composition. Quintin Ferraris1, ferrarisquintin@gmail.com, Joe Hale2, Elizabeth Teigland2, Anand Rao3, Michael C. Qian4. (1) Food Sci. & Tech., Oregon State Univ., Port Reading, New Jersey (2) Protein Research Center, Agropur US, Le Sueur, Minnesota (3) Protein Applications Center, Agropur US, Eden Prairie, Minnesota (4) Oregon State Univ, Corvallis. Phospholipids (PL) have gained the interest of academia and the food industry alike over the last two decades as nutraceuticals (commonly in infant formula and fitness nutrition) and as a functional ingredient, aiding in the instantization of powdered food products. The most prevalent PL in dairy matrices are phosphatidylcholinol (PI), phosphatidylethanolamine (PE), phosphatidylserine (PS), phosphatidylcholine (PC), and sphingomyelin (SM). Analysis of PL in published literature range from less expensive chromatography techniques like thin-layer chromatography to larger investments in instrumentration methods with varying detection techniques including fluorescence spectroscopy, evaporative light scattering, and mass spectrometry. Methods from literature are often difficult to adopt as plug-and-play solutions to starting analysis of PL in industry, and typically require some degree of modification for acceptable results on the specific system configuration being used. A rigorous, reproducible analytical method is required in an industry setting that allows for consistent analysis of food products at several location, in potentially more than one country. The method generated in this collaboration between industry and academia has been fully validated for accuracy and reproducibility including intermediate precision within a group of industry scientists, resulting in ≤0.6% variation in total PL content measured compared to third party contracted analysis. This method applies a modified Folch extraction procedure for sample preparation and clean-up followed by UPLC-ELSD analysis using HILIC chemistry on a silica normal phase column. Briefly, powdered whey is homogenized in 125mM saline solution and extracted following the Folch method using 2:1 v/v chloroform-methanol. After drying down the recovered lipids and reconstitution in extraction solvent the samples are analyzed on a Waters Acquity UPLC-ELSD system using a quaternary solvent system comprised of aqueous ammonium formate (200mM), isopropyl alcohol, methanol, and acetonitrile. Spike recovery samples yielded reproducible results for all measured PL at >75%.

AGFD 127 Differentiation of commercial vanilla extracts by volatile and non-volatile chemical profiles employing GC-MS and
AGFD 129 Differential proliferation of bacterial species under varying poised potentials and its functional implications in bioelectrochemical denitrification  Taymee Brandon1, taymee.brandon@gmail.com, Ashton Cummings1, Xin Wang2, Blake Stamps3, Daqian Jiang1. (1) Environmental Eng., Montana Tech, Butte (2) Nankai Univ., Tianjin, China (3) Colorado School of Mines, Golden Agricultural runoff accounts for >80% human-induced nitrate discharge to the aquatic environment, and excessive nitrate leads to some of the most challenging water quality issues globally (e.g., eutrophication). Current nitrate remediation technologies often require operational conditions infeasible for the scale of the problem. For example, heterotrophic denitrification, the most widely used denitrification process, requires the addition of organic carbon. Bio-electrochemical denitrification (BED), where bacteria turn nitrate into nitrogen gas using only electricity, is a promising solution, as it can be in situ, solar-powered, and chemical-free. Despite the successful proof of concept, the functional roles of different species in the BED biofilm matrix remain under-explored. This study uses metagenomic sequencing to investigate the compositional shifts in the biofilm communities under different poised potentials, and correlate these shifts with reactor-level functional differences (i.e., denitrification rate and current density).

The results suggest that: 1) The denitrification rate achieved by BED was 50 g-N/m3 cathode/day under lab conditions, and was loosely correlated with the current density (Fig 1); 2) Elevated relative abundances of thiobacillus denitrificans (a heterotrophic nitrate reducer) and thiobacillus thioparus, and lower relative abundances of hyphomicrobium denitrificans were correlated with the highest denitrification rate and -0.4V poised potential (vs. AgCl). The findings are the first time that the functional roles are suggested in BED – a potential synergy between denitrification and electrogenic species. Consequently, future Eng. efforts should consider selectively co-enriching the two families to enhance BED performance.

AGFD 128 Sustainable conformational modification of soy proteins by physical and chemical treatments  Jiahon Zou1, jhzou@ucdavis.edu, Ngoc T. Nguyen2, Gang Sun3. (1) Biological and Agricultural Eng,. Univ. of California, Davis (2) Dept. of Chemistry, Univ. of California, Davis, Davis (3) Textiles and Clothing, Univ. of California, Davis Soy protein isolate (SPI) aqueous solutions were investigated for denaturation under different mechanical treatments without the addition of any chemicals. Compared with the traditional magnetic stirring treatment (MS), high-intensity ultrasonication (US), high-speed mechanical shearing (SH) and their combined treatments (USH, SHUS) were able to dissolve better and further swell and deform the globular structures of the SPI. Higher solubility, lower turbidity, enlarged particle size, more uniform particle size distribution, higher free sulphydryl group content, and higher viscosity were detected from the SPI solutions after US and SH treatments. Among all samples, the SPI solution after USH treatment demonstrated that the soy proteins were denatured and possessed the most extended conformational structure. A schematic structure model illustrating the dissolution and denaturation of SPI under the treatments was established. The denatured protein solutions could relax back and degrade after storing still for up to 12 days. Further, extreme pH conditions, the addition of glycerol, together with a combination of ultrasound and shear treatments (USHH) were applied to increase the solubility of SPI in aqueous solutions and denaturation the globular structure of soy proteins. USH treatment was proved capable of increasing the solubility of SPI under extreme pH conditions, such as very high and low pH values. Also, the addition of glycerol was able to assist the dissolution of SPI in the solution and also provide antimicrobial and SPI structural stabilizing functions. With stable increased viscosity, higher content of sulphydryl groups, and larger particle size, 30% and 50% Glycerol-H2O solvent systems were proved to be compelling solvent systems to assist the protein denaturation under the USH treatments. The results could help the development of soy proteins in material applications.

AGFD 130 Atmospheric cold plasma promoted mung bean sprouting and the content of bioactive components  Yu-Jou Chou, r06641022@ntu.edu.tw, Yuwen Ting, James Wu, Kuan-Chen Cheng. Food Sci. & Tech., National Taiwan Univ., Taipei Mung bean sprout is one of the common vegetable consumed in the world, especially in Asian cuisine. Previous studies had found spraying of seed would significantly enhance the nutrition value and, thus, mung bean sprout contains larger amount of mobilized starch and protein as well as bioactive components, such as vitamins, minerals, and phenolic compounds, than the seed. However, many of the grower would use herbicide, bleaching agents and fertilizers to promote the growth of mung bean sprouts and to increase its appearance. Besides the fact that these chemical agents may leave toxic residue to the crops, they would also impose adverse effect to the growing environment. Thus, it is desirable to find alternative method to facilitate higher germination rate as well as the subsequent sprout growth. Atmospheric cold plasma (ACP) is non-thermal Tech. generating concentrated reactive species that can rapidly react with the substrate forming massive micro-fissures on the surface. In this work, we aim to use ACP to promote germination of mung beans, to facilitate desirable growth of its sprout, and to increase the concentration of bioactive components in the final product. To find the optimum treating condition, mung beans were treated several times with different combination of processing powers, nozzle concentration of bioactive components in the final product. To find the optimum treating condition, mung beans were treated several times with different combination of processing powers, nozzle particle size, 30% and 50% Glycerol-H2O solvent systems were proved to be compelling solvent systems to assist the protein denaturation under the USH treatments. The results could help the development of soy proteins in material applications.

AGFD 128 Sustainable conformational modification of soy proteins by physical and chemical treatments  Jiahon Zou1, jhzou@ucdavis.edu, Ngoc T. Nguyen2, Gang Sun3. (1) Biological and Agricultural Eng,. Univ. of California, Davis (2) Dept. of Chemistry, Univ. of California, Davis, Davis (3) Textiles and Clothing, Univ. of California, Davis Soy protein isolate (SPI) aqueous solutions were investigated for denaturation under different mechanical treatments without the addition of any chemicals. Compared with the traditional magnetic stirring treatment (MS), high-intensity ultrasonication (US), high-speed mechanical shearing (SH) and their combined treatments (USH, SHUS) were able to dissolve better and further swell and deform the globular structures of the SPI. Higher solubility, lower turbidity, enlarged particle size, more uniform particle size distribution, higher free sulphydryl group content, and higher viscosity were detected from the SPI solutions after US and SH treatments. Among all samples, the SPI solution after USH treatment demonstrated that the soy proteins were denatured and possessed the most extended conformational structure. A schematic structure model illustrating the dissolution and denaturation of SPI under the treatments was established. The denatured protein solutions could relax back and degrade after storing still for up to 12 days. Further, extreme pH conditions, the addition of glycerol, together with a combination of ultrasound and shear treatments (USHH) were applied to increase the solubility of SPI in aqueous solutions and denaturation the globular structure of soy proteins. USH treatment was proved capable of increasing the solubility of SPI under extreme pH conditions, such as very high and low pH values. Also, the addition of glycerol was able to assist the dissolution of SPI in the solution and also provide antimicrobial and SPI structural stabilizing functions. With stable increased viscosity, higher content of sulphydryl groups, and larger particle size, 30% and 50% Glycerol-H2O solvent systems were proved to be compelling solvent systems to assist the protein denaturation under the USH treatments. The results could help the development of soy proteins in material applications.

AGFD 130 Atmospheric cold plasma promoted mung bean sprouting and the content of bioactive components  Yu-Jou Chou, r06641022@ntu.edu.tw, Yuwen Ting, James Wu, Kuan-Chen Cheng. Food Sci. & Tech., National Taiwan Univ., Taipei Mung bean sprout is one of the common vegetable consumed in the world, especially in Asian cuisine. Previous studies had found spraying of seed would significantly enhance the nutrition value and, thus, mung bean sprout contains larger amount of mobilized starch and protein as well as bioactive components, such as vitamins, minerals, and phenolic compounds, than the seed. However, many of the grower would use herbicide, bleaching agents and fertilizers to promote the growth of mung bean sprouts and to increase its appearance. Besides the fact that these chemical agents may leave toxic residue to the crops, they would also impose adverse effect to the growing environment. Thus, it is desirable to find alternative method to facilitate higher germination rate as well as the subsequent sprout growth. Atmospheric cold plasma (ACP) is non-thermal Tech. generating concentrated reactive species that can rapidly react with the substrate forming massive micro-fissures on the surface. In this work, we aim to use ACP to promote germination of mung beans, to facilitate desirable growth of its sprout, and to increase the concentration of bioactive components in the final product. To find the optimum treating condition, mung beans were treated several times with different combination of processing powers, nozzle concentration of bioactive components in the final product. To find the optimum treating condition, mung beans were treated several times with different combination of processing powers, nozzle power, and chemical treatments. The results could help the development of soy proteins in material applications.
and significantly increase in diameter was reported. In addition, the HPLC system was used to measure the amount of GABA, an important bioactive component in bean sprouts, and found it was significantly increase with plasma treatment. Overall, we have successfully demonstrate the feasibility and effectiveness ACP Tech. to promote the growth of mung bean sprouts and to increase the content of bioactive component.

AGFD 131 Long-term impact of mushroom derived β-glucan on obesity and gut microflora in mice fed with high fat diet  Moonjiae Cho, moonjiao@gmail.com, Muthuramalingam Karthika, Young Mee Kim. medicine, Jeju National Univ., Jeju city, Jeju, Korea (Republic of) Dietary elements and its resulting metabolites have influential role in shaping the microbiota, which has paramount impact on host associated metabolic disorders. Consumption of high fat diet (HFD) has detrimental effects in deteriorating the host system with dysbiosis in the gut microbial community. Intervening such metabolic abnormalities with pre- or pro-biotics is emanating as a topic of current interest, since the world has started to highly rely on westernized diet having bountiful supply of fat. Herein this study, we have investigated the effect of mushroom derived β-glucan, a highly soluble dietary fiber, on high fat diet induced obesity and the associated gut microbial imbalances. Apart from inducing anti-obesity nature, β-glucan consumption adds bulk to stool with faster intestinal transit rate (p<0.05) thereby relieving high fat diet induced colonic motility disorder such as constipation. Further, β-glucan intake ameliorates high fat induced stress condition on liver in addition to restoration of intestinal architecture with enhanced expression of tight and adherent junctions. The reduction in goblet cell counts with the consumption of high fat and thus mucin production has been reverted to normal with the inclusion of β-glucan in the diet. More importantly, favourable shift in the gut microfloral community with the β-glucan uptake suppresses the adverse effects of high fat diet consumption. Altogether, the outcomes of the present study indicate that the β-glucan can be used as a promising therapeutic prebiotic in alleviating the high fat diet induced metabolic disorders.

AGFD 132 Comparison of the adhesive performance of water- and alkali-soluble cottonseed protein  Zhongqi He1, zhongqi.he@ars.usda.gov, H.N. Cheng2. (1) USDA ARS, New Orleans, Louisiana (2) Southern Regional Res. Center, USDA Agricultural Res. Service, New Orleans, Louisiana The interests on bio-based wood adhesives have been steadily increased in recent years. Cottonseed protein isolate (CSPI) has been shown the potential as one of the renewal bio-based adhesives. For better understanding of adhesive performance and mechanism of CSPI, in this work, we sequentially separated cottonseed protein into a water-soluble (CSPw) and an alkali-soluble (CSPA) fraction. We tested the adhesive properties of both fractions on bonding maple wood veneers at their natural pH (4.0 for CSPw and 7.0 for CSPA) and a common pH 11. The dry, wet, and soaked strength of the bonded wood pairs at break were measured and regarded as the adhesives strength and water resistance of CSPw and CSPA. While CSPw and CSPA at their natural pH conditions showed comparable adhesive strength, the wet and soaked strength of CSPw are greater than CSPA when the pH of both adhesive slurries were adjusted to 11. Rheological analysis showed lower viscosity of CSPw than CSPA while both viscosity values were increased with pH. These observations implied that higher pH conditions might have changed the protein conformation, thus the bonding mechanism and rheology between the protein components.

AGFD 133 Detection of Vibrio parahaemolyticus in marine foods  Xiaoli Zhao, Chunyu Yan, Cuiping Ma, 82388868@qq.com. Inst. of Marine science and biological Eng., Qingdao Univ. of Science and Tech., Qingdao, Shandong, China. A denatured bubble-mediated chain exchange-induced isothermal nucleic acid detection technique (SEA) was developed to detect Vibrio parahaemolyticus in seafood. This method is based on the respiration of DNA’s own denatured bubbles, which makes the DNA double strands dynamically dissociated. The reaction requires only one DNA polymerase to participate in the reaction. It can detect 1.0×10^-13 M, and has strong specificity and anti-interference ability. Compared with other traditional methods, the reaction can be detected within 20-40 min. The SEA method can directly detect the bacterial liquid of Vibrio parahaemolyticus, avoiding the cumbersome steps of extracting genomic DNA and the technical requirements of the experimental personnel, and greatly shortening the time of experimental detection. This method may play a role in immediate detection, animal disease surveillance, and environmental monitoring.

AGFD 134 Characterization of cadmium absorption and translocation in amaranth affected by iron deficiency  Hongli Fan, fanhongli@caas.cn, Rong Zou, Li Wang. CAAS,IARRP, Beijing, China Amaranth has shown to be capable of accumulating cadmium (Cd) and could potentially be used for phytoremediation of Cd contaminated soils. Iron (Fe) is chemically similar to Cd, the kinetics of root 109Cd2+ absorption in amaranth as influenced by Fe deficiency. To trace the root Cd absorption dynamics, 109Cd2+ isotope labelling technique was applied, the effect of calcium channel inhibitor LaCl3 and metabolic inhibitor Carbonyl cyanide 3-chlorophenylhydrazone (CCCP) on the absorption of 109Cd2+ was examined, in order to reveal the absorption characteristics of Cd2+ by amaranth root. The result showed that compared to Fe treatment, the root absorption of 109Cd2+ was enhanced under Fe deficiency which induced more Fe transporters in the root cell membrane. In addition, LaCl3 and CCCP could inhibit the saturation and linear absorption process of 109Cd2+ in amaranth root. It was concluded that Cd uptake was stimulated by Fe deficiency, and Fe transporter may be involved in regulating Cd uptake by amaranth roots.

AGFD 135 Exploration of the compositional changes of Californian Hass and Gem avocados throughout the season and its effect on avocado flavor  Bethany Hausch1, bethany.j.hausch@gmail.com, David M. Obenland1, Mary Lu Arpaia2. (1) USDA Agricultural Research Service, Clovis, California (2) Botany & Plant Sciences, Univ. of California, Riverside Consumer demand for avocados continues to grow, and the fruits’ nutritional value contributes to its popularity. While the body of research on avocados is likewise growing, the flavor and sensory aspects of avocados are areas where scientists need a deeper understanding, in order to deliver a quality standard for the industry and explore varieties in addition to Hass that could be desirable to consumers. Our research evaluates the flavor of Californian Hass and Gem avocados during the 2019 harvest season. Avocados were harvested from one grower in Ventura County starting in February 2019 and will be harvested until August 2019, on an approximately monthly basis. Analytical measures on the dry weight, moisture content by freeze drying and fat content by Soxhlet are collected at each harvest. The changing composition of the oil is monitored with fatty acid methyl esters (FAMES) analysis. We expect the oil content and oleic acid content to reach a peak concentration during the mid-season and then taper back down. Solvent assisted flavor evaporation (SAFE) extracts are collected and analyzed by gas chromatographyolfactory (GCO) to identify the aroma active compounds, followed by aroma extract dilution analysis (AEDA) to determine each compound’s relative importance. We expect that more aroma-active compounds in avocado will be found in the fruit as the season progresses, along with increased concentrations of compounds...
formed from lipid breakdown. We expect that the avocados will develop an undesirable, rancid-like off-flavor at the end of the season correlated with higher levels of lipid oxidation products. Descriptive Analysis (DA) data collected over the harvest season will be used to identify and rate the key attributes of avocado. Together, the fatty acid profile, aroma active compounds and sensory descriptive scores offer insights into the connection between molecular composition and the flavor experience.

AGFD 136 Implications of the acid/base profile of food chemicals
Marisa G. Santibanez-Moran1, marisagsantibanez@gmail.com, Mariel P. Rico-Hidalgo1, David T. Manallack2, Jose L. Medina-Franco1. (1) Dept. of pharmacy, Univ. Nacional Autónoma de México, Mexico City (2) Monash Inst. of Pharmaceutical Sciences, Monash Univ., Parkville, Victoria, Australia. The acid/base profile has an important role in food preservation and stability. At a molecular level acid/base properties impact on absorption, membrane permeation, metabolism, affinity for biological targets, and toxicity. In the present study, we estimated the acid/base profile of FooDB, a public food chemical database with more than 22,000 compounds. The results were compared with a molecular database of approved drugs. It was found that FooDB has twice as many the percentage of neutral compounds that approved drugs. The most common acidic and basic functional groups in food chemicals were phenols (16.1%), phosphates (17.3%), and carboxylates (17.3%) whereas the single-basic-containing compounds accounted for just 5.5%. This is part of a continued effort to further characterize the food chemicals for their importance in the food industry and their possible implications in health-related benefits.

AGFD 137 Comparative study of safety, nutrition and flavor of aronia berry (Aronia melanocarpa) grown in the US Xiaoxing Xie1, xxie5@unl.edu, Tian Yi1, Wei Fang1, Changmou Xu2. (1) Food Sci. & Tech., UNL, Lincoln, Nebraska (2) Univ. of Nebraska-Lincoln Aronia (Aronia melanocarpa) is a cold hardness and pathogen free shrub which comparatively requires low input and labor force. Aronia berries were reported having high content of anthocyanins and total polyphenols, which contribute to the highest in vitro antioxidant activities among fruits. However, limited reports have been focused on the overall fruit quality of aronia berries grown in different locations in the US during ripening, although aronia berries are generally being grown as a specialty crop in the Midwest and throughout the US. Thus, the objectives of the study were to compare the overall quality of aronia berries collected from different locations in the U.S. and investigate the correlations among microbiological counts, fruit nutrient, and flavor. Aronia berries of representative production area in Midwest (NE, IA, SD), Mid-Atlantic (NJ, MD) and North East (VT) were collected at commercial harvest time (Ht) of each farm and then for two more times at Ht+1 week and Ht+2 weeks. Berries were frozen immediately and then shipped overnight to the research lab for microbiological, basic berry characteristics, nutrition and flavor analysis. In general, total aerobic plate counts of berries from different locations were averaged at 4.0 log10CFU/g, with no significant difference on locations or harvest times. Similarly, the yeasts and molds content of these berries were averaged at 3.9 log10CFU/g, and lactic acid bacteria content at 3.7 log10CFU/g. No coliforms or pathogens (Salmonella, Listeria, E.coliO157:H7) were detected on these berries. Basic berry characteristics (Brix, pH, and Brix/acid ratio) were varied among different locations but generally increased with the ripening. While titratable acidity and nutrition related properties (total polyphenols, anthocyanins, and antioxidant activities) were also differentiated by locations but mostly decreased with the ripening. This indicates postponing harvest time may be able to enhance the flavor of aronia berries but also decrease the nutrition. The correlation of these compositions with flavor by sensory evaluation and aroma analysis also were discussed.

AGFD 138 Acylated glucose for integrated pest management in greenhouse production of tomatoes Hannah M. Payne3, Daniel Payne4, Barbara Liedl2, Micheal W. Fultz1, mfultz@wvstateu.edu. (1) Dept of Chemistry, West Virginia State Univ., Inst., (3) West Virginia State Univ. Charleston, West Virginia (4) Biology, West Virginia State Univ., Inst. Tomatoes (Solanum lycopersicum) are susceptible to a wide array of arthropod pests. Most commercially available tomatoes do not have pest resistance and rely of the use of pesticides. In protected culture, using biological control agents (beneficial insects) are critical to integrated pest management, especially to control the two major pests: whiteflies and aphids. Our first step has been to synthesize specific acyl-sugars (derived from Solanum pennelli) in order to ultimately be able to test their effects on beneficial insects and biological controls in the greenhouse. The focus of this research was testing the behavior of adult lady beetles in a choice assay with five OMRI approved insecticides, a positive control (DEET) and negative control (acetone), as well as the synthesized acyl sugars from its project to ascertain if there is any associated repellence or irritability characteristics from the insecticides versus the solvent (acetone). A ViewPointä tracking system was used with a single adult released in the untreated center of a Plexiglas arena with two adjacent areas for choice (treated and control). Collected data included ambulatory time, walking distance, velocity, and proportion of time spent in each area for 10 minutes. The target compound was investigated from a retrosynthetic perspective, which allowed for the development of a synthetic route. In retrosynthesis, a synthetic route is created from starting at the end and working towards the beginning. The target compound had positions 2, 3, and 4 esterified. In order to selectively add these acyl groups, the anomeric and primary positions had to be protected first. Once these positions are blocked, the acyl groups can be added with ease. The last two steps are then to remove the protecting groups, which yields the final product.

AGFD 139 Phenolic compound profile and physiological activities of fermented blueberries Somi K. Cho1,2, phd.kim.somi@gmail.com, Ji-yeon Ryu1. (1) Jeju Nat’l Univ., Jeju, Korea (Republic of) (2) Subtropical/Tropical Organism Gene Bank, Jeju Nat’l Univ., Jeju, Korea (Republic of) The aim of this study was to determine the effect of fermentation of blueberry by Lactobacillus plantarum on the antioxidant and anti-cancer activities. The fermented blueberry extracted with 80% ethanol (FBE) exhibited increases in the superoxide dismutase-like activity and in the scavenging activities of DPPH and alkyl radical, and in antiproliferative activity against human cervical carcinoma HeLa cells. The amount of 18 representative phenolic compounds in FBE was measured by high-performance liquid chromatography at different fermentation times. The content of each phenolic compound in the FBEs was dependent on the fermentation period. The three major compounds, protocatechuic acid, catechol, and caffeic acid, catechol showed the most significant anticancer activity when Hela cells were treated with each of these three major alone or mixed at various mixing ratios. Pearson’s product-moment correlation analysis revealed that increases in antioxidant- and anticancer- activities following blueberry fermentation were positively correlated with phenolic acids present in FEBs.

AGFD 140 Removal of dilute ethylene using repetitive cycles of adsorption and plasma-catalytic oxidation over Pd/ZSM-5 catalyst Seung-gun Kim, Young Sun Mok, smokie@jejunu.ac.kr. Chem. Eng., Jeju National Univ., Korea (Republic of) In order to supply fresh agricultural products throughout the year, it is required to
develop related technologies for long-term storage. One of the factors affecting long-term storage of agricultural products is the concentration of ethylene (C2H4) that is produced during the respiration process of agricultural products. Commercial catalysts have problems such as poor low-temperature activity and selectivity to CO2. These problems may be overcome by the combination of plasma with catalysis. The objective of this work is to develop environment-friendly agricultural product storage Tech. using plasma and catalysis. The process consists of repetitive cycles of adsorption/emeriment and plasma-catalytic decomposition. The inside of the plasma reactor is filled with adsorptive catalyst (Pd/ZSM-5 prepared by ion-exchange) which can highly concentrate C2H4 during the adsorption step and catalyze the oxidation of the concentrated C2H4 in the plasma decomposition step. The presence of catalyst helps completely oxidize the adsorbed C2H4. Further, when the catalyst is placed in the plasma space, it is activated at temperatures lower than that required for the thermal catalysis, so that C2H4 oxidation can be effectively performed without additional energy for activating the catalyst. The feed gas for the dynamic adsorption and plasma-catalytic oxidation of the adsorbed C2H4 was a mixture of C2H4 (20–100 ppm), CO2 (10000 ppm), H2O (100% humidity) and air. A chamber of 1×1×1 m3 containing the above gas mixture was used to examine the performance of the plasma-catalytic process. The proposed ethylene removal system could effectively reduce C2H4 at near room temperature to harmless level.

AGFD 141 Linear and non-linear calibration approaches for the rapid quantification of marine oil omega-3 supplements using vibrational spectroscopy Sanjeewa R Karunathilaka1, sanjeewakarunathilaka@yahoo.com, Betsy Jean Yakes1, Sung Hwan Choi1, Lea Brückner1, Zachary Ellsworth2, Magdi M. Mossoba1 (1) U.S FDA, College Park, Maryland (2) Univ. of Maryland, Joint Inst. for Food Safety and Applied Nutrition, College Park The increased demand for marine oil dietary supplements requires rapid and accurate screening to verify the accuracy of label declarations. Simple and rapid procedures based on spectra from a portable Fourier-transform infrared (FTIR) device and a benchtop FT-near infrared spectrometer were evaluated for predicting the fatty acid (FA) concentrations in a representative set of marine oil products (n=95). Additionally, two chemometric calibration approaches for each spectrometer were tested. Separate calibration models using partial least squares regression (PLS-R) and support vector regression (SV-R) were developed to correlate the FA concentrations of the marine oils with spectroscopic responses. The developed models were successfully validated by cross-validation, testing an independent sample set, and comparing to a commercially available fish oil standard reference material (SRM). Both PLS-R and SV-R model predictions showed good linear correlations with a reference gas chromatographic method (R2 > 0.91) and excellent predictive qualities for eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). When compared, SV-R outperformed PLS-R as shown in improved accuracies as well as prediction qualities. For the six FA/FA class models, the prediction errors for the SV-R models developed for the FTIR spectral data were decreased by as much as 20-58% compared to the corresponding PLS-R models. Similarly, the prediction performance of FT-NIR models were also improved (i.e. RMSEP values were decreased by 25-58%). Further, the SV-R models yielded better agreement with the NIST certified/reference values for the prediction of EPA and DHA concentrations in three SRM samples. This higher performance of SV-R can be attributed to its ability to better quantify the non-linear relationships in marine oil samples. This study confirmed that the simple, fast, and nondestructive quantitative procedures based on PLS-R and SV-R coupled with ATR-FTIR and FT-NIR spectroscopies can be successfully applied for the rapid screening of marine oil products to verify the accuracy of label declarations.

AGFD 142 Efficient Eng. of T4 bacteriophage via CRISPR-Cas9 Michelle M. Duong1, mmd277@cornell.edu, Sam R. Nugen2. (1) Food Sci. & Tech., Cornell Univ., Ithaca, New York (2) Food Sci., Cornell Univ., Ithaca, New York Food and waterborne pathogens are the leading causes of illnesses worldwide. However, the current protocols for pathogen detection are expensive and time consuming. Bacteriophages (phages) are viruses that selectively infect bacterial species, resulting in lysis and self-propagation in a targeted and efficient manner. Therefore, using phages as a new bacterial detection platform reduces cost and time and improves detection specificity. The T4 phage has a broad host range for detecting E. coli making it an ideal candidate to engineer for use as a biorecognition element. However, the T4 phage genome is complex and has compounded modifications such as cysteine hydroxymethylhydation and glucosylation; thus classical recombineering approaches are ineffective or inefficient to allow insertion of reporter probe or modification of host range. Here, we applied CRISPR-Cas9 to mediate genome Eng. of the T4 phage. In this study, we assembled a guide RNA (gRNA) library against targeted genes in the T4 phage genome to mediate infectivity and detection of bacterias. We cloned the respective gRNAs into the pCRISPR plasmid and determined the efficiency of palting (EOP) for each respective gRNA using the dual plasmid system; pCRISPR and pCAS9. Thereby using the most effective gRNA within the library, we co-delivered the CRISPR-Cas9 plasmids and the donor plasmid containing a luciferase gene and performed standard plaque assay using T4. Our results indicate that CRISPR-Cas9 is effective at splicing the T4 phage genome and demonstrated up to a 5-log reduction of phage infectivity. Preliminary data indicates that the CRISPR-Cas9 system facilitates recombineering at an impressive rate of >90%. Effective recombineering has allow us to make efficient edits to the T4 phage, broaden the host range capability, and improve the limit of detection of our biosensor against bacteria.

AGFD 143 Protein oxidation in food: Focus on individual structures Peter Richter, Michael Hellwig, Michael.Hellwig@chemie.tu-dresden.de, Technische Universität Dresden, Germany During food processing and storage, food proteins are subject to oxidative degradation reactions. In particular, essential amino acids such as methionine and tryptophan are oxidized. Methionine oxidation is associated with the light-struck off-flavor of milk. Protein oxidation in food is sometimes assessed by measuring “protein carbonylation” through reaction with 2,4-dinitrophenylhydrazine (DNPH), however, this method cannot give a reliable picture on protein oxidation in food, because structures such as methionine sulfoxide and oxidation products of tyrosine and tryptophan do not react. Hence, methionine oxidation was analysed in milk products by HILIC-HPLC-MS/MS after enzymatic hydrolysis in the absence of oxygen. An isotopically modified methionine probe was added to record artificial methionine oxidation during hydrolysis. In UHT and evaporated milks, up to 8% of methionine was oxidized, and up to 33% in milk drinks containing cocoa or coffee. The concentrations of methionine sulfoxide are far above the concentrations of protein carbonyls measured in milk products by the DNPH method. When heated at 80 °C for 6 h in a model system, methionine is strongly oxidized to the sulfoxide in the presence of catechin (13%), caffeic acid (20%), or gallic acid (70%), but not in the absence of these additives. This may explain the pronounced methionine oxidation in milk drinks containing cocoa and coffee. A multi-method using Hypercarb-HPLC-MS/MS was developed to explore further prominent protein oxidation products in different foodstuffs after acid hydrolysis. 3,4-Dihydroxyphenylalanine (DOPA) was detected in bakery and milk products, 3-nitrotrosine and aminoadipic acid in meat products, and dityrosine in milk-powder based sweets. Methionine oxidation is an important chemical
understanding the conditions at which flavor compounds will each vary with functional groups of the flavor compounds, and their interactions of different flavor molecules with intact proteins under weight (Protein + flavor compound/s). This study also investigates approach of monitoring the extent and rate of

- acetaldehyde, eugenol, E,E,Z-decenal, 3-(methylthio)-propan-1-ol, 2-acytetyl-1-pyrroline, 2-acetyl-2-thiazole were identified as the predominant off-notes contributors to the cooked off odor in thermally processed muskmelon juice. The reconstitution and omission experiment further proved that DMS, methional, dimethyl oxide, phenylacetaldehyde, citronellol, and linalool were the most important aroma-active compounds in fresh litchi juice. The heating process affected many odor-active compounds in the litchi juice. The heating process dramatically decreased geranial, cis-rose oxide, phenylacetaldehyde, citronellol, and linalool, while significantly increased dimethyl sulfide (DMS), methional, dimethyl disulfide (DMDS), dimethyl trisulfide (DMTS), 3-methylbutanal and 2,4-dithiapentane, which could be responsible for the cooked cabbage/potato, garlic/onion and sulfurous off-flavor perceived in processed juice. The reconstitution and omission experiment further proved that DMS, methional, DMTS and DMDS were the main contributors to the cooked off-flavor in heated litchi juice.

AGFD 148 Differences in lipid content of young and aged Pinot Noir wines and their impacts on wine mouthfeel perception Quynh Phan, quynh.phan@oregonstate.edu, Elizabeth Tomasino. Oregon State Univ., Corvallis Changes in chemical structures and interactions between wine chemical components have been observed during the wine aging process. These chemical transformations contribute to differences in wine sensory. In many cases wine aging results in an improvement of mouthfeel qualities, these chemical changes due to aging are not well understood. While the content of lipids in wine is low compared to other foods, it is unknown if they have a direct impact to mouthfeel perception or if they interact with covalently bond with a protein. The end goal is to help the food industry develop flavor systems to flavor products that perform better. Results have confirmed that irreversible covalent bonds are formed between flavor compounds and protein. Single variant Beta-lactoglobulin (BLG) was chosen as the model protein and five different aldehydes as flavoring compounds (F). The protein samples (1% in water) were maintained at pH 6.7, held at 25°C with added flavor (12 ul) and sampled at 6 different reaction times. The results have shown new spectra that indicated the formation of Schiff bases and Michael addition products. The new masses observed after flavor reaction correspond to the different number of flavor molecules that have reacted with the proteins: BLG + one F, BLG + two F and so on. The reaction rate increased over time leading to the disappearance of the pure protein peak with only protein:flavor adduct peaks being present.

AGFD 147  WITHDRAWN

AGFD 146 Effect of thermal sterilization on the aroma profile of Lychee (Litchi chinensis Sonn.) juice  Kejing An1,2, ankejing2008@163.com, Yujuan Xu1, Michael C. Qian2. (1) Sericulture and Agri-Food Research Inst. Guangdong Academy of Agricultural Sciences, Guangzhou, China (2) Oregon State Univ., Corvallis Litchi fruit and fresh litchi juice are highly appreciated in south part of China and many countries in the world. China is the largest production country of litchi fruit, and more than half of all of litchi production in China are in Guangdong province. Among various litchi cultivars, Feizhixiao, is the most prized for its wonderful flavor and aroma, and it is also the most popular fruits to be processed to other value-added products such as litchi juice or litchi wine. However, the delicate litchi aroma and flavor are altered during the thermal sterilization process used in litchi juice production. The thermal process of litchi juice causes the decrease of pleasant litchi aroma and gives rise to the distinct cooked-vegetable off-flavor, which impeded the commercialization of litchi juice and the growth of litchi industry. It is important to understand the flavor change of litchi juice during thermal processing. In this study, the aroma profiles of fresh and heat-treated litchi juices were investigated using aroma extract dilution analysis (AEDA), followed by isotope dilution based quantitation, and odor activity value (OAV) comparison. Both the AEDA and OAV results suggested that cis-rose oxide, geraniol, phenylacetaldehyde, citronellol and linalool were the most important aroma-active compounds in fresh litchi juice. The heating process affected many odor-active compounds in the litchi juice. The heating process dramatically decreased geranial, cis-rose oxide, phenylacetaldehyde, citronellol, and linalool, while significantly increased dimethyl sulfide (DMS), methional, dimethyl disulfide (DMDS), dimethyl trisulfide (DMTS), 3-methylbutanal and 2,4-dithiapentane, which could be responsible for the cooked cabbage/potato, garlic/onion and sulfurous off-flavor perceived in processed juice. The reconstitution and omission experiment further proved that DMS, methional, DMTS and DMDS were the main contributors to the cooked off-flavor in heated litchi juice.

AGFD 145 Plant and dairy protein and their covalent interactions with flavor Vaidyathanathan Anantharamkrishnan, amant040@umn.edu, Gary A. Reineccius. Food Sci. and Nutrition, Univ. of Minnesota, St Paul Flavoring high protein products is problematic initially and then over the shelf life of a product due to interactions that occur between the two food components. The interactions are multifaceted. There has been a lot of research over the past four decades studying the “temporary” interactions between flavor compounds and various proteins but very little work has been done on a more permanent interaction: covalent bonding. This research is focused on studying the various covalent bonds that may be formed between the side chains and terminal amino acids of food proteins (plant and dairy based), and reactive aroma compounds which will alter the flavor profile in an irreversible manner. The study takes the approach of monitoring the extent and rate of flavor reactions with intact proteins using UPLC-QTOF MS for increase in molecular weight (Protein + flavor compound/s). This study also investigates interactions of different flavor molecules with intact proteins under different conditions as the type and rate of interaction are expected to vary with functional groups of the flavor compounds, and their concentrations as well as amino acid composition of the protein, pH, water activity, and storage temperature. A proteomics approach is taken to find the post translational modification site on the protein by each flavor molecule. The results of this study will help in understanding the conditions at which flavor compounds will

AGFD 144 Identification of predominant contributors to off-odors in thermally processed muskmelon juice using multidimensional gas chromatography techniques and comparative aroma extract dilution analysis Xueli Pang1, pangxuelei@caas.cn, Keith R. Cadwallader2, Fanyu Kong1. (1) Tobacco Research Inst. of Chinese Academy of Agricultural Sciences, Qingdao, Shandong, China (2) Dept. Food Sci. Human Nutr., Univ. of Illinois, Urbana To identify the predominant odorants responsible for the off-notes in thermally processed muskmelon juice (MJ), odor profiles and odor-active compounds in fresh and heated MJ were comparatively studied by combined use of sensory evaluation, GC-olfactometry (GC-O) analysis, and comprehensive two-dimensional gas chromatography with quadrupole-time-of-flight mass spectrometry (GC×GC-QTOF-MS). “Fermented” and “sulfurous” were revealed as the two major offensive odor notes of heat-treated MJ in quantitative descriptive sensory analysis, and fundamental heat-induced alterations in potent odorant compositions of MJ was demonstrated by GC×GC-QTOF-MS. Comparative static headspace dilution analysis (SHDA) and aroma extract dilution analysis (AEDA) showed that the odor profile of heated MJ is mainly characterized by newly formed compounds possessing extremely low odor threshold and unpleasant smell, including volatile sulfur compounds with rotten cabbage-like odors, Strecker aldehydes having fermented, dark chocolate-like notes, and heterocyclics exhibiting roasted, cooked-rice like smells. Specifically, dimethyl sulfide, methional, furanethiol, methanethiol, acetaldehyde, eugenol, E,E,Z-2,4,6-nonatrienal, trans-4,5-epoxy-(E)-2-decenal, 3-(methylthio)-propan-1-ol, 2-acytetyl-1-pyrroline, 2-acetyl-2-thiazole were identified as the predominant off-notes contributors due to they showed higher FD factors. The coupling use of GC-O and GC×GC-QTOF-MS is a powerful tool for location and reliable identification of trace and predominant flavor compounds in complex food matrix. Results of this study will provide useful information for further exploration of the pathway(s) involved in the formation of the off-note as well as the development of potential solutions to minimize or prevent the heat-induced off-note generation.
other compounds, such as phenolics, and alter perception due to interactions. Total lipids, fatty acid composition, and concentrations of different lipid classes were analyzed to evaluate the relationship between lipid content and wine age. Pinot noir wines made in different vintages were selected for the chemical analyses. Total lipid was isolated using liquid-liquid extraction method with chloroform/methanol/water as the solvent system. The different lipids extracted from Pinot noir wines were separated and quantified using high-pressure liquid chromatography. Results of total lipid and concentration of lipid classes were then analyzed by principal component analysis and discriminant analysis to determine variables that contribute to the uniqueness of the aged wines. The differences in total lipid content, fatty acid composition, and concentration of lipid classes in Pinot noir wines are potential factors contributing to the evaluation of wine style and wine quality.

AGFD 149 Identifying hyperstable proteins in legumes: Implications for food allergy and intolerance, and GMOs Wilfredo Colon, colorw@rpi.edu, Jane Thibeault, Ke Xia. Dept of Chemistry, Chemical Biology; Center for BioTech. and Interdisciplinary Studies, Rensselaer Polytechnic Inst., Troy, New York The structure of most proteins is marginally stable, and this allows the degradation of damaged proteins, the regulation of protein function, and their breakdown during the digestion process. However, some proteins are hyperstable and resistant to degradation and denaturing detergents like sodium dodecyl sulfate. The stability of such proteins is under kinetic control, and are often referred to as kinetically stable proteins (KSPs). The resilience of KSPs may have arisen in nature as a mechanism for organismal adaptation and survival against harsh conditions. Of nutritional and agricultural relevance, legumes are well known for possessing degradation-resistant proteins – many of them biopesticides - that may lead to food allergy or intolerance. This seminar will describe the study of KSPs in legumes using electrophoresis methods developed to quantify the kinetic stability of proteins or identify KSPs at a proteomics level. The results show a correlation between KSPs in legumes and their digestibility that has implications for food allergy and intolerance, and perhaps for genetically modified organisms containing hyperstable proteins.

AGFD 150 Analysis of fungicides by liquid chromatography - mass spectrometry Renata Raina-Fulton, renata.raina@uregina.ca, Aisha Mohamad, Asal Behdarvandan. Univ of Regina Dept Chemistry, Regina, Saskatchewan, Canada There is growing interest in developing methods for the analysis of fungicides in environment sample matrices. Strobilurin fungicides and conazole fungicides are two important classes of fungicides with different modes of action that can be found in agricultural formulations containing more than one active fungicide ingredient. Analysis of conazole fungicides is more challenging due to isobaric interferences such that chromatographic resolution must be obtained for those conazole fungicides with the same selected reaction monitoring transitions. Similarly, simultaneous analysis of fungicides with other active ingredients is desirable. Our liquid chromatography-electrospray positive ion-tandem mass spectrometry method has been expanded to include new conazole and strobilurin fungicides along with other active ingredients found in agricultural formulations that are less frequently analyzed due to their difficulty. The feasibility of simultaneous liquid chromatography-electrospray positive ion-tandem mass spectrometry analysis of a large range of fungicides and other selective ingredients will be demonstrated. Further evaluation of matrix effects in mass spectrometric detection of fungicides in air samples and bee products will be discussed. Pressurized solvent extraction with and without additional clean-up was used to obtain extracts for LC-ESI+-MS/MS analysis.

AGFD 151 Chemical composition of a red sorghum variety (Ji Lian No.1) and its antioxidant and anti-inflammatory properties Yaqiong Zhang2, yqzhang2006@sjtu.edu.cn, Ming Li2, Hang Gao2, Bo Wang2, Tongcheng Xu3, Boyan Gao2, Liangli Yu1. (1) Nutrition and Food Sci., Univ. of Maryland, College Park, College Park (2) Inst. of Food and Nutraceutical Science, School of Agriculture and Biology, Shanghai Jiao Tong Univ., China (3) Shandong Academy of Agricultural Science, Inst. of Agro-Food Sci. & Tech., Jinan, China A red sorghum variety (Ji Lian No.1) was investigated for its lipid profiles, phenolic components, and anti-inflammatory properties. A total of 17 TAGs were identified in the red sorghum oil. Limonel and oleic acids were the primary fatty acids, contributing more than 80% of the total fatty acids. Moreover, acetone-water (60:40, v/v) extract of the red sorghum exhibited the greatest total phenolic content of 2.77 mg GAE/g and total flavonoid content of 5.44 mg RE/g. The extract suppressed LPS stimulated IL-1β, IL-6 and COX-2 mRNA expressions in a dose-dependent manner. Ferulic, p-coumaric, isoferulic and p-hydroxybenzoic acids were found in the red sorghum, with ferulic acid as the predominant phenolic acid and mostly in an insoluble bound form.

AGFD 152 Establishment of a stable human small intestinal and colonic microbiota in an in vitro cultivar: Form vs. function and response to oxygen Jenni Firrman1, jenni.firrman@ars.usda.gov, Peggy Tomaasula1, Lin Liu2. (1) USDA, Wyndmoor, Pennsylvania (2) USDA ARS ERRC, Wyndmoor, Pennsylvania Despite a large amount of information regarding the composition of the human fecal microbiota, there is very limited information about the communities that inhabit the small intestine. Due to the difficulties in accessing the human small intestine to perform longitudinal studies, we sought to develop an in vitro model of the human small intestinal microbiota using a cultivar system to compare its steady state composition and metabolite production with an established fecal community. The research carried out in both U Penn and our laboratory revealed the possibility to establish a stable small intestinal bacterial community in vitro using a cultivar that is similar to composition of an ileostomy microbiota, but maximally distinct from a fecal community established using the same culture conditions. The functionality of the small intestinal community demonstrates the predicted metabolic functionality in vivo, specifically regarding bile acid and SCFA production. The use of in vitro cultivar technologies may be helpful in creating models of the human small intestinal microbiota to examine the effect of diet and other perturbations on its composition and function.

AGFD 153 Chemical compositions and antioxidant properties of cold-pressed edible seed flours Zhangyi Song1, song16@terpmail.umd.edu, Li Yanfang2, Boyan Gao3, Liangli Yu1. (1) Nutrition and Food Sci., Univ. of Maryland, College Park, College Park (2) School of Agriculture and Biology, Shanghai Jiaotong Univ., China (3) Univ. of Maryland, College Park The chemical compositions of blackberry, broccoli, carrot, and milk thistle seed flours, the by-products of seed oil production, were investigated. All four samples were extracted with 100 % ethanol using a Soxhlet extractor. A total of 11, 8, 10 and 13 chemical compounds were detected in the blackberry, broccoli, carrot and milk thistle seed flours, the by-products of seed oil production, were investigated. All four samples were extracted with 100 % ethanol using a Soxhlet extractor. A total of 11, 8, 10 and 13 chemical compounds were detected in the blackberry, broccoli, carrot and milk thistle seed flours, respectively. Ellagic acid, disinapoylgentiobiose, kaempferol-3-O-rutinoside isomers and silychristin isomer isomers are the primary component(s) in the blackberry, broccoli, carrot and milk thistle flour extracts, respectively.

AGFD 154 Sensory properties and consumer acceptance of mushroom-egg white blends Xiaofen Du, xdu@tsu.edu, Joanna Sissoms, Adriana Muniz, Marcus Shanks. Nutrition and Food Sci., Texas Woman's Univ., Denton Mushroom has been consumed for
thousands of years. Mushroom has high nutrition values, low energy density, and distinctive sensory qualities, making it an ideal dietary source. Egg white is a widely consumed animal protein with well-balanced amino acid composition. Egg white is also widely used as a binder for mushroom based products, contributing binding and bite during the eating. To date, there is no research literature available on the sensory and consumer aspects of Mushroom-egg products. The objective of this study was to develop Mushroom-egg blend and investigate their sensory properties and consumer acceptance. Sets of mushroom-egg blends were characterized as possessing a blended note of mushroom and egg white. Increasing mushroom ratio in the blends shifted sensory attributes to the mushroom note predominantly. The cooking methods have a significantly higher impact on the flavor and texture of the final blends compared to mushroom varieties (p<0.05). The highest acceptance level of white button and cremini mushroom blends was 30% mushroom in steam, while it was 20% mushroom for both oven roasted methods. These results will increase knowledge of sensory properties of mushroom-egg white blends, consequently increasing the recognition and consumption of mushrooms.

**AGFD 155** Novel metal–organic frameworks for encapsulating curcumin to achieve controlled release Qin Wang, Peihua Ma, ma.peihua@outlook.com. Nutrition and Food Sci., Univ. of Maryland at College Park, College Park Application of a series of zirconium-based metal-organic frameworks (MOFs), have drawn considerable research attention because outstanding stability and significant progress have been achieved in recent years. Meanwhile, with the computational simulation method progress, especially the emergence of machine learning tools represented by Deep learning, it provides the possibility to conduct interactions between organic molecular and metal ion quickly and simply. UIO-66 was synthesized with zirconium (IV) chloride and benzene-1,4-dicarboxylic acid by solvothermal synthesis method. Crystal structure, morphology, physicochemical properties and in vitro release property were used to demonstrate that low toxicity stable MOFs have potential application in a delivery system. We anticipate that this approach will be useful to further explore the relevant mechanism of metal-organic interaction and fabricate more porous delivery systems for bioactives.

**AGFD 156** Effect of fragmentation degree on sensory and texture attributes of cooked rice Zhiyuan Wang2,1, wangzhiyuan@bjbnu.edu.cn, Huimin Su2, Xue Bi2, Min Zhang2,1. (1) Beijing Eng. and Tech. Research Center of Food Additives, Beijing Tech. & Business Univ., China (2) Beijing Advanced Innovation Center for Food Nutrition and Human Health, Beijing Tech. & Business Univ., China Rice is considered to be the most important food crop all over the world, especially in Asian area. However, broken rice with different fragmentations are formed inevitably during rice processing. Although they have varying utilization in agricultural field as by-products, relevant experimental investigation on the sensory quality of broken rice is very limited. In the present study, solid phase micro-extraction coupled with gas chromatography-mass spectrometry (SPME-GCMS) was adopted to analyze the volatile flavor components in broken rice compared with head rice. Furthermore, analysis of texture and content of water-soluble protein as well as sensory evaluation were performed to compare their differences. The results showed that 44 volatile compounds were identified from three broken rice samples, mainly including alcohols, aldehydes, ketones and esters. The relative concentration of volatile components in broken rice of three fragmentations (25%, 50%, 75%) increased by different degrees, among which 50% fragmentation sample contained the highest concentration of rice typical aroma. The hardness of cooked rice with 25%, 50% and 75% fragmentation decreased 7.99%, 14.55% and 23.98%, while the stickiness increased 5.88%, 23.53% and 32.35%, respectively. These results suggested that suitable utilization of broken rice with 50% fragmentation had a potential to enhance desirable rice flavor and possibly increase the added-value of rice milling by-product.

**AGFD 157** Gypenosides prevent obesity and insulin resistance in C57BL/6J mice by improving thermogenesis in association with alleviating gut dysbiosis Jie Liu3,2, liu_jie@bjbnu.edu.cn, Li Yanfang2, Puyu Yang2, Liangli Yu1. (1) Nutrition and Food Sci., Univ. of Maryland, College Park, College Park (2) School of Agriculture and Biology, Shanghai Jiaotong Univ., China (3) Beijing Tech. & Business Univ., China This study investigated the effect of dietary gypenosides on obesity and insulin resistance in male C57BL/6J mice induced by feeding a high-fat diet (HFD). Oral gypenosides administration prevented or reversed HFD-induced obesity and insulin resistance in C57BL/6J mice, without affecting their food intake. Treatment with 300 mg/kg BW/d gypenosides could significantly reduce body weight gain, total plasma cholesterol and homeostasis model assessment-estimated insulin resistance (HOMA-IR) index compared with the control. Moreover, gypenosides consumption alleviated insulin resistance possibly by promoting energy expenditure which upregulating thermogenic genes in the brown and inguinal white adipocyte tissues. In addition, gypenosides administration alleviated gut dysbiosis which accompanied by decreased the ratio of Firmicutes to Bacteroidetes and increased Akkermansia muciniphila abundance in the gut microbiota. The results suggest the health benefits of gypenosides intake in obese mice.

**AGFD 158** Triacylglycerols composition analysis of olive oils by ultra-performance convergence chromatography combined with mass spectrometry Yinghua Luo2, luoyinghua2008@gmail.com, Boyan Gao3, Liangli Yu1. (1) Nutrition and Food Sci., Univ. of Maryland, College Park (2) Dept. of Food Sci. & Tech., China Agricultural Univ., Beijing, China (3) Shanghai Jiao Tong Univ., China Triacylglycerols (TAGs) compositions of ten commercial olive oil samples were analyzed using an ultrasensitive convergence chromatography (UPCC) combined with a QTof MS. A total of 23 TAGs were characterized based on their QTof MS data, and 17 of those were not reported in olive oils. The results from this study are important for further understanding the nutritional value and stability of olive or other edible oils.

**AGFD 159** Analysis of triacylglycerol, sterol, and tocopherol compositions of oils from 8 different berry seeds by ultra-performance convergence chromatography-quadrupole time-of-flight mass spectrometry Boyan Gao2, gaoboyan@stu.edu.cn, Yinghua Luo4, Fanghao Yuan2, Yaqiong Zhang3, Liangli Yu1. (1) Nutrition and Food Sci., Univ. of Maryland, College Park (2) Inst. of Food and Nutraceutical Science, Shanghai Jiao Tong Univ., Shanghai, China (3) Inst. of Food and Nutraceutical Science, School of Agriculture and Biology, Shanghai Jiao Tong Univ., China (4) China Agricultural Univ., Beijing The triacylglycerol (TAG) compositions of oils extracted from the seeds of 8 different daily consumed berries,
including white grape, red grape, cranberry, pomegranate, red raspberry, black raspberry, blackberry and blueberry seeds were
determined using ultra-performance convergence chromatography-
quadropole time-of-flight mass spectrometry (UPC2-QTOF MS). A
total of 25, 28, 25, 32, 35, 35, 31 and 33 TAGs were detected and
tentatively identified these 8 berry seed oils. The chemical
structures of TAGs in each oil sample were determined based on their
accurate molecular weight in MS1 and fragment ion profiles in MS2.
Besides, the fatty acid compositions of 8 berries seed oils were also
directly determined by GC-MS, and the results represented similar
trends while compared with the fatty acid compositions calculated
from TAGs compositions. And the sterols, tocopherols compositions
for each berry seed oil were also investigated. All these results
indicated that the combination of UPC2 and QTOF MS could
effectively identify and semi-quantify the TAGs compositions of
berry seed oils, even including their sn positions. Understanding the
TAGs compositions of these berry seed oils could improve the
utilization of these potential high nutritional value oils both in
academic research and in daily consumption.

AGFD 160 Gating infrared radiation in a textile  YuHuang Wang,
yhw@umd.edu. Dept Chem BioChem, Univ. of Maryland, College
Park  Our human body absorbs and loses heat largely through
infrared radiation that peaks at around 10 μm. However, despite
thousands of years’ development, none of our clothing systems are
capable of controlling this major heat exchange channel. The infrared
properties of both clothing and our own skin are fixed at a nearly
constant level, regardless of whether one feels hot or cold. In
contrast, many species in nature have evolved elegant strategies to
manipulate light for the purpose of cooling and surviving harsh
environments. For instance, Saharan silver ants feature triangular
shaped hairs that can reflect near-infrared rays according to the
position of the sun to keep themselves cool, while the geckos of
Madagascar have photonic skins with changeable colors that can
blend in the environment to hide from predators. In this talk, I will
discuss a clothing textile that is capable of dynamically gating
infrared radiation through the fabric in response to personal thermal
discomfort. We show that by simply coating triacetate-cellulose
fibers with a thin layer of carbon nanotubes we can modulate the
infrared radiation through the fabric by as much as 35% as a function
of the relative humidity of skin. Both opportunities and challenges
ahead will also be discussed if time permits.

AGFD 161 Value-added uses for raw cotton and cotton by-
products  Alvin F. Bopp1, albopp@gmail.com, Vince Edwards2, Brian D. Condon2.  (1) Natural Sciences, Southern Univ.
New Orleans, Louisiana (2) USDA-SRRC, New Orleans, Louisiana
Cotton, which has long been cultivated and processed, finds uses in
many and varied applications. Typical processing includes chemical
scouring and bleaching, which removes native waxes from the fibers
and imparts the classic white finish. Finding uses for raw cotton
fibers (termed ‘griege cotton’), which is unscoured and unbleached,
as well as cotton-byproducts is of interest for value-added
applications and economic, processing and environmental reasons.
Absorbent nonwoven fabrics have been identified as one where
griege cotton can be incorporated into a variety of products. To
evaluate the potential of cotton-based absorbent made from griege
cotton and cotton-gin by-products, candidate materials were prepared
from either one-hundred percent griege cotton or blends of griege
cotton with cotton by-products and/or polypropylene and woven into
hydroentangled nonwoven fabrics. These materials were then
analyzed for key surface and physical properties: electrokinetic
parameters (zeta potential), water absorbency and contact angles. In
an additional application, griege-cotton containing fabrics were used
in materials for enhanced blood-clotting properties. These materials
were evaluated by thromboelastography (to measure the rate of fibrin
and clot formation) and compared to commercial wound dressings
containing bleached cotton for enhancing the rate of coagulation.
These findings will be presented.

AGFD 162 Novel technologies development for the value added
cotton fabrics  SeChin Chang, sechin.chang@ars.usda.gov, Brian D.
Condon, Jade Smith. USDA-ARS, New Orleans, Louisiana
Microwave reactor is a considered in green chemistry as a substitute
for organic solvents in chemical reactions. In this presentation,
innovative approaches for preparation of flame retardant fabrics were
obtained by microwave with minimum amount of co-solvent. Our
attempts at flame retardant cotton fabrics treated with low cost
inorganic formulations, such as urea and diammonium phosphate, or
a novel environmentally friendly phosphorus-nitrogen containing
small molecules were done successfully. The evidence of flame
retardant chemical penetrations or surface modification of cotton
fabrics was confirmed by scanning electron microscope (SEM), and
the treated cotton fabrics were evaluated by flammability tests, such
as 45°angle (clothing textiles test), vertical flame(clothing textile test)
and limiting oxygen index (LOI). Additional thermal properties of
desired products were discussed using thermogravimetric analysis
(TGA) and microscale combustion calorimeter (MCC).

AGFD 163 Preparation and evaluation of composites comprising
polypropylene and cotton gin trash  Massoud J. Miri1, mnjmsch@rit.edu, Johnathan B. Francis2, Shao M. Demyttenaere1, Najat A.
Alharbi3, Changfeng Ge2, Richard K. Hailstone3, Huai N.
Cheng4.  (1) Chemistry and Materials Science, Rochester Inst. of
Tech., New York (2) Packaging Science, Rochester Inst. of Tech.,
New York (3) Imaging Science, Rochester Inst. of Tech., New York
(4) Commodity Utilization Research, Southern Regional Research
Center, USDA ARS, New Orleans, Louisiana  We have been
interested in using agricultural waste materials for higher value
applications. Cotton gin trash (including cotton burr, stems, leaves,
immature seeds, and dirt) represents such an opportunity. In this work
we prepared and evaluated the composites made from polypropylene
and gin trash and studied their mechanical and chemical properties.
Prior to making the composites, the gin trash was treated by two
methods. In Treatment 1, the gin trash was washed with toluene to
remove any grease on the surface, and in Treatment 2, the gin trash
was washed with toluene and then reacted with maleic anhydride-
modified polypropylene (MAPP). Samples of the modified gin trash
were milled into a powder, blended with polypropylene pellets,
MAPP, and ethylene-vinyl acetate copolymer (EVAc) in different
weight ratios, and extruded into films. Each film was then test for
Young’s modulus, tensile strength, and elongation. In general, the
addition of gin trash to polypropylene reduced tensile strength and
elongation, but enhanced Young’s modulus. The moduli were
particularly higher with gin trash prepared by Treatment 1. The
polypropylene and polymer blends were characterized by contact
angle measurements, TGA, DSC and SEM. These measurements
showed that the polymer blends with the gin trash prepared by
Treatment 1 were more hydrophilic than polypropylene and melted
and degraded at slightly lower temperatures than polypropylene.
However, the changes were more pronounced for the blends with the
gin trash modified by Treatment 2. The advantages of gin trash as a
filler include its low cost, ease in absorbing dyes and pigments,
greater permeability of gas through the film, and greater affinity for
water. Thus, polypropylene-gin trash composites may be useful in
applications where reduced cost and/or additional films properties are
desirable, and reductions in tensile strength and elongation are
tolerable.

AGFD 164 Imaging of cotton fiber maturity using an infrared
focal plane array detector  Michael Santiago,
AGFD 165 Variation in the level of metals on raw, scoured, and bleached varietal cotton samples produced in different locations 

Chanel A. Fortier, chanel.fortier@ars.usda.gov, Christopher D. Delhom, Michael K. Dowd. Cotton and Oat Quality, USDA, New Orleans, Louisiana It has been proposed that the surface metal composition of cotton fiber can affect fabric dyeability. Cotton fabrics are normally scoured and bleached to remove surface contaminants, including metals, prior to being dyed. While the metal content of raw cotton varies significantly, it is not known how variable the metal content of cotton fabrics are after they have been scoured and bleached. To better understand the likelihood that variation of metal levels affects the dying process, cotton fiber samples from different cotton varieties (grown in Lubbock, TX) and of one variety (PHY499) grown in different field locations were analyzed for metal content in the raw state, after scouring, and after bleaching. As expected, there were considerable differences in the levels of different metals in the raw cottons and the levels decreased as the fibers were scoured and then bleached. Potassium was largely removed by the treatments, but significant levels of calcium, magnesium, and phosphorus remained after the treatments. The variation (CV) of the different metals on the raw fiber were between 15 and 60% for the variety (PHY499) grown in different locations and between 15 and 20% for the different varieties grown in Lubbock, TX. In general, the CV of the same samples was greater after scouring and bleaching (40-60%), indicating that the variation in metal content was greater than observed by the raw fibers. Whether this variation is sufficient to affect dyeability of the fibers is being explored.

AGFD 166 Lignin and hemicelluloses isolated from the largest bamboo species: Dendrocalamus sinicus 

Zhengjun Shi1, Chunhua Wu1, Gao Feng Xu1, Jiayan Zhang1, Mengyao Dong2, Chunhua Liu1, Zhanhu Guo3, zguo10@utk.edu. (1) Southwest Forestry Univ., Kunming, China (2) Zhengzhou Univ., China (3) Univ. of Tennessee, Knoxville Dendrocalamus sinicus, which is the largest bamboo species in the world, has broad prospects in the fields of pulp and bioenergy. In this study, the isolated arabinoglucuronoxylans from bamboo could be defined as a xylopyranosyl backbone to which α-L-arabinofuranose and/or 4-O-methyl-glucuronic acid units were attached as single-unit side chains via α-(1→3) and/or α-(1→2) linkages. These abundant natural components isolated from bamboo, which has polyhydroxy structure, can therefore be used as a platform for preparation of more advanced materials by structural modification or polymerization with functional branch, including hydrogel, drug delivery, nutrition carrier, nanoscale systems.

AGFD 167 Formation of coacervated Pickering emulsions: Effect of the interactions between protein and polysaccharide 

Yang Yuan, gzn228@ymail.com, Mengfan Li, Shan He. Dept. of Food Sci. and Chem. Eng., Guangzhou Univ., China This paper investigated the formation of Pickering emulsion stabilized by three types of structure of gliadin–chitosan nanoparticles (GCNPs). The stability, rheological and antioxidant properties of the Pickering emulsion were mainly studied. Three types of GCNPs structure, including primary complexation, soluble complexes, and coacervates were obtained by a facile pH alteration approach to represent three kinds of gliadin–chitosan interaction levels. The obtained GCNPs with diverse size (125.13 ~ 5000.67 nm) and various wettability (θ = 37.88 ~ 96.32°) were then selected to fabricate Pickering emulsion. The droplet size of Pickering emulsions stabilized by soluble complexes and coacervates showed unimodal distribution with high symmetry. The surface loading and microstructure of emulsion confirmed that the coacervates could stabilize more oil (90.24%) via bridging droplets together and producing the percolating network structure against coalescence. The coacervate-stabilized Pickering emulsions were especially stable during the storage period, showing high viscoelasticity and solid-like behavior. Furthermore, the retarding effect of Pickering emulsion by embedding curcumin was confirmed and the coacervates were resistant to lipid oxidation, evidenced by low lipid hydroperoxides (15.22 mmol/kg of oil) and hexanal levels (Peak area 73.9) in the emulsions after thermally-accelerated storage. The findings showed that the stability, rheological and antioxidant properties of GCNPs stabilized Pickering emulsion could be regulated by gliadin–chitosan interactions through only changing pH. This study could be an available reference for the practical applications of Pickering emulsions stabilized using the gliadin–chitosan systems.

AGFD 168 Development of phospholipid-based pterostilbene nanoemulsion system: Preparation, storage stability, and oral bioavailability 

Yuwen Ting1, pywting@ntu.edu.tw, Fu-Min Sun1, Yu-Jou Chou2. (1) Inst. of FoodScience and Tech., National Taiwan Univ., Taipei City (2) National Taiwan Univ., Taipei Pterostilbene, found in a wide variety of food sources, has been documented to have many health-promoting functionalities. However, the oral bioavailability of Pterostilbene is limited due to its poor solubility in aqueous environment. Encapsulation of pterostilbene in the oral delivery system become a popular means to enhance the solubility, stability, bioaccessibility and, thus, its oral bioavailability. In this work, nanoemulsion systems were carefully designed and optimized. To find the optimum formulation, lecitin, MCT oil, and water, were investigated using the pseudoternary phase diagram. Nanoemulsion was formed after passing 5 cycles through a high-pressure homogenizer at 500 psi. The rheological properties and particle size were measured by dynamic light scattering and viscometer. The storage stability of prepared formulations was determined based on
its ability to maintain its particle size and loading concentration, which is analyzed using a dynamic light scattering method and HPLC, respectively. According to the experimental results, the nanoemulsion system composed of 1.5% lecithin (w/w) could produce the optimum nanoemulsion formulation that more than 20% loading of pterostilbene and could remain stable for over 1 month. The antioxidant activity was found significantly improved in chemical and cellular models. The positive effect of prepared nanoemulsion system on the bioavailability was studied and confirmed by in vitro lipolysis and Caco-2 monolayer model. To sum up, the nanoemulsion system could successfully enhance the solubility, stability, and bioavailability of pterostilbene. This work is by far the first few reported successful oral formulation for Pterostilbene and could serve as future reference for further development.

AGFD 169 Industrially scalable complex coacervation process for microencapsulation: Robust protection and effective delivery Yuting Tang, tttyang@ucdavis.edu, Herbert B. Scher, Tina Jeoh. Biological and agricultural Eng., Univ. of California, Davis Microencapsulation by complex coacervation, though highly effective and achievable at the bench-scale, is challenging to scale-up because of the complexity of the process. An industrially scalable microencapsulation process by in situ complex coacervation during spray drying (‘CoCo process’) is developed. This novel process forms dry complex coacervate microcapsules in one step using a low-cost spray drying approach. Results showed that insoluble complex coacervation microcapsules were formed without additional cross-linking by this process and they were within optimal size micrometer size ranges. The complex coacervated matrix exhibited excellent barrier property to protect volatile cargo (e.g. d-limonene) against losses during spray drying and increase the stability of the cargo during storage. As the formation of complex coacervates is based on electrostatic interaction between polymers, the release of the cargo is pH sensitive. Overall, the matrix microcapsules formed by this novel industrially scalable process have the potential to stabilize bioactive components and control the release of the bioactive components for various applications.

AGFD 170 Development of GI-stable lipid–polymer hybrid nanoparticles for potential oral delivery of astaxanthin Yangchao Luo, luo142@gmail.com, Taoran Wang. Nutritional Sciences, Univ. of Connecticut, Storrs Solid lipid–polymer hybrid nanoparticles (SLPN) are nanocarriers made from a combination of polymers and lipids, integrating the advantages of biocompatible lipid-based nanoparticles and gastrointestinal (GI)-stable polymeric nanoparticles. In this study, a novel preparation strategy was proposed to fabricate GI-stable SLPN through in situ conjugation between oxidized dextran and bovine serum albumin. Effects of molecular weight of dextran (20, 40, 75, and 150 kDa), conjugation temperature (65 °C, 75 °C, and 85 °C), and time (30, 60, 120 min) on the particulate characteristics and stability were comprehensively investigated and optimized. As heating temperature increased from 65 °C to 75 °C, the particle size of SLPN increased from 139 to 180 nm with narrow size distribution, but when the temperature reached 85 °C severe aggregation was observed after 60 min. SLPN prepared with 40 kDa oxidized dextran under 85 °C/30 min heating condition exhibited excellent GI stability with no significant changes in particle size and PDI after incubation in simulated GI fluids. The prepared SLPN were then used to encapsulate astaxanthin, a lipophilic bioactive compound, studied as a model nutrient. After encapsulation in SLPN, antioxidant activity of astaxanthin was dramatically enhanced in aqueous condition and a sustained release was achieved in simulated GI fluids. Therefore, the SLPN developed in this study are a promising oral delivery system for lipophilic compounds, such as astaxanthin.

AGFD 171 Enhanced stability and bioaccessibility of resveratrol infused in grape skin powder Rewa Rai, rewarai.iitd@gmail.com, Nitin Nitin. Univ. of California, Davis This study investigated a novel nature derived encapsulation approach using a winery by-product grape skin powder (GSP) to enhance the loading, stability and bioaccessibility of resveratrol. The rapid vacuum infusion method provides high encapsulation yield (1 mg/g) of trans-resveratrol (trans-Res) in GSP. The encapsulation was validated using fluorescence multiphoton imaging and spectroscopic quantification of resveratrol in GSP. The photostability of non-encapsulated and encapsulated trans-Res in GSP under UVA light were evaluated. Naturally present UV-shielding pigments in GSP completely prevented the photodegradation of highly light sensitive trans-Res to the cis-isomer. The role of GSP as microcarrier for controlled delivery of trans-Res in gastrointestinal tract were evaluated under the simulated gastric, intestinal (at low and high bile salts), and sequential (gastric followed by intestinal) conditions. The release of trans-Res from GSP was ~45 % during gastric, ~70 % during sequential intestinal at low bile salts and ~90 % during sequential intestinal digestion at high bile salts. Interestingly, even after sequential digestion at extreme condition of intestinal bile salts, 0.1 mg trans-Res/g of GSP which is far more than the encapsulation yield of engineered emulsions would be available to deliver in colon. Furthermore, the release of anthocyanin and non-anthocyanin polyphenols naturally available in GSP as microcarriers were estimated during simulated gastrointestinal digestion. The simultaneous release of these health promoting polyphenols from GSP microcarriers along with the release of infused trans-Res may provide the synergistic health effects. In summary, this research illustrates a novel approach to utilize food by-products to enhance stability and bioaccessibility of bioactive compounds.

AGFD 172 Cellulose-coated emulsions with multilayered structure for microencapsulation Yachin Cohen, yachin6@technion.ac.il, Sofia Naps, Dmitry Rein. Chem. Eng., Technion - Israel Inst. of Tech., Haifa With increasing complexity in the nature of bioactive food additives, interest in multi-compartment encapsulation and arises. Polysaccharides, including cellulose derivatives, have been useful encapsulation materials for many years. However, natural cellulose, the most abundant and renewable organic polymer, has not been utilized for this purpose, mostly due to its recalcitrance towards dissolution and processing. Cellulose can dissolve in some solvents such as ionic liquids, in particular 1-ethyl-3-methylimidazolium acetate, or aqueous sodium hydroxide. Cellulose hydrogel microparticle dispersions are fabricated from such solutions by regeneration with water under strong shear. When a cellulose solution or a microgel dispersion is mixed vigorously with oil and water a stable oil-in-water emulsion is formed, stabilized by the regenerated amorphous cellulose coating on the oil droplets. Imaging by cryo-transmission electron microscopy, indicates a unique multilayered structure of the cellulose coating. This structure was highlighted by using electron radiolysis to enhance contrast between the constituents, as shown by the figure below. This unique structure is quantitatively evaluated by small-angle neutron scattering measurements with contrast variation. The presented model describes a spherical oil core with two concentric shells: an inner shell is a water-imbibed cellulose hydrogel (~3% cellulose) and an outer coating of a dense cellulose layer. This novel structure may be utilized for microencapsulation of different types of food additives.

AGFD 173 Antidiabetic and anti-inflammatory potential of isolated compounds from bitter melon: In vitro and in silico approaches Siddanagouda Shivanagoudral, Wilmer Perera1, Jose Perez1, Giridhar Athrey2, Yuxiang Sun3, Chia Shan Wu3,
Guddadarang K. Jayaprakash1, Bhimu Patil1, b-patil@tamu.edu. (1) Vegetable Fruit Improvement Center, Texas A and M Univ., College Station (2) Dept. of Poultry Science, Texas A&M Univ., College Station (3) Dept. of Nutrition and Food Sci., Texas A&M Univ., College Station. Morromicaria charantia L. (Cucurbitaceae) is commonly known as bitter melon and thrives in tropical areas such as Amazon, East Africa, Asia, South America, and the Caribbean. Indigenous populations have been using bitter melons to treat diabetes and related health conditions. Cucurbitane-type triterpenes and their glycosides from this plant have received the most attention due to their wide range of biological activities. More than 240 cucurbitane triterpenoids have been reported from different bitter melon plants. However, the constituents responsible for the hypoglycemic/anti-hyperglycemic activities have not been determined. Therefore, to understand active constituents responsible for anti-diabetic activity, present research was conducted to isolate potential compounds from bitter melon. Ten compounds were isolated from bitter melon and structures were unambiguously elucidated by spectroscopic studies. Purified compounds displayed potential inhibition of carboylzytic enzymes. Moromicoside G and 2-hydroxy-5-O-β-D-xylopyranosyl benzoic acid exhibited the highest α-amylase and α-glucosidase inhibition respectively. Furthermore, molecular docking studies substantiated in vitro findings in which isolated compounds were able to bind to the active sites of both enzymes. Additionally, the isolated compounds significantly attenuated lipopolysaccharide-induced inflammation, downregulating the expression of pro-inflammatory markers NF-κb, iNOS, IL-6, IL-1β, TNF-α, and Cox-2 in murine macrophage RAW264.7. Moreover, 2-hydroxy-5-O-β-D-xylopyranosyl benzoic acid was isolated for the first time, and significantly suppressed the expression of Cox-2 and IL-6 compared to the LPS-treated group. Our findings suggest that selected compounds purified from bitter melon may have potential to reduce risk from diabetes as functional food ingredients based on their inhibition potential α-amylase and α-glucosidase.

AGFD 174 Phytochemical screening and antioxidant activities of Irvingia gabonensis and its effect on alloxan induced diabetes rats Oluwasayo E. Ogunjimi, ogunwasayoesther@yahoo.com, Mubarak O. Abdulganeey, Ibrahim A. Salaudeen., Chemistry, The Polytechnic, Ibadan, Oyo State, Nigeria. Natural products, especially those derived from plants, have been used to help sustain mankind's health. Glucose is an indispensable fuel for the brain and other tissues, and chronic amounts of circulating glucose causes toxic effects on the structure and function of organs, including pancreatic islets. Therefore, there is need to regulate glucose in the body. This study determines antioxidant activities of Irvingia gabonensis fruit and leaves crude extracts and its effect on alloxan induced diabetes rats. Phytochemical screening and antioxidant capacities of Irvingia gabonensis crude extracts were determined using DPPH and Total antioxidant methods and its effect on diabetes induced alloxan rats were also investigated. Phytochemical screening results showed that Irvingia gabonensis fruits possessed alkaloids, flavonoids, saponins, tannins and glucosides. Irvingia gabonensis leaves revealed highest antioxidant capacity when compared with the fruits. The DPPH scavenging assay of Irvingia gabonensis leaves shows the % scavenging of 97.1, 97.3, 97.6, 98.3, 98.7 and 98.8. The leaves extract was effective on induced diabetes rats when compared with the standard drugs and could be used as alternative naturally occurring antioxidants.

AGFD 175 Wheatscan: Unraveling the causes for wheat sensitivities Darina Pronin, d.pronin.leibniz-izb@tum.de, Katharina Scherf, Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Germany. The prevalence of celiac disease and wheat allergy has increased over the last decades. Certain wheat proteins are held to be responsible for triggering inflammatory disorders in the human body. The consumption of wheat can also cause a reaction in which neither allergic nor autoimmune mechanisms are involved. This entity is called non-celiac gluten sensitivity (NCGS) and is characterized by intestinal and/or extraintestinal symptoms with an estimated prevalence of 1-6%. Since the pathogenesis is poorly recognized and the biomarkers are still unclear the diagnosis is rather difficult. Besides growing attention and improved diagnostic techniques, changes in the protein content and composition over the last 100 years due to breeding might be one reason for the increasing number of patients who suffer from NCGS. Breeding may have unintentionally resulted in higher immunostimulatory potential of modern cultivars (registered after 1950) compared to older cultivars (registered before 1950). The objective of this project is to investigate causes for NCGS in order to improve the diagnosis and treatment. Therefore, the protein content and distribution of 60 German wheat cultivars, which were registered in the period of 1891 to 2010, were investigated by Osborne fractionation and reversed-phase high-performance liquid chromatography (RP-HPLC). The results indicated a decreasing trend over the last 100 years for the crude protein contents. Also a decreasing trend was observed for the albumin/globulin and gliadin contents, while an increasing trend was determined for the glutenin contents. On the basis of the balance between gliadin and glutenin contents no change in the gluten contents was observed. In line with the hypothesis, the results showed that the contents of the fractions as well as crude protein have changed over the past 100 years due to breeding and followed a specific trend although the contents were highly variable over different cultivars. Due to significant changes in the RP-HPLC patterns, a new method of peak integration was performed to allow a comprehensive characterization of individual wheat cultivars and better distinction between those. Consequently, principal component analysis of all data showed a clear cluster formation for modern and old wheat cultivars. Further work will focus on elucidating the immunoreactive potential of the wheat cultivars and how this can be traced back to the identified qualitative changes in protein composition.

AGFD 176 Chemistry of psilacetin: Prodrug of psilocin David R. Manke1, dmanke@umassd.edu, Andrew R. Chadeayne2. (1) Chemistry & Biochemistry, Univ. of Massachusetts Dartmouth, Fairhaven (2) CaaM Tech, LLC, Issaquah, Washington. Psychedelic drugs have earned newfound attention as treatments for some of society's most troubling medical problems - depression, anxiety, addiction and PTSD. The tryptamines found in so-called "magic mushrooms" (e.g. psilocybin, psilocin, etc.) are particularly attractive because they appear to offer immediate and long-lasting benefits without unwanted side-effects. This great promise has led political groups across the US to seek legislative reform for "magic mushrooms". Despite their potential benefits, the physical properties of these molecules have not been adequately studied. In this talk, we will present new developments regarding the purification, characterization, stability and chemical reactivity of psilocybin derivatives, including the first reported crystal structure of psilacetin fumarate, a readily attainable, cost-effective prodrug of psilocin.

AGFD 177 Cytotoxic and antioxidant activity from Andean mashua (Tropaeolum tuberosum R. & P.) extract against prostate (DU-145) and human breast (MCF-7) cancer cell lines Ivan Bestl1, ibestl@usi.edu.pe, Jennifer Arenas1, Juan Manuel Ilegias1, Oscar Reategui Arevalo1, Jesús Arcos2. (1) Universidad Científica del Sur, Lima, Peru (2) Estación Experimental Agraria ILLPA-Puno, Peru. Mashua (Tropaeolum tuberosum R. & P.) is an Andean tuber from Peru with a high economic value as a food and crop with medicinal properties, which grows from 1,500 to 4,200 (m.a.s.l.) and has a great diversity in morphology and color, which varies from cream to dark purple. Within the genotypes of Mashua, the purple-colored Mashua,
which contains a high content of phytochemicals such as anthocyanins and glucosinolates, would have antioxidant, anti-inflammatory and anticancer properties. The objective of the study was to evaluate the in vitro cytotoxic and antioxidant activity of a purple-colored Mashua extract against the prostate (DU-145) and human breast (MCF-7) cancer cell lines. A purple-colored (peel/flesh, purple/purple) genotype of Mashua (T23) from the ILLPA Puno Agricultural Experiment Station, Peru, located at 3,815 m asl, was evaluated. From a lyophilized sample, extraction was performed with Methanol:acetone:water (45/45/10, v/v/v). The content of total phenolic compounds, flavonoids and antioxidant capacity was determined by the Folin-Ciocalteu method, colorimetric method of aluminum chloride and DPPH assay, respectively. Cytotoxic activity was evaluated using the lactate dehydrogenase (LDH) release assay after 12 and 24 hours of exposure with different concentrations of Mashua extract (100, 250 and 500 µg/mL). Statistical analysis of the experimental data was carried out using one-way ANOVA followed by a Tukey test (P<0.05). According to our results, the Mashua extract showed a content of polyphenols, flavonoids and antioxidant capacity of 19.53±0.210 mg AEG/g, 2450±84.507 µg CE/g and 1107.61±74.013 mmol TEAC/g. A greater cytotoxic activity was observed for 24 hours of exposure with different concentrations of Mashua extract (100, 200 and 500 µg/mL) in DU-145 cells (P<0.05, Table 1). After 24 hours of exposure, the Mashua extract (100 µg/mL) showed a significant increase in cytotoxic activity in DU-145 compared to MCF-7 cancer cell line (P<0.05, Table 1). Our results suggest that the Andean Mashua extract has an increased cytotoxic activity against prostate (DU-145) cancer cell line, mediated by its high flavonoid content and antioxidant capacity.

AGFD 178 Amination as a novel metabolic pathway of myricetin in mice
Shuwei Zhang, szhang@ncat.edu, Ronghui Wang, Yantao Zhao, Fahk Tareq, Shengmin Sang. Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis
In this study, we investigated whether amination is a novel metabolic pathway of myricetin, one of the major dietary flavonoids found in fruits and vegetables, and whether the aminated metabolite of myricetin remains bioactive. We found that myricetin with a vic-trihydroxy group on the B ring could chemically react with ammonia via the formation of myricetin quinone to generate the aminated product in vitro. As expected, the amination occurred on position 4’ of the B-ring of myricetin. The structure of this new product was confirmed based on 1D and 2D NMR and LC-MS spectra analysis, and subsequently named as 4’-NH2-myricetin. Using the synthetic 4’-NH2-myricetin as standard, we searched this compound in fecal samples collected from myricetin treated mice using LC-MS and confirmed 4’-NH2-myricetin as the metabolite of myricetin in mice for the first time. Furthermore, two metabolites of myricetin, the mono methylated myricetin and the microbial-derived metabolite 3,4,5-trihydroxyphenylactic acid, were confirmed to be aminated in vivo based on LC-MS data analysis. After administration of different doses of myricetin, the amination of myricetin showed dose-dependent response. A similar trend was observed for the amination of the mono methylated myricetin, but not for the microbial-derived metabolite 3,4,5-trihydroxyphenylactic acid. Interestingly, we observed that the aminated myricetin retained the anti-inflammatory activity of myricetin.

AGFD 179 Changes in the elemental profiles of grapes and wines from the vineyard through processing
Courtney K. Tanabe1, cktanabe@ucdavis.edu, Jenny Nelson2, jenny.nelson@agilent.com, Helene Hopfer3, hxx83@psu.edu, Susan E. Ebeler1, seebeler@ucdavis.edu. (1) Dept of Viticulture Enology, Univ. of California, Davis (2) Agilent Technologies, Inc., Santa Clara, California (3) Food Sci., Pennsylvania State Univ., Univ. Park
Wine is produced all over the world and the quality is dependent on various factors, including elemental content. Metals and minerals are needed to grow healthy vines and grapes and they can influence the efficiency of alcoholic fermentation, chemical stability during storage, and human health. It is believed the element content in a wine is a reflection of the environment where the grapes were grown as well as wine processing, storage, and packaging conditions. Using inductively coupled plasma-mass spectrometry (ICP-MS) we have shown that elemental composition may be used to differentiate grapes grown in different countries and regions within a country. However, when grapes from the same region were processed in different wineries, the elemental profile of the resulting wines was often more dependent on the winery than the vineyard of origin. In subsequent studies we monitored changes in elemental concentrations during wine production. Samples were collected from harvest to bottling from two different harvest years. Wines were produced from Cabernet Sauvignon, Merlot, and Chardonnay grape varieties and 61 elements were measured at each collection timepoint. Rare earth, alkaline earth and alkali metals in particular seemed to be impacted by processing. Measured concentrations of all regulated elements were lower than the maximum limits regulated by the International Organization of Vine and Wine (OIV). By understanding how processing can effect the final elemental content of wine, winemakers will better be equipped to manufacture a more stable and higher quality product.

AGFD 180 Iron and zinc fortification of cheddar cheese
Zey Ustunol, ustunol@anr.msu.edu, Abraham Arce, Ozge Kahraman. Food Sci. and Human Nutrition, Michigan State Univ., East Lansing
Globally, iron, iodine, folate, vitamin A and zinc are the most deficient micronutrients in the diet. Most susceptible populations for micronutrient deficiencies are children and pregnant women. Two of the most widely used approaches to fighting malnutrition, are food fortification and micronutrient supplementation. Currently, food fortification is the most promising and cost-effective strategy to reduce malnutrition on a global scale. Due to its popularity, cheese can be the perfect vehicle for iron and zinc fortification programs. In the U.S., majority of milk is consumed as cheese. In 2017, in the U.S. per capita consumption of cheeses was approximately 39.0 pounds. Milk and cheese are nutrient dense foods. Cheese is often the recommended meat alternative in school lunch programs and in vegetarian diets. However, milk, cheese and other dairy products are naturally low in iron and zinc; One serving (28 g) of Cheddar cheese provides approximately 0.04 mg of iron and 0.87 mg of zinc. Iron and zinc are challenging micronutrients to add to cheese due to their potential to negatively affect cheese composition and organoleptic properties. Iron and zinc can further be challenging nutrients to add to milk and dairy foods due to their potential to displace other divalent cations in the milk systems. The goal of fortification is to increase nutritional content in a food product, without compromising other nutrients, and desirable sensory attributes. This presentation will review our most current research on iron and zinc fortification of Cheddar cheese; provide data and discuss the effect of microencapsulated ferrous sulfate and particle size on Cheddar cheese composition and quality, and sensory attributes. Data on divalent cation balance disturbances when fortifying Cheddar cheese with iron also will be discussed. The presentation will also provide data and discussion on the effect of zinc sulfate on culture growth and activity during cheese making, impact of zinc sulfate on cheese composition, quality and sensory attributes. Data on the impact of zinc sulfate addition on calcium balance in the cheese systems will also be presented and discussed. Selection of the fortificant, particle size, levels used, and the point addition during processing are all important considerations when fortifying dairy foods such as Cheddar cheese with iron and zinc. Iron and zinc fortified Cheddar cheese can be a suitable food source that is high in these nutrients.
AGFD 181 Calcium absorption and metabolism is influenced by age, sex, race, bioactive constituents, and the gut microbiome. Connie M. Weaver, weavercm@purdue.edu. Nutrition Science, Purdue Univ., West Lafayette, Indiana. Calcium absorption and utilization and factors affecting them can be studied with isotopic tracers. Calcium absorption is highest during lifestages of growth and decreases dramatically with age. Calcium absorption is also more efficient in subgroups genetically programme for larger bone mass, i.e., males greater than females and blacks greater than whites. Calcium absorption efficiency is higher in humans, but when calcium intakes are low, bone accretion is reduced. Some bioactive ingredients or food components enhance calcium absorption and inhibit bone loss. Prebiotic fibers serve as substrates that shift the gut microbiome to favor fiber fermenters resulting in enhanced mineral absorption during growth and bone retention in postmenopausal women. Polyphenolic-rich fruit can enhance calcium utilization, but it depends on sex and sex steroid status.

AGFD 182 NCOA4-mediated ferritinophagy: Linking cellular iron storage with systemic iron homeostasis and inflammation. Moon-Suhn Ryu, mryu@umn.edu, Cole A. Guggisberg, Emily F. Bengson, Dept. of Food Sci. and Nutrition, Univ. of Minnesota, Twin Cities. Iron is essential for nearly all living organisms, and serves as a native cofactor for hundreds of mammalian proteins. Conversely, free iron is exo-redox-active and thus can potentially damage cells by producing reactive oxygen species. Hence, cells must coordinate the import, export, and storage of iron based on their physiological iron demand. Recently, NCOA4 was characterized as a selective autophagic cargo receptor for ferritin, mediating the release of stored iron via ferritinophagy. In erythroid progenitors, NCOA4 is highly upregulated by iron deficiency and during hemoglobinization. Yet, how NCOA4 contributes to cellular iron regulation in other tissues remains unclear. Reticuloendothelial macrophages (REM) recycle iron from effete erythrocytes and thereby serve as a primary iron source for red cell production, while neuronal cells represent a population of iron utilization. Employing J774 macrophages and HT-22 hippocampal cells, we studied the roles of NCOA4 in these two distinct cell types integral to whole body iron metabolism. Initially, we identified hypersensitivity of the neuronal cells to excess iron. The acute iron-induced cell death accompanied by biomarker changes reflecting ferroptosis was inhibited by ferrostatin-1. Both neuronal and macrophage cells effectively handled iron restriction until NCOA4 was co-depleted. Cells with insufficient NCOA4 featured higher ferritin levels but lower viability when extracellular iron was deprived. Proteomic profiling of HT-22 cells confirmed functional iron deficiency by NCOA4 depletion. To recapitulate the iron-recycling REM, J774 cells were fed opsonized erythrocytes. Upon erythropagocytosis, macrophages produced temporal changes in ferritin protein abundance, which were NCOA4-dependent. Moreover, hepcidin, the central regulator for systemic iron homeostasis, and lipopolysaccharide caused repression in NCOA4 expression by macrophages. Collectively, we identify NCOA4-mediated ferritinophagy as a survival mechanism for neurons and macrophages to cope with iron deficiency, and its regulation by cues of systemic iron and inflammatory status in macrophages. These suggest that dysregulated ferritinophagy may have pathogenic implications on the development of neurodegeneration and inflammatory diseases, such as anemia of chronic disease.

AGFD 183 Dietary phosphorus in human health: Cause for concern? Kathleen M. Hill Gallant1,2, hillgallant@purdue.edu. (1) Nutrition Science, Purdue Univ., West Lafayette, Indiana (2) Medicine-Nephrology, Indiana Univ. School of Medicine, Indianapolis. Phosphorus is an essential mineral in human health and is required for various body functions that include structural roles in bone mineral, nucleic acids, and cell membranes; acid-base balance; and energy metabolism. Phosphorus is naturally widespread across the food supply and phosphate-containing food additives are widely used in food processing. Thus, excessive dietary intake is far more likely than dietary phosphorus deficiency in the US. In fact, average dietary intakes are estimated as close to twice the RDA for phosphorus in most age groups. This is cause for concern because, despite the essential roles of phosphorus in health, excessive serum phosphorus has been associated with cardiovascular disease, bone disease, and all-cause and cardiovascular mortality, particularly in those with impaired kidney function (about 10% of US adults), but also in the general population. Mechanisms to support these associations have been demonstrated in experimental models. Studies associating dietary phosphorus with such outcomes are sparser but do generally support the associations made for serum phosphorus. But, the effect of dietary phosphorus on serum phosphorus is not well-understood, and factors like dietary phosphorus bioavailability, kidney function, and the timing of blood draws (e.g. fasting versus postprandial) can affect this relationship. Nevertheless, because of the unfavorable relationships among serum phosphorus, cardiovascular disease, and mortality, there is growing interest in potentially limiting the use of phosphate-containing food additives and requiring phosphorus content on food labels. Whether or not these efforts would be of clinical benefit to patients with impaired kidney function, and further whether there would be greater benefit to such efforts to the general population, is an area of debate.

AGFD 184 Manganese-induced neurotoxicity: Lessons from worms to human neonates. Michael Aschner, michael.aschner@einstein.yu.edu, Molecular Pharmacology, Albert Einstein College of Medicine, Bronx, New York. Manganese (Mn), is a trace metal required for normal physiological processes in humans. Mn levels are tightly regulated, as high levels of Mn result in accumulation in the brain and cause a neurological disease known as manganism. Manganism shares many similarities with Parkinson’s disease (PD), both at the physiological level and the cellular level. Exposure to high Mn-containing environments increases the risk of developing manganism. Combining genetics and biochemical assays, we established in the nematode (C. elegans) and other experimental models that dopamine (DA) is responsible for Mn-induced DAergic neurodegeneration, and that this process (1) requires functional DA-reuptake transporter (DAT-1), (2) is associated with oxidative stress and lifespan reduction, (3) and is enhanced by iron deficiency. The presentation will focus on the mechanisms of Mn uptake and efflux into the brain, genetic susceptibility to Mn-induced damage, and molecular mechanisms of neurotoxicity. Additional studies will address the role of parenteral nutrition (PN) as a risk factor for increased Mn brain deposition, and demonstrate that hepatic cholestasis is a risk factor for increased brain Mn deposition in neonates receiving PN.

AGFD 185 Key note address: The ageing of beer and spirits. Charles Bamforth, cbamforth@ucdavis.edu. Dept. of Food Sci. & Tech., UC Davis. There is nothing so certain as change in the world of the flavor of alcoholic beverages. When it comes to spirits it is very much the case that the storage of the product is beneficial in terms of story line (and bottom line). In the case of beer there are a relatively few that achieve enhanced character upon storage, examples being barley wines and products aged in wood. Most beers are never better than when they are first packaged. The chemistry of the storage of these products will be addressed.

AGFD 186 Barrell-aged compounds associated with the brewing process. Brian Schneider1, bmschnei@hotmail.com, Nick O. Flynn2. (1) Texas Tech Health Sciences Center, Amarillo (2) Chemistry/Physics, West Texas A&M Univ., Canyon. This
presentation will cover some of the more common compounds found in barrel aged beers which are associated with the brewing process. Specific compounds which will be discussed are benzaldehyde, g-Nonalactone, Caryophyllene, Humulene, β-Damascenone and 4-ethylphenol. Causes and sources of these compounds will also be presented.

**AGFD 187 Rapid wood aging in beer** Ryan R. Wilson, Rogelio J. Ordonez, Eric G. Theisen, Michael D. Mosher, michael.mosher@unco.edu. Dept Chemistry Biochemistry, Univ. of Northern Colorado, Greeley  The excitement surrounding craft beer has introduced a myriad of styles to the beer drinking world. These include re-introduced styles that were once lost and creation of new styles that push the flavor envelope. In some cases, the products of the brewer’s labor garner premium prices. Wood aged beer falls into this category. However, in order to achieve the full effect of wood aging, brewers typically rack a mature beer to a wooden cask and leave it in the cellar for multiple months. The time is required for the product to fully develop the wood flavor profile that the brewer desires. By deconstructing this process, we have been able to illustrate that a very similar wood flavor profile can be achieved in significantly less time. Herein, we report the effects of wood type, wood particle size, and temperature on the extraction rates of key flavor components as determined by chromatographic analysis. Coupled with sensory analysis, our conclusions suggest alternative ways to wood age beer without the need for cellars full of casked beer.

**AGFD 188 Barrel-aged compounds commonly associated with barrel substrate** James Welbaum, jawelbaum1@buffs.wtamu.edu. Chemistry/Physics, West Texas A&M Univ., Canyon  We will explore those compounds found in barrel aged beers which arise from the barrel substrate itself. These compounds will include vanillin, syringol, guaiacol, 2-heptanol, 5-Methyl Furfural and lactone. The origins of these flavoring compounds in barrels will be included in the presentation.

**AGFD 189 Age-induced haze formation in beer** Benedikt Baechler1, benedikt.baechler@gmx.de, Andreas Dunkel2, Thomas Hofmann1,2. (1) Technical Univ. of Munich, Freising, Germany (2) Leibniz-Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Germany  Haze formation in beer due to aging processes is one of the most determining parameters of shelf life and thus consumer’s acceptance. Therefore, the goal of this research was to identify main haze active beer compounds which are responsible for initiation of haze formation and to explain decisive chemical interactions which are barely understood on a molecular level so far. In these studies, the key mechanisms of age-related haze formation in beer during storage are investigated. High molecular weight just as low molecular weight haze ingredients were identified and quantitated using, among other analytical applications, latest mass spectrometric techniques such as LC-MS/MS(MRM), UHPLC-TOF-MS and nano-LC-MS/MS based proteomic approaches, respectively. Activity-guided fractionation coupled with nephelometric fraction analysis followed by generation of haze model systems and omission experiments revealed and validated the key molecules initiating beer haze formation. The results can be helpful tools in the future in terms of proper raw material selection and thus prevention of undesired haze formation which often comes up with financial and image loss.

**AGFD 190 History and chemistry of tequila** Christopher E. Hobbs, chobbss@shsu.edu. Dept. of Chemistry, Sam Houston State Univ., Huntsville, Texas  Tequila is an aged spirit that comes from blue agave (Agave tequilana). This internationally popular drink is a traditional spirit that originated in Tequila, a small town in the Mexican state of Jalisco. The distinctive flavor profiles of different tequilas are due to the enormous range of interesting compounds that arise from the production and aging process. This talk will provide some insight into, both, the history of tequila as well as the chemistry responsible for its unique flavor.

**AGFD 191 Effect of oak spiral aging on beer IBU, dissolved oxygen, SRM, and ABV** Nick O. Flynn, nflynn@wtamu.edu. Math, Chemistry Physics, West Texas A&M Univ., Canyon  Oak has been used to age beer for many years now. This process has seen a resurgence in recent years due to the increased use of oak spirals and other oak substrates which, in turn, was brought about by the increased demand for whole oak barrels by brewers. This study details the effect of oak spiral aging on commonly measured beer parameters over the course of one month. The parameters studied were beer IBU, Dissolved Oxygen, SRM (color) and ABV (alcohol content). Additionally, a sensory analysis was conducted on beers throughout the process. Results of the sensory analysis will be compared to parameter results.

**AGFD 192 In-line detection of diacetyl throughout fermentation** in brewing beer  Ashley Campanella1, Ashley.Campanella@unco.edu, Michael D. Mosher2. (1) Chemistry and Biochemistry , Univ. of N. Colorado, Greeley (2) Dept Chemistry Biochemistry, Univ. of Northern Colorado, Greeley  Diacetyl (2,3-butanedione), a butter flavored compound made during beer production, is formed by an oxidative decarboxylation reaction. Current analytical methods for detecting diacetyl concentrations are time consuming and expensive; however, measurements of carbon dioxide can be rapid and inexpensive, directly relating back to the concentration of diacetyl. Attenuated total reflectance –Fourier transform infrared spectroscopy (ATR-FTIR) utilizing a flow cell and mid-range infrared energy (4000 cm-1 - 400 cm-1) can perform in-line measurements. Concentrations of dissolved CO2 can be determined based on the peak area or height of the absorption in the 2400-2300 cm-1 range. Detection of diacetyl throughout fermentation will improve efficiency in the brewing process, producing better beer.

**AGFD 193 Impact of water constituents on taste/mouthfeel properties of distilled spirits** Zhuzhu Wang, zhuzhuw2@illinois.edu, Keith R. Cadwallader. Dept. Food Sci. Human Nutr., Univ. of Illinois, Urbana  Ethanol and aldehydes are the main constituents that stimulate the trigeminal burn sensation associated with the consumption of distilled spirits. For some spirits such as whiskey, brandy and rum, years of maturation in oak wood casks can help reduce the perceived burn and imparting to the spirit a mellow and smooth mouthfeel. However, after the aging process, the spirit is often diluted with water to bottling strength, which can cause a change to its mouthfeel properties. Effect of water constituents on the sensory characteristics of brewed tea and coffee and other beverages such as beer have been studied to some extent, and both positive and negative impacts were reported. Surprisingly, research on how constituents of water (e.g., dissolved mineral salts) impact the taste and mouthfeel properties of distilled spirits are rare. This presentation will summarize the existing literature regarding how sensory properties of beverages and spirits can be affected by the water quality (constituents), and will discuss some recent studies conducted in our laboratory on this subject.

**AGFD 194 Nanoscience of bourbon: Self-assembled micro-webs** of colloids from whiskey droplet evaporation as unique identifiers of bourbon whiskeys  Sabina Islaml1, sislam3@ncsu.edu, Orlin D. Velev1, Stuart J. Williams2. (1) Chemical and Biomolecular Eng., North Carolina State Univ., Raleigh (2) Dept. of Mechanical Eng.,
Properties of the final products. However, we demonstrated that sub-micrometer colloidal micelles form when whiskey is diluted with water or when the temperature is lowered. Despite being such a distinct product, to date, there is no fundamental quantitative study on bourbon whiskey colloids. Using dynamic light scattering techniques, fundamental investigation on colloid occurrence as a function of (i) aging, (ii) proof, and (iii) temperature was performed in this study. These colloids are electrostatically stabilized, and the particle size remained stable at low alcohol concentrations. Additionally, these whiskey colloids increased in concentration with higher barrel aging. We also investigated how these colloids interact during sessile droplet evaporation. During droplet evaporation, as alcohol evaporates at a rate much higher than water, these water-insoluble colloidal species precipitated. This results in a dynamic and complex evaporation process whose initial conditions govern the resultant pattern of assembled colloids. At low alcohol content (<15% ABV) the pattern resembled a coffee ring and at high alcohol content (>35% ABV) the colloids formed a thin film. However, at intermediate proofs, rich variety of web-like microstructures formed. Moreover, we found that, only American whiskies formed these highly visual patterns (n = 65 of 66 samples) whereas others did not (one Cognac, three Irish whiskies, four Scotch, and two Canadian whiskies tested). The web-like patterns were qualitatively different between commercial brands. Various aged samples (12 months to 71 months) were acquired from a local distillery and, for this brand, the web’s density increased with age; webs did not form with unaged whiskey (a.k.a. “white dog”, n = 5). This facile technique could be used for maturation analysis or counterfeit detection based on a new class of evaporation-deposition phenomena. Additionally, the colloidal findings of this study could impact industrial filtration and tasting practices of bourbon whiskies.

**AGFD 195 Bioprocess development toward zero waste**

Agricultural processing William J. Orts2, bill.orts@ars.usda.gov, Gustavo H. Tonolli1, Lennard F. Torres2, Bor-Sen Chios2, Delilah F. Wood2, Tina Williams2, Gregory Glenn2. (1) Dept. de Ciencias Florestais - DCF, Univ. Federal de Lavras - UFLA, Lavras, MG, Brazil (2) Bioproducts, USDA-ARS Western Regional Research Center, Albany, California The Western U.S. is among the world’s leaders in production of a wide array of specialty crops, including almonds, walnuts, pistachios, table grapes, wine grapes, olives, lettuce, artichokes, avocados and, most recently, hemp – which together and even individually – contribute billions of dollars to the rural economy. During their processing each of these crops generate their own specific waste streams, and our USDA team has been investigating ways to optimize end-use applications for specific agricultural byproducts in line with zero-waste initiatives. This presentation outlines multiple recent strategies for adding value to under-utilized biomass by expanding their commercial potential in (bio)composites and nanocomposites. First, the high cost of creating and separating nanocrystalline cellulose fibrils at a viable commercial scale has prevented their wide-scale adoption as a commodity. To address these high costs, we isolated nanofibrils from an array of biomass sources using the enzyme-rich digestate from a commercial-grade anaerobic digester – a “cost-free” source of enzymes. Data is reported from various fiber pulps that were incubated for 5, 10, and 20 days in the liquid supernatant isolated from a mesophilic anaerobic digester. In another (nano)composite application, biomass was subjected to torrefaction whereby an array of feedstocks was thermally-treated between 200°C-300°C in limited oxygen, to create “torrefied” fibrils. When used as a “functional pigment” in recycled plastics, torrefied fibrils act as a suitable replacement for carbon black with added benefits, improving the mechanical and thermal properties of the final products. In one example, the addition of torrefied walnut and almond shells to commercial polypropylene increased heat distortion temperatures; i.e., their softening points, by 8–24°C compared with neat polypropylene, and also increased flexural modulus by up to 40%. As will be discussed here, the USDA team partners with commercial entities to create potential new commercial applications for underutilized biomass resources found in Western agriculture. This presentation will discuss processing methods to meet the cost-points required for these low-cost, high volume commodity markets.

**AGFD 196 Functional properties of pulse flours affected by processing**

Mukti Singh, mukti.singh@ars.usda.gov. FFR, USDA-ARS, Peoria, Illinois In recent years, due to environment and humanity concerns, there is an increased demand for quality plant proteins. Pulse are a good source of protein, carbohydrates, soluble fiber, vitamins and minerals, low in fat. Pulses offer added advantages of being gluten-free and low in allergenicity. Therefore, there is a great interest in the use of pulses as a replacement of cereal flours. Pulse flours contain oligosaccharides – raffinose, stachyose and verbascose, and fibers that are associated with the perception of flatulence. Various processing methods such as germination, fermentation, and jet-cooking reduce the undesirables and improve the nutritional properties of pulse flours. The effects of processing of pulses on the functional properties of pulse flours, and their food applications will be discussed.

**AGFD 197 Variability of the chemical composition in the Abies species**

Jinhee Kim, jhkimitamu@gmail.com, Sooyeon Lim, Chungkwang Lee. National Inst. of Ecology, Seocheon, Korea (Republic of) Numerous research data have confirmed that plant secondary metabolites (PSMs) are crucial organic compounds that are related to the interaction and adaptation process between a plant and the biotic/abiotic environment. An unprecedented rise in temperature has led to changes in various environmental factors (temperature, rainfall, air humidity, and soil moisture) that affect plant growth. Thus, understanding the relation between environmental changes and the production of secondary metabolites is essential in order to determine plant regeneration. In the present study, we aimed to evaluate the effects of seasonal variation, sampling site, vegetative area, and environmental conditions on secondary metabolites using principle component analysis and multi-variable analysis. Phenols, polyphenols, and carotenoids were identified and quantified using high-performance liquid chromatography analysis. Herein, we present our approaches for evaluating the vulnerability and predicting the population of Abies koreana based on scientific evidence.

**AGFD 198 Diabetes is an environmental risk factor: Chemistry, biochemistry, and structural characterization via MALDI-TOFMS of target molecules found in bitter melon peel potentially useful for fighting macro- and micro-vascular complications as well as blindness in diabetic patients**

Bishambar Dayal1, dayalb77@gmail.com, Amita Kulkarni1,3, Gene S. Hall2. (1) Medicine, Rutgers Univ. New Jersey Medical School, Princeton Jct (2) Chemistry, Rutgers Univ., Princeton, New Jersey (3) Rutgers Univ. Honors Program, New Brunswick, New Jersey In India, 70 million people are diabetic and are at risk of diabetic retinopathy, which can cause blindness if untreated. Above studies prompted us to pursue natural products discovery in light of recent reports published in New York Times (March 2019) highlighting artificial intelligence Tech. developed by Google as a screening tool for diabetic retinopathy by identifying tiny lesions, hemorrhages, discoloration resulting blindness of the eyes. Every day 2,000 people across India come to Arvind Eye Hospital to get treatment which uses artificial intelligence, and this system can detect illness early and diagnose and treat diabetic retinopathy. Our laboratory has studied mechanistic
details of inhibition of advanced glycation end products (AGEs) using natural bioactive compounds from plants (ACS 2012,2014-2018). AGEs are implicated in macro- and micro-vascular complications in diabetes Type-II patients. We are investigating bioactive compounds present in bitter melon peel were lutein and chlorogenic acid and other metabolites exhibited include the potassium ion \( (m/z = 156.991 = 157) \) derivative of octanolic acid \( ([157 + H + K] = 158 + 39 = 197) \), the sodiated derivative of palmitic acid \( (256.432 + 22 = 278) \), sodium ion arachidonic acid \( ((304 + H + Na+) = 327.028) \), chlorogenic acid \( ((354.311 + K + H) = 394.057) \), and sodiated lutein \( ([569 + Na] = 569 + 22 = 591.077) \).

AGFD 199 Phosphorus flame retardants from crop plant phenolic acids Bob A. Howell, bob.a.howell@cmich.edu, Eric A. Ostrander, Kendall Oberdorfer. Central Michigan Univ, Mount Pleasant. While polymeric materials have had an enormously positive impact on the development of modern society, for most applications they must be flame-retarded. This may be accomplished in a variety of ways, most notably by introduction of a suitable additive during processing. Traditionally, organohalogen compounds, particularly brominated aromatics, have been effective, affordable, popular gas-phase flame retardants. However, these compounds readily migrate from a polymer matrix in which they have been incorporated, persist in the environment, tend to bioaccumulate and may pose risks to human health. For this reason, the use of these compounds is coming under increasing regulatory pressure worldwide. Phosphorus compounds derived from renewable biosources provide attractive alternatives to these traditional organohalogen flame retardants. Precursors to biobased organophosphorus flame retardants are generally nontoxic and readily available at modest cost. Phenolics are ubiquitous in nature and may be isolated from numerous plants. Gallic acid \((3,4,5\)-trihydroxybenzoic acid\) is a constituent many edible plants, nuts and legumes. 3,5-Dihydroxybenzoic acid may be found in several plants, principally buckwheat. Both of these compounds may serve as the base for the generation of a series of phosphorus esters, both phosphate and phosphate, that display good flame retardancy in DGEBA epoxy.

AGFD 200 Experimental design for the extraction of phenolics from Mentha arvensis L. using green extraction media Zubera Naseem1, Muhammad Zahid1, zahid595@gmail.com, Muhammad A. Hani1, Muhammad Shahid2, Tajamal Hussain3. (1) Dept. of Chemistry, Univ. of Agriculture Faisalabad, Punjab, Pakistan (2) Dept. of Biochemistry, Univ. of Agriculture Faisalabad, Pakistan (3) Inst. of Chemistry, Univ. of the Punjab, Lahore, Pakistan In present study, deep eutectic solvent was synthesized by combining the choline chloride and glycerol and used for the extraction of bioactive contents from M. arvensis L. using maceration and ultrasound assisted extraction (UAEE) techniques. The optimization of extraction parameters and their interactive influence was evaluated by response surface methodology (RSM). The highest extraction yield of total phenolic contents (TPC) 117 mg GAEE/g, total flavonoids contents (TFC) 80 mg QE/g and 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical inhibition 94% was assessed with deep eutectic solvent through UAE. The antibacterial activity of extracts was evaluated against Staphylococcus aureus and Escherichia coli and antifungal assay was performed against Fusarium solani and Aspergillus niger by well diffusion method. The eutectic solvent showed significant antibacterial and antifungal activity against these strains with UAE using Rifampicin and Terbinafine standards respectively. Chrysins, p-coumaric acid, naringenin, scopoletin, phenlypyruvic acid, pinocembrin, hesperidin, carnosic acid and caffeic acid were main bioactive components of Mentha arvensis L. characterized by LC-MS-MS.

AGFD 201 Computer-aided agrochemistry: Overview of modelling possibilities at the molecular level Bruno Horta, bruno.horta@gmail.com. Univ. Federal do Rio de Janeiro, Brazil Molecular simulation techniques cover different sizes and time scales, ranging from small molecular systems (no more than few nm in size that can be treated using quantum mechanics) to mesoscopic systems that can be computed with classical mechanics. This work attempts to illustrate how computer simulations at the molecular level can help in the design of new agrochemicals and agro-based materials. In terms of agrochemicals (e.g., pesticides), the design can follow a similar strategy adopted by medicinal chemists that currently rely on computational methods, viz., identification of an important macromolecular target, modelling of its 3-dimensional structure, virtual screening with molecular docking, and free-energy calculations. The results obtained from the computations may provide insights, guide novel experiments, or filter a library of compounds, thereby reducing the number of (usually) costly and time-consuming experiments. As regards the R&D of agro-based materials, computational methods can be used to study chemical reactions, catalysis, structure and dynamics of biopolymers (e.g., cellulose fibres), interactions of small molecules with biomacromolecules, solvation, and other phenomena. The knowledge gained can be potentially useful for the design of new materials, catalysts, synthetic strategies, and industrial processes. As illustrations, a few examples will be presented, highlighting the rationale behind the methodological choices, the usefulness of the results, as well as the limitations in each case.

AGFD 202 Rapid paper tests for detection of pathogenic Vibrios in aquaculture Cristina Rodriguez-Quijada1, Brianna Leonardo2, Cassandra Lyons2, Sara Quinn2, Michael Tlsty3, Michael Shiariis2,3, Kimberly Hamad-Schifferlli1,3, kim.hamad@umb.edu. (1) Eng., Univ. of Massachusetts Boston (2) Biology, Univ. of Massachusetts Boston (3) School for the Environment, Univ. of Massachusetts Boston With the growing population on the planet, aquaculture is expected to increase to help increase food production in a sustainable manner. Routes to ensure safe food products are necessary. In particular, oysters, the second most produced animal in aquaculture, have a food safety challenge. Bacterial pathogens, and specifically vibrios, are a major problem in oysters production. The species Vibrio parahaemolyticus and Vibrio vulnificus can result in illness and sometimes fatalities. The current standard method for vibrio detection in seafood is lab based in centralized lab locations such as PCR, where turnaround can be several days. We present here a low-cost rapid paper based test for the detection of V. parahaemolyticus in oysters that can be read out by eye. The assay is in a dipstick paper immunoassay format using gold nanoparticles conjugated to antibodies for Vibrio. We studied the effect of NP surface chemistry on NP-Ab stability and test in oyster hemolymph matrices. Results from this work could have could have implications on food safety in aquaculture, and better production of a wide number of species.

AGFD 203 WITHDRAWN

AGFD 204 High-throughput Shiga toxin detection using immune-sensing Tech. with surface plasmon resonance imaging Bosoon Park1, bosoon.park@ars.usda.gov, Jing Chen1, Xiaohua He2. (1) USDA, ARS, Athens, Georgia (2) USDA-ARS, Albany, California Shiga toxin-producing Escherichia coli (STEC) are responsible for gastrointestinal diseases reported in numerous
outbreaks around the world. The Center for Disease Control and Prevention (CDC) estimates that each year Shiga toxin-producing E. coli or STEC causes 265,000 illnesses, 3,600 hospitalizations and 30 deaths in the US. About 5–10% of people diagnosed with E. coli O157 infection develop a potentially life-threatening complication known as hemolytic uremic syndrome (HUS) external, a type of kidney failure. Current detection methods including real-time PCR, enzyme immunoassay (EIA) in addition to traditional culture on sorbitol MacConkey agar are used. Although each method has advantage over others in terms of specificity and sensitivity, current methods have limitation to implement for rapid detection with high volume of samples that are needed for regulatory agency. Our previous study demonstrated an optical method with surface plasmon resonance imaging (SPRi) has the potential for rapid and label-free screening of multiple pathogenic bacteria simultaneously, such that we extend evaluation of SPRi for detection of Shiga-toxins (Stx1, Stx2) produced by E. coli. To select optimal Shiga-toxin antibodies, eight different antibodies (Stx1pAb, 1-2mAb, 1d-3mAb, 1e-4mAb, Stx2pAb, 2-1mAb, 2-2mAb, and 2-10mAb) were examined with a gold (50 nm) sensor surface through mercaptoundecanoic acid monolayer and carbodiimide crosslinking, and subsequently blocked with 1% skim milk proteins. Shiga-toxins were detected by SPR sensorgram analysis and difference images between targets and reference. Among eight antibodies tested, Stx1pAb and Stx1d-3mAb for toxoid 1A and Stx2-1mAb and Stx2-2mAb for toxoid 2A performed well with potential for detection 50 ng/mL and detection time of 20 min. The results suggest that SPRi method with selected antibodies has the potential for rapid, high-throughput and multiplex Shiga-toxin detection. Although SPRi is a feasible optical method for rapid detection, more research to enhance protocol to improve binding affinity, sensitivity and specificity of sensor chips is necessary.

AGFD 205 Macromolecular therapies in treatment of citrus greening Victoria A. Piunova1, vapiunov@us.ibm.com, James Hedrick1, Niina Haiminen2. (1) IBM Almaden Research Center, San Jose, California (2) IBM T. J. Watson Research Center, Yorktown Heights, New York Citrus Greening is an infectious disease affecting citrus groves throughout the world and resulting in significant loses to the citrus industry. The infection is caused by bacteria C. Libraribacter, which affects the development of the root and ultimately resulting in the tree death. Current solution toward citrus greening utilizes administration of large quantities of antibiotics to the trees, however, such strategy unknowably results in the development of bacterial resistance and potentially cross resistance with human pathogens. Here we discuss the application of macromolecular therapy in combination with metagenomics analysis toward mitigation of citrus greening. Synthesis of antibacterial polymers, activity and in vivo testing are discussed. Onset of resistance and effect of antimicrobial polymers on the ecosystem is evaluated through 16S and 18S amplicon sequencing.

AGFD 206 Preparation of starch graft copolymers and grafted starch nanoparticles via nitroxide mediated polymerization Jaime C. Cazotti1, Alexander T. Fritz1, Omar Garcia-Valdez1, Niels M. Smeets2, Michael F. Cunningham1, Michael.Cunningham@chee.queensu.ca. (1) Dept Chem Eng., Queens Univ, Kingston, Ontario, Canada (2) EcoSynthetix Corporation, Burlington, Ontario, Canada Starch is attracting increasing attention as a potential substitute for conventional synthetic, petroleum-based polymers due to its low cost, abundance, and biodegradability. Native starch is hydrophilic with poor mechanical properties, but can be graft copolymerized to improve the physical properties and increase compatibility with hydrophobic polymers. If a suitable improvement in properties and compatibility with synthetic polymers could be achieved, the use of starch in a wide range of commercial applications becomes feasible, including paper coatings, water-based adhesives and other types coatings. We have developed methods to modify both cold water soluble starch and starch nanoparticles by grafting synthetic polymers to the starch backbone. First, cold water soluble starch (CWS) was graft copolymerized using nitroxide-mediated polymerization (NMP). The CWS hydroxyl groups were first modified with 4-vinylbenzyl chloride (VBC) followed by reaction with a nitroxide alkoxamine to covalently bind the nitroxide to the starch backbone. This functionalized CWS was then grafted with synthetic polymer. Using a similar type of approach, we have also grafted synthetic polymer to crosslinked starch nanoparticles. The approach we have developed is highly flexible, allowing modification of the starch with a wide range of different synthetic polymers, and allowing facile tailoring of the graft copolymer design, including for example the number of grafted chains, the molecular weight of the grafted chains, and the incorporation of functional groups to impart desired functionality to the grafted starch.

AGFD 207 Omega-3 oils and lipophenols as important food bioactives Fereidoon Shahidi, fshahidi@gmail.com. Biochem Dept, Memorial Univ of Newfoundland, St. John’s, Canada The omega-3 oils originate from seafood as well as algal and fungal species. The health benefits of omega-3 fatty acids, particularly their long-chain members such as eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and to a lesser extent docosapentaenoic acid (DPA) are well recognized for their pivotal multifunctional role in health promotion and disease risk reduction. They constitute an integral component in the development of the brain following gestation and pay a positive role during the entire lifespan. However, their highly unsaturated nature requires their stabilization using appropriate antioxidants or protection via encapsulation. In addition, one may prepare lipophenols in which the phenolic moiety would render stability to the product and may also render additional benefits to health. The presentation will provide examples to demonstrate the role of omega-3 oils in health and discuss certain literature and opinions that have tried to undermine their benefits to health.

AGFD 208 Canola oil: Important source of omega-3 fatty acids, but also an oil with flavor challenges Michael Granvoig1,2, michael.granvogl@ch.tum.de, Katrin Matheis1. (1) Technical Univ. of Munich, Freising, Germany (2) Food Chemistry, Univ. of Hohenheim, Stuttgart, Germany After palm oil (72.8 million tons) and soybean oil (57.6 million tons), steam-treated and refined rapeseed oils were one of the most consumed edible oils worldwide (28.5 million tons) in the (source: US Dept. of Agriculture, O. w. m. a. t., August 2018; page 11; https://apps.fas.usda.gov/psdonline/circulars/oilseeds.pdf). Besides native rapeseed oils, which are appreciated for their unique nutty and cabbage-like aroma, steam-treated and refined rapeseed oils, with low odor intensities, are very popular due to their physiological properties, e.g., as source of omega-3 fatty acids. However, native cold-pressed rapeseed oils are also prone to elicit a fuzzy/musty off-flavor and steam-treated canola oils can end up with a fishy off-flavor. Thus, the lecture will highlight desired and undesired food-bioactives in canola oils based on a chemical and molecular level. For flavor analysis, the well-known molecular sensory science concept was applied to several canola oils revealing the respective key odorants for the oils eliciting the desired aroma attributes on the one hand, but also the aroma-active compounds responsible for the off-flavors on the other hand.

AGFD 209 Effects of honey extracted polyphenols on serum antioxidant capacity and metabolic phenotype Haoan Zhao, haoan_zhao@126.com. School of Chem. Eng., Northwest Univ.,
Xi'an, China  Honey, a natural food of nutritional and medicinal value, has been favored by consumers in recent years. Concerning the recent researches about honey, the majority of them have concentrated on the biological functions of polyphenols, such as improving carcinogenesis, aging and atherosclerosis associated with oxidative stress, but there are virtually no reports about the effect of honey at the metabolic level. Based on the identification of honey extracted polyphenols (HEP) and the confirmation of serum antioxidant capacity, this study was dedicated to investigate the metabolite changes in the serum of HEP-intake rats by using an UHPLC-Orbitrap-HRMS based metabolomics approach. The results showed that metabolites in the serum of rats administered HEP differed from those gavaged with distilled water alone. Twenty-nine compounds were identified as discriminating metabolites. All of these compounds involved in five metabolic pathways altered after the intake of HEP, which were related to oxidative stress, inflammation regulation and immune response. The correlation analysis indicated that HEP improve antioxidant capacity in serum, which were relative to discriminating metabolites. The metabolome of rats and associated metabolic pathways were significant altered after the intake of honey extracted polyphenols. The alteration of metabolome may be responsible for the increased serum antioxidant capacity, which may conduce to studying the biological functions and emerging health benefits of honey.

AGFD 210 Effect of growing conditions on the digestibility and anti-oxidant activity of the Nebraska Great Northern dry edible bean (Phaseolus vulgaris) Kaustav Majumder, kaustav.majumder@unl.edu. Food Sci. & Tech., Univ. of Nebraska, Lincoln  Dry edible beans are an excellent source of dietary proteins and peptides. Great Northern (GN) beans are a market class of dry edible bean and a valuable agricultural commodity of Nebraska. These GN beans are generally cultivated in the western part of the province, whose annual precipitation rates are meager. So different bean varieties were developed to grow in these environmental conditions. However, it is not known how the different growing conditions may modulate the biological activity of the bean-derived proteins and peptides. Therefore, the primary objective of the present study is to evaluate the effect of growing conditions on protein digestibility and the anti-oxidant activity of the whole bean hydrolysate. GN beans grown in both drought and irrigated conditions were first soaked overnight and cooked at 95°C for 90 minutes. Alcalase then used to hydrolyze the cooked GN beans at pH 8.5 and temp 60°C for 3 hrs. The degree of hydrolysis (DH) was measured by the pH-stat method, and the antioxidant capacity of the cooked whole bean hydrolysate was measured by the ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) radical scavenging assay. The beans grown in irrigated conditions have a significantly high amount of total protein (22.8%) compared to the beans grown in drought conditions (18.9%). However, the drought-beans have exhibited a slightly higher degree of hydrolysis (DH: 19.2% ± 1.9), not statistically significant, compared with irrigated-beans (DH: 16.9% ± 1.2). Furthermore, the ABTS radical scavenging assay resulted in an IC50 value of 0.8 mg/mL for the drought-bean-hydrolysate and 0.7 mg/mL for the irrigated-bean-hydrolysate. Thus, the results obtained from the study so far indicates that the GN beans grown in drought conditions despite having a low amount of protein had exhibited similar Alcalase digestibility and antioxidant activity as compared to the beans grown in irrigated conditions. Thus, this study concludes that the beans grown in different environmental conditions do not affect the biological activity of bean-derived peptides.

AGFD 211 Protective effect of wheat alkylresorcinols against hydrogen peroxide-induced oxidative stress in ARPE-19 cells Jie Liu, liujiefantasy@163.com, Yiming Hao, Ziyuan Wang, Jing Wang, Food Sci. & Tech., Beijing Tech. and Business Univ., China  The protective effect of wheat alkylresorcinols (ARs) on ARPE-19 cells against oxidative stress and the possible underlying mechanism were investigated in this study. The results showed that ARs significantly inhibited 300 μM H2O2-induced ARPE-19 cells damage and reactive oxygen species (ROS) generation by 19 % and 32 %, respectively. Moreover, ARs treatment increased NF-E2-related factor 2 (Nrf2) signaling activation, which was evidenced by increasing transcription of anti-oxidant responsive, GCL, NQO1 and HO-1. Knockdown of Nrf2 through targeted siRNA alleviated ARs-mediated HO-1 transcription, and almost abolished ARs-mediated cytoprotection against H2O2 induced cell damage. Further studies showed that the protective effect of ARs was depended on Akt activation. Taken together, these results demonstrated that ARs could protect ARPE-19 cells from oxidative stress induced cell damage possibly through Akt dependent Nrf2/HO-1 signaling.

AGFD 212 Nucleophilic chemistry of tea polyphenols Wei-Lun Hung2, whung@tmu.edu.tw, Chi-Tang Ho1. (1) Food Sci., Rutgers Univ., New Brunswick, New Jersey (2) School of Food Safety, Taipei Medical Univ., Taipei, Taiwan  Tea (Camellia sinensis) originates from processed fresh tea leaves and has become one of the most consumed beverages in the world. There are various characteristic substances and nutrients in tea including polyphenols, theanine, caffeine, poly saccharides and other ingredients as well. These compounds not only contribute significantly to the sensory properties of tea, but also are thought to possess various health-promoting, such as antioxidant, anti-inflammatory, anti-obesity and anticancer activities. Certainly, the most important compounds are catechins. The B-ring of tea catechins is responsible for the first line antioxidant properties of tea polyphenols. On the other hand, a resorcinol structure of A-ring can create high nucleophilic centers at C6 and C8 positions. We will discuss recent profound findings of carbon-carbon (C-C) connection from the unambiguous characterization of novel A-ring addition derivatives of tea catechins, including catechin-carbonyl and catechin-theanine conjugates and the C-C formation mechanisms. The bioactivity of novel conjugated derivatives will also be discussed.

AGFD 213 Aqueous extracts of vegetable leaf-fortified bread reduce blood pressure and heart rate when orally administered to spontaneously hypertensive rats Adeola M. Alashik1, Kehinde Taiwo4, Durodoluwa Oyedele5, Oduyayo Adebooye3, Rotimi Aluko1,2, rotimi.aluko@umanitoba.ca. (1) Food and Human Nutritional Sciences, Univ. of Manitoba, Winnipeg, Canada (2) Richardson Centre for Functional Foods and Nutraceuticals, Univ. of Manitoba, Winnipeg, Canada (3) Agronomy, Osun State Univ., Osogbo, Nigeria (4) Food Sci. & Tech., Obafemi Awolowo Univ., Ile-Ife, Nigeria (5) Soil and Land Resources Management, Obafemi Awolowo Univ., Ile-Ife, Nigeria  The aim of this study was to determine the effect of vegetable leaf-fortified bread samples on blood pressure and heart rate after oral administration of their aqueous extracts to spontaneously hypertensive rats (SHR). Dried vegetable leaf powders were obtained from Amaranthus viridis (AO), Solanum macrocarpon (SM) and Telfaria occidentalis (TO) followed by incorporation into wheat flour at 1, 2 and 3% (w/w). Leavened bread samples were baked using these composite flours (fortified bread) and compared with bread from 100% wheat flour (control bread). The bread samples were freeze-dried and extracted with water followed by analysis for total polyphenolic content (TPC), polyphenolic composition as well as inhibition of the in vitro activities of angiotensin converting enzyme (ACE) and renin. The SHR were implanted with telemetry sensors, which enabled continuous recording of blood pressure and heart rate parameters in freely moving rats over a 24-h period. As expected the vegetable leaf-fortified bread samples had significantly (P < 0.05) higher TPC (5.8-7.6 mg gallic acid equivalent, GAE/g) when compared to that of
control bread (5.5 mg GAE/g). Rutin, catechin, gallic acid, myricetin and caffeic acid were the main polyphenolic compounds detected in all the bread samples. The control bread exhibited significantly (P < 0.05) higher ACE inhibition (~24%) than the fortified bread samples (4-18%). In contrast, the fortified bread samples had significantly (P < 0.05) higher (up to 44.2%) renin inhibitory activity when compared to the control bread (5.9%). After oral administration (100 mg extract/kg body weight) to SHR, aqueous extracts of the fortified breads produced strong decreases (up to ~24 mmHg) in systolic, diastolic, and mean arterial blood pressure, which is twice the effect (~20 mmHg) produced by the control bread. The fortified bread aqueous extracts also significantly (P < 0.05) reduced the heart rate of SHR by up 102 beats per minute (bpm) when compared to 43 bpm for the control bread. The results indicate potential used of a common food staple such as bread to carry bioactive compounds that could ameliorate disease symptoms associated with hypertension.

**AGFD 214 Status update on methods for arsenic speciation at FDA**  
Sean Conklin, conklinds@hotmail.com, CFSAN, US FDA, Burtonsville, Maryland. The US FDA has published methods for arsenic speciation analysis of fruit juice (EAM 4.10), rice (EAM 4.11), and seafood (draft EAM 4.14), with each method undergoing at least a single-laboratory validation. The methods have also been revised to reflect updates in instrumentation and reagents. The juice method has recently been extended to cover several sample types not included in the original validation. The current status of each method will be discussed, including results from some recent applications of the methods. The presentation will include a discussion of potential future directions for arsenic speciation at FDA.

**AGFD 215 Two-year study of elemental differences in pinot noir wines from different neighborhoods within one AVA**  
Courtney K. Tanabe, ctanabe@ucdavis.edu, Jenny Nelson3,1, jenny_nelson@agilent.com, Susan E. Eberle1, seebeler@ucdavis.edu, Helene Hopfer4, helene.hopfer@gmail.com.  
(1) Food Safety & Measurement Facility, Univ. of California, Davis  
(2) Dept of Viticulture & Enology, Univ. of California, Davis  
(3) Agilent Technologies, Berkeley, California  
(4) Dept of Food Sci., Pennsylvania State Univ., Univ. Park  
The geographic authentication of wine is of great interest because product quality is often associated with specific geographical origin. Past studies have attempted to discriminate wines from various wine producing regions, however, these focus on differences between larger regions. In this study we used element profiles to distinguish Pinot noir wines from six sub-appellations, or neighborhoods, within one American Viticultural Area (AVA). Twenty-eight mono-varietal samples were collected over two harvests that were representative of the neighborhoods. All wines were made with minimal oak contact and without significant additions other than yeast and nutrient additions during winemaking. Elemental analysis was completed using various spectrochemical techniques covering the m/z range from 6 to 238. Trace and minor elements were quantified using inductively coupled plasma-mass spectrometry (ICP-QQQ, Agilent Technologies, Inc.). Calibration curves were prepared in 6-point calibration curves using multi-element standards and matrix-matched for each element. All elements were monitored in various modes (helium, high energy helium, or oxygen mode) to ensure lowest detection limits and accurate analysis. Major elements were quantified using microwave plasma-atomic emission spectroscopy (MP-AES, Agilent Technologies, Inc.). Samples were mixed with 2,000 mg/L ionization buffer solution prior to entering the system. Six-point calibration curves were prepared for the major elements and matrix matched to the samples. Analysis of variance was used to determine statistically significant differences across the neighborhoods. Further discrimination testing was completed using canonical variance. Recovery studies were completed, and all detected elements were within 20% of the target concentration. Sixty-two elements were monitored and fifty-three were found to be significantly different across the wines originating from the different neighborhoods. The CVA showed between 78%-88% of variance ratio was explained in the samples from the two vintages.

**AGFD 216 Selective and sensitive determination of bromate in bread by IC-MS**  
Manali Aggrawal, manali.aggrawal@gmail.com, Jeffrey S. Rohrer. Thermofisher Scientific, Sunnyvale, California  
Potassium bromate is an odorless and tasteless white crystal that is commonly used in the baking industry. It is often added in flour and flour products to improve the product quality. It acts by oxidizing thiol groups of the gluten protein in flour and in the process forming disulfide bonds. The overall effect is to make bread rise in the oven, and increase loaf volume and texture. However, potassium bromate is considered a carcinogenic and nephrotoxic substance. Bromate has been listed as a potential carcinogen at low levels by the International Agency for Research on Cancer (IARC). Due to its hazardous properties, the concentration of bromate must be carefully monitored in bread. Ion-exchange chromatography with suppressed conductivity detection is the most commonly applied tech. for the bromate measurements. However, conductivity detection has low selectivity, especially when applied to complex food matrices in which many compounds are ionic and thus can possibly interfere with bromate detection. Here we developed a new method using ion chromatography coupled with single quadrupole mass spectrometry (IC-MS) for a selective and sensitive determination of bromate in flour and flour products. The Thermo Scientific™ ISO™ EC Single Quadrupole Mass Spectrometer allows seamless integration of IC with MS, taking advantage of the strengths of both techniques. IC separation with eluent generation and suppressed conductivity detection provides chromatographic selectivity and analytes in the ionic form. Electrospray ionization (ESI) introduces the liquid IC stream (after suppression) as a fine spray into the MS source. Flur samples were extracted with high-purity water and subjected to a series of simple clean up steps before they were analyzed on the IC-MS system. We used a recently introduced Thermo Scientific™ Dionex™ IonPac™ AS31 column to separate bromate from matrix anions. The IonPac™ AS31 column is a high capacity column which allows large injection volumes, thus allowing the determination of low bromate concentrations. In this work we analyzed various samples including flour, burger buns, white bread, bread (baked using bromated flour), etc. The method provided good precision and accuracy with recovery of 90–110%. The limit of detection (LOD) and the limit of quantitation (LOQ) of bromate in the solution were 0.10 ppb and 0.34 ppb, expressed as H79BrO3- (m/z 127), respectively, which corresponded to 5 μg/kg and 17 μg/kg, respectively, in bread.

**AGFD 217 Rapid detection of engineered nanomaterials in environmental and food matrices using surface-enhanced Raman spectroscopy**  
Lili He, liliehe@fooodsi.umass.edu. Food Sci., Univ. of Massachusetts-Amherst, Belchertown  
The increasing use of engineered nanomaterials (ENMs) has resulted in environmental, agriculture, and food contamination. However, there is no effective technique for rapid detecting these ENMs in complex matrices. Here we demonstrated the capability of surface-enhanced Raman spectroscopy (SERS) for rapid detection of engineered nanomaterials, i.e. silver nanoparticles (Ag NPs) and titanium dioxide nanoparticles (TiO2 NPs) in various matrices. Upon adding a surfactant ligand which can bind and replace the adsorbents on the NPs, we were able to extract these modified NPs using the hydrophobization-mediated extraction and followed by Raman measurement. For Ag NPs, 4-mercaptobenzoic acid (4-MBA) were used to modify the NP surface for extraction, and the detection is based on the 4-MBA signals. For TiO2 NPs, myricetin, a nature flavonoid was used for surface
hydrophobization and extraction. The extracted TiO2 NPs can be quantified based on the intrinsic Raman signals of TiO2 NPs. The sensitivity of the SERS methods reached as low as 0.1 ppb for Ag NPs and 20 ppb for TiO2 NPs within 1 hour and also validated the methods in various matrices. In conclusion, our study demonstrates the great potential of establishing SERS as a rapid, simple, and effective method for detecting ENMs in environmental, agriculture, and food matrices.

AGFD 218 Iodine, bromine, and arsenic speciation analysis in infant formulas  Jenny Nelson1, jenny_nelson@agilent.com, Lawrence Pacquette2, Courtney K. Tanabe3, Shuofei Dong1, Michiko Yamandl1. (1) Agilent, Berkeley, California (2) Abbott Nutrition, Columbus, Ohio (3) UC Davis  Elemental speciation plays an important role in food safety. The determination of the total form of an element only tells part of the story. For example, the toxicity of arsenic is strongly affected by its chemical form. The inorganic forms of arsenic, i.e. arsenite (As (III)) and arsenate (As(V)), are generally more toxic than the organic forms of arsenic (dimethylarsinic acid (DMA) and monomethylarsonic acid (MMA)). In this first study, we report the results obtained from Abbott Nutrition (AN) and UC Davis laboratories for the determination of four arsenic species (As(III), As(V), DMA and MMA) in raw ingredients and milk-based infant formula products using high-performance liquid chromatography-inductively coupled plasma mass spectrometry (HPLC-ICP-MS). The second study, furthers our speciation study in infant formula products. A simultaneous, fast and sensitive method for the analysis of iodine and bromine species in infant formula was developed using HPLC-ICP-MS. The 4 species of interest were I-, IO3-, Br-, and BrO3-. All 4 species were separated in less than 6.5 min. The limits of detection for I-, IO3-, Br-, and BrO3- were all less than 0.6 mg/kg respectively. The method was used to determine the four halogen species in a NIST 1849a (Infant/Adult Nutritional Formula) standard reference material and four commercially available infant formula products from the US and China. To test the suitability of the method for the accurate determination of low concentrations of the four species in infant formula samples, a spike recovery test was carried out at 20 and 40 μg/kg. Total elemental determinations of iodine and bromine were also performed using the triple quadrupole ICP-MS, without HPLC.

AGFD 219 Comparison of aroma compounds in fresh-water and salt-water frozen surimi  Yueqi An1,3, anyu@oregonstate.edu, YanPing L. Qian2, Shanbai Xiong1, Michael C. Qian3. (1) Food Sci. & Tech., Huazhong Agricultural Univ., Wuhan, Hubei, China (2) Crop and Soil, Oregon State Univ., Corvallis (3) Oregon State Univ, Corvallis  Alaska pollock surimi contained the least quantity of the aroma compounds. Some alcohols (such as 1-penten-3-ol, Z)-3-hexen-1-ol, and benzyl alcohol), butanoic acid, and γ-octalactone were not detected in Alaska pollock surimi. AEDA results showed that the flavor dilution (FD) factors of most aldehydes and alcohols were higher in silver carp surimi, particularly hexanal (grassy odor), 1-octen-3-ol (mushroom-like odor), and some unsaturated aldehydes such as (E)-2-hexenal (grassy odor), (E)-2-octenal (natty odor), (E)-2-nonenal (natty odor), (E,E)-2,4-heptadienal (oily odor), (E,Z)-2,6-nonadienal (cucumber-like odor), and (E,E,E)-2,4,6-nonatrienal (fishy odor). Additionally, geosmin, contributed to a typical earthy odor, showed an FD factor in silver carp surimi at 32, which was much higher than that in salt-water surimi (FD=2). However, the FD factors of sulfur-containing compounds in Pacific whiting frozen surimi were the highest. Overall, silver carp frozen surimi showed more powerful fishy, green, and oily odor compared with salt-water frozen surimi. This study provides some basic information for further studies on surimi-based products aroma.

AGFD 220 Elucidation of the molecular background of smoky and hammy off-flavors in cocoa  Daniela Fuellleman, d.fuellleman.leibniz-lsb@tum.de, Martin Steinhaus. Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Germany  Fermented cocoa is occasionally affected by off-flavors, which might be transferred into the final product and then lead to rejection by the consumers. The occurrence of moldy, smoky, fecal, mushroom-like, and coconut-like off-flavors has been reported. Among them, the smoky off-flavor, often also referred to as hammy off-flavor, is the most prevalent. For the elucidation of the molecular background of smoky off-flavors, a fermented cocoa sample showing a pronounced off-note was subjected to gas chromatography–olfactometry (GC–O) and aroma extract dilution analysis (AEDA). A fermented cocoa sample with a flavorless and typical aroma was used as a reference and analyzed in parallel. The comparative AEDA in combination with the structure elucidation of major odorants revealed the following potential off-flavor compounds (flavor dilution (FD) factor in the off-flavor sample/FD factor in the reference sample): 4-ethylphenol (4096/<1), 2-methoxyphenol (2048/512), 3- and 4-propylphenol (2048/<1), 3-methylphenol (256/<1), 4-methylphenol (64/<1), and 3-ethylphenol (16/2). To estimate the contribution of the individual odorants to the observed off-flavor, their concentrations were determined in various smoky off-flavor samples as well as in flawless reference samples by using stable isotopically substituted odorants as internal standards. Data were related to the individual breakthrough thresholds of the potential off-flavor compounds determined in deodorized cocoa butter, cocoa liquor, and chocolate mass. Results showed that particularly 4-ethylphenol, 4-methylphenol, 3-methylphenol, and 3-ethylphenol contributed to the observed smoky/hammy off-flavor. Further studies will focus on the identification of the crucial processing parameters promoting the formation of these compounds. This will finally lead to suggestions on how to avoid their formation on the way from the cocoa pods to fermented cocoa.

AGFD 221 Thermally induced generation of desirable aroma-active and undesirable toxicologically relevant compounds from glucosinolates  Carolina Schury1, carolina.schury@tum.de, Thomas Hofmann1,2, Michael Granov3,4. (1) Technical Univ. of Munich, Freising, Bavaria, Germany (2) Leibniz-Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Bavaria, Germany (3) Chair of Analytical Food Chemistry, Technical Univ. of Munich, Freising, Bavaria, Germany (4) Inst. for Food Chemistry, Univ. of Hohenheim, Stuttgart, Baden-Wuerttemberg, Germany  The consumption of vegetables plays an important role in the daily nutrition. A large part is represented by the order of Brassicales such as cabbage, horseradish, or water cress. These species contain a high
amount of glucosinolates (GSL) which are secondary sulfur-containing plant metabolites. These β-thioglucoside-N-hydroxysulfates protect the plants from predators and contribute to aroma and taste as well. An important issue related to these compounds is their degradation mechanism(s) during food processing. Previous studies showed that a heat-treatment of GSL in different matrices led to pleasant desired aroma impressions. However, also undesired toxicologically relevant compounds, such as nitriles and epithionitriles are formed. The aim of the present study was to consider risks and benefits using GSL as a source of natural aroma compositions, with a special focus on sinigrin (2-propenyl GSL) and glucotropaeolin (benzyl GSL). After heat-processing of the GSL in phosphate buffer at pH values of 5.3, 7, or 9, the volatile compounds were extracted via solvent assisted flavor evaporation (SAFE) technique. Screening for aroma-active compounds was performed by aroma extract dilution analysis (AEDA) based on high resolution gas chromatography–olfactometry (HRGC-O). Afterwards, the odor-active areas with the highest flavor intensity (FD) factors were identified by comparison of their retention indices on two columns of different polarities, their odor quality and intensity at the sniffing port as well as their mass spectra (EI and CI mode) with data of reference compounds in an in-house database containing >1000 aroma-active volatiles. Finally, these compounds were quantitated by means of comprehensive two-dimensional GCxGC-ToF-MS on the basis of stable isotopically labeled standards. In summary, the lecture will present glucosinolates as a possible source for natural flavor compositions in the future, which could fulfill the demand by consumers to have all natural food products.

AGFD 222 Fatty acid profiles of neutral and polar whey lipids determined by liquid-liquid stationary phase gas chromatography Quintin Ferraris1, ferrarisquintin@gmail.com, Michael C. Qian2, (1) Food Sci. & Tech., Oregon State Univ., Port Reading, New Jersey (2) Oregon State Univ, Corvallis Animal derived lipids often offer more complex fatty acid (FA) profiles when compared to plant-based fats and oils. These FA mixtures attribute to potential flavor generation during food production but also have associated health effects based on carbon chain length, degree of saturation, and presence of chain branching. Understanding FA composition of neutral and polar lipid species in whey allows for future utilization of whey streams, guiding process design, to make new nutritional ingredients and functional food products. The advent of liquid-liquid (LL) stationary phases for gas chromatography (GC) have led to highly polar phases commercially marketed for rapid, high resolution, and reproducible analysis of fatty acid methyl esters (FAME). Commonly these LL columns can resolve cis/trans isomers of FA in half the time of other traditional polar stationary phases. Lipids were extracted from whey powders using a modified Folch method (chloroform-methanol 2:1 v/v) followed by subsequent fractionation by aminopropyl solid phase extraction into neutral and polar lipid fractions. These lipid fractions were qualitatively analyzed by silica TLC before FAME synthesis by acidic methanolysis. Lipids were subjected to 2% sulfuric acid in dry methanol overnight in a heated shaking water bath, then extracted with hexane-diethyl ether (1:1 v/v). Recovered FAME were concentrated under gentle stream of nitrogen before analysis by GC. Both wax and IL phases (specifically Supelco IL111i) were compared in this study coupled to a flame ionization detector and mass spectrometer. Neutral and polar lipid fractions differ in fatty acid profiles and relative composition with whey neutral lipids showing more diversity. In addition, mass spectrometry was used to identify unbranched FA species in powder whey samples including 12-methyltetradecanoic acid, 14-methylpentadecanoic acid and 14-methylhexadecanoic acid.

AGFD 223 Discovery of novel α-amylase inhibitors from natural products with a computer-aided approach Lianghua Xie, 11613026@zju.edu.cn, Wei Chen. Dept. of Biosystems Eng. and Food Sci., Zhejiang Univ., Hangzhou, ZheJiang Province, China α-amylase is an important target for the maintenance of postprandial blood glucose level, especially for patients with diabetes. Currently, the available drug acarbose has disturbing gastrointestinal side-effects that cannot be neglected. Thus, development of novel α-amylase inhibitors with no side-effects as functional food is of great importance. Natural products have been widely recognized as a promising source for discovery of bioactive components. Here, we adopt a computer-aided approach to search for potential α-amylase inhibitors in a natural product database. Virtual screening was first used to assess every compound in the database, then the results were ranked on the basis of predicted binding energy. The top 1% ranked compounds were selected as candidate compounds and evaluated in vitro enzymatic activity and kinetic assays. The compound with the best inhibitory activity was evaluated with CD spectroscopy and oral starch tolerance test in mice and identified as a novel α-amylase inhibitor. Molecular docking and molecular dynamics were subsequently used to identify the inhibitory mechanism. Then pharmacophore modeling and 3D-QSAR analyses were used in combination to generate a model for computer-aided design of α-amylase inhibitors. Taken together, our results offer new insights for discovery of novel α-amylase inhibitors as functional food from natural products, for control of postprandial blood glucose level.

AGFD 224 Development of a filter-based SERS platform for total and specific bacterial detection Siyue Gao, siyuegao@umass.edu. Food Sci., Univ. of Massachusetts Amherst Pathogens in food and environment can be easily exposed to human during harvest, processing, and food handling and thus a huge issue to public health. Rapid bacterial detection methods are critical for quick identification of target pathogens, and of great research interest over the decades. Well-established rapid methods such as PCR and ELISA offers great sensitivity at the cost of complicated sample preparation and require pre-enrichment in most cases. In addition, PCR-based methods cannot differentiate live and dead bacteria which leads to false positive results. Surface-enhanced Raman spectroscopy (SERS) is a combination of Raman spectroscopy and nanoTech., which can provide signature spectral information of the target analyte upon interaction with metallic nanostructures and has been widely applied to the characterization and detection of microorganisms. We have developed filter-based SERS mapping assays for detection of total and specific bacteria, which requires simple sample preparation procedures and can achieve low detection limit with adjustable sample volume. 4-mercaptophenylboronic acid (4-mpba) serves as a chemical label for total bacteria, which specifically bind to the diol structure on the bacterial cell wall. We also applied an aptamer specifically designed for Salmonella enteritidis to develop a filter-based rapid screening assay for target pathogen using ultra-fast Raman imaging. This method can rapidly identify and estimate the level of target pathogen in pure water and produce rinsed water within 3 hours. We also applied propidium iodide to SERS for live and dead validation. The success of combining the filtration technique with SERS mapping demonstrates the compatibility of the filter-based system with multiple SERS labels to serve various detection purposes and provides useful implications for future applications of the filtration technique in SERS-based bacterial screening methods.

AGFD 225 Optimization of curcumin delivery system functionality: Impact of pH, temperature, and molecular environment Mahesh Kharat1, mkharat@umass.edu, Guodong Zhang2, David McClements3, (1) Food Sci., Univ. of Massachusetts-Amherst (2) 245 Chenoweth Laboratory, Univ. of Massachusetts Amherst (3) UMASS Dept of Food Sci., Amherst Curcumin is a polyphenolic antioxidant found in Turmeric. Despite having several health benefits
including anticancer, and anti-inflammatory, its use in food and supplements is limited due to low water solubility, poor chemical stability, and low oral bioavailability. Our study showed that unlike naturally occurring curcuminoid mixtures (that contain curcumin, demethoxy-curcumin, and bisdemethoxy-curcumin), pure curcumin degraded quickly in alkaline aqueous solutions and crystallized out in acidic aqueous environments. Its water dispersibility and chemical stability was improved by incorporation into oil-in-water emulsions (30% MCT, 1 mg curcumin/g MCT, D32 ≈ 298 nm). After incubation at 37 °C for 1 month, >85% of curcumin was retained by emulsions stored under acidic conditions (pH < 7), whereas 62, 60, and 53% was retained by emulsions stored at pH 7.0, 7.4, and 8.0, respectively. Stability of curcumin in emulsions can also be impacted by emulsifiers due to their chemical nature. The extent of curcumin degradation in emulsions fabricated using four different emulsifiers decreased in the following order: saponins > gum arabic ≈ caseinate ≈ Tween 80 after storage at 55 °C for 15 days. These results suggest that saponins accelerate curcumin degradation. Our study shows that the stability of curcumin in food systems is influenced by physical factors such as pH and temperature, and also by the molecular environment. This information may be useful in formulating emulsion-based delivery systems for curcumin with improved physicochemical and functional properties.

AGFD 226 Identification and characterization of curcumin-metabolizing gut bacteria Ermin Zhao1, erminzhao@umass.edu, Katherine Chacon-Vargas2, John Gibbons1, Hang Xiao1. (1) Food Sci., Univ. of Massachusetts (2) Graduate Program in Molecular and Cellular Biology, Univ. of Massachusetts, Amherst Curcumin is a widely used yellow pigment exhibiting a variety of beneficial health effects. Our previous data have shown that human gut microflora can metabolize curcumin to produce metabolites with important biological activities. However, the identities of the bacteria and the bacterial genes involved in curcumin metabolism have been poorly studied. We hypothesized that the curcumin-metabolizing bacteria possess unique genes dedicated to curcumin metabolism which influence the bioavailability and anti-inflammatory effects to the human host. We surveyed the interactions between curcumin and 13 strains from human fecal bacteria, and cell-free supernatants were profiled for targeted metabolites using HPLC. For the first time, we identified three strains that were capable of metabolizing curcumin to produce its hydrogenated products and ferulic acid. Next, we sequenced the whole genome of each bacterium using Illumina HiSeq platform, and ran the large-scale BLAST score ratio (LS-BSR) pipeline to identify the unique genes that were potentially involved in curcumin metabolism. In conclusion, we use a combination of metabolic and genetics profiling to identify and characterize three gut symbionts Lactobacillus gasseri, Bifidobacterium bifidum and Bifidobacterium infantis that generated bioactive curcumin-metabolites. These results emphasized the importance of gut microbial genomes in biotransformation of food components and its impact on human health.

AGFD 227 Biopapers, a novel barrier and active electropun fiber based materials concept Kelly Johana Figueroa-Lopez2, Adriane Cherpinjisk1, Beatriz Melendez2,1, M Pardo-Figueroz2,1, C. Prieto2, Sergio Torres-Giner2, Jose M. Lagaron2, lagaron@iata.csic.es. (1) R&D, Biomacia, Paterna, Valencia, Spain (2) Novel Materials and NanoTech. Group, IATA-CSIC, Paterna, Valencia, Spain The main goal of this paper is to present recently developed and optimized high-barrier, antioxidative, antimicrobial, and oxygen scavenging mono- and multi-layered electropun materials, so-called biopapers, made of poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) derived from fruit waste, polycaprolactone (PCL) and other biopolymers, containing different extracts and nanomaterials. The resultant ultrathin fiber-based materials were post-processed to lead to continuous self-adhesive films. The morphology, thermal properties, mechanical, antioxidative, antimicrobial, barrier, and oxygen absorption properties of the nanocomposites and multilayers were investigated.

AGFD 228 Development of functional materials by utilizing bioresource polymers Jun Li, jun-li@nus.edu.sg. Dept. of Biomedical Eng., Nat’l Univ. of Singapore Considering the limitation of fossil-based materials, now more and more attention has been focused on the utilization of bioresources which are generally renewable and then environmentally friendly. Our research group has been working on developing high-value added novel functional materials using various molecules and polymers from bioresources or biomasses, which are produced by microorganisms, plants, and algae. My talk will highlight a few novel biomaterials developed in our lab for biomedical applications staring from biomass molecules and polymers such as cyclodextrins, polyhydroxybutyrate, lignin, and alginate, using these naturally occurring molecules and polymers as important building blocks for developing the functional biomaterials. For example, supramolecular molecules, hydrogels, and nanoparticles were developed from cyclodextrins for drug and gene delivery; novel smart hydrogels and nanovesicles were developed from polyhydroxybutyrate, gene carriers were developed from lignin, and injectable smart hydrogels releasing drug encapsulated micelles were developed from alginate.

AGFD 229 Pesticide-loaded cationic zein nanoparticle as a control agent against soybean looper Cristina Sabliov1, c.sabliov@lsu.edu, Sara Navarro1, Carlos E. Astete2, Jeffrey Davis3. (1) Biological and Agricultural Eng., Louisiana State Univ., Baton Rouge (2) Biological & Ag. Eng., Louisiana State Univ., Baton Rouge (3) Entomology, Louisiana State Univ., Baton Rouge Positively charged zein nanoparticles (ZNPs), 135±3 nm in diameter, monodisperse with a PDI of 0.202 ± 0.034 and a zeta potential of 81 ± 4 mV at pH 6, were engineered to adhere to plant tissues, roots and leaves. ZNPs were loaded with methoxyfenozide and chlorantraniliprole. Experiments using a diet overlay were conducted to evaluate the effects of nanoparticles alone and with entrapped pesticide on SBL. It was determined that empty nanoparticles killed neonates in a dose-response manner; the higher the concentration of the particles, the higher the mortality. An average of fifty percent SBL neonates were killed at 200 ppm nanoparticles regardless of the colony tested, but no third instars were affected. Particles loaded with chlorantraniliprole at 50, 100, and 200 ppm all resulted in 100% mortality in SBL neonates and third instars. Field experiments showed that nanodelivered methoxyfenozide controlled soybean looper (SBL) 28 days after treatment (DAT) in a field study, while methoxyfenozide alone controlled SBL out to 21 DAT only. Results indicated that positively charged zein nanoparticles could work as efficient delivery systems for hydrophobic pesticides and have the potential to be used in an integrated pest management program.

AGFD 230 Seed priming with nanomaterials from agro-industrial byproducts modulate the growth and metabolome of onion seedlings James Semper, Pratibha Acharya, Guddadarang K. Jayaprapaksha, gkjp@tamu.edu, Bhimu Patil. Vegetable Fruit Improvement Center, Texas A and M Univ., College Station Seed priming is one of the most promising approaches to improve germination, emergence, and seedling growth by altering seed vigor and/or the physiological state. Recently, nanoprimering gained importance in crop improvement due to small size and unique physicochemical characteristic of nanomaterial. In the present study, silver and gold nanoparticles (NPs) were synthesized using environmentally benign process involving the use of onion extracts as reducing agents. Similarly, agro-food industrial byproducts such as...
citrus seed oil and curcumin removed turmeric oleoresin were used for the preparation of nanoemulsions using a low energy method based on spontaneous emulsification. These industrial byproducts are eco-friendly, sustainable, cost-effective and bio-renewable platforms, and ideal sources for the production of green NPs. In the present study, two metal NP and two nanoemulsions were used for priming two onion cultivars such as “Legum” and pink root rot resistant cultivar “50147”. The priming method involves overnight soaking seeds with NPs solution at ambient temperature and seeds were incubated for a total of 72 h. The effect of seed priming with different nanomaterials on seedling growth, metabolites, and morphological profiles of onion varieties were studied on greenhouse for three weeks. Seed priming with these nanomaterials had positive effects on seed germination and seedling development. Untargeted metabolomics studies showed that different nano priming treatments distinctly altered the metabolome of onion seedlings. Moreover, seed priming treatments significantly modulate the gamma aminobutyric acid and 12-oxo phytodienoic acid level in onion seedlings.

AGFD 231 Therapeutic nanoparticles penetrate leaves and deliver nutrients to agricultural crops improving tomato yields Avi Schroeder, avidis@technion.ac.il. Chem. Eng., Technion Israel Inst. of Tech., Haifa, Israel As the world population grows, there is a need for efficient agricultural technologies to provide global food requirements and reduce environmental toll. In medicine, nanoscale drug delivery systems grant improved therapeutic precision by overcoming biological barriers and enhancing drug targeting to diseased tissues. Here, we loaded nanoscale drug-delivery systems with agricultural nutrients, and applied them to the leaves of tomato plants. We show that the nanoparticles – liposomes composed of plant-derived lipids, penetrate the leaf and translocate in a bidirectional manner, distributing to other leaves and to the roots. The liposomes were then internalized by the plant cells, where they released their active ingredient. Up to 33% of the applied nanoparticles penetrated the leaf, compared to less than one percent of free-molecules applied in a similar manner. In our study, tomato plants treated with liposomes loaded with Fe and Mg overcame acute nutrient deficiency which was not treatable using ordinary agricultural nutrients. Furthermore, to address regulatory concerns regarding airborne nanoparticles, we engineered liposomes that were stable only over short spraying distances (less than 2m), while the liposomes disassembled into safe molecular building blocks (phospholipids) over longer air flight distances. These findings support expanding the study of nanoTech. for delivering micronutrients to agricultural crops for increasing yield.

AGFD 232 Cellulose nanocrystals confined to polymer microgels Sujin Rebecca Lee, sujin@gatech.edu, Elsa Reichmanis, Jung Ok Park, Mohan Srinivasarao. Georgia Inst. of Tech., Atlanta Cellulose nanocrystals (CNCs) can be extracted by acid hydrolysis, thus removing the amorphous regions from fibrous matrix of plant cell walls. These bio-sourced particles, of about 100-200 nm long and 5-15 nm in width, have received a great deal of attention due to their superior mechanical and chemical properties. In addition, CNCs have the ability to form a chiral nematic or “cholesteric” liquid crystal phase in aqueous suspension, due to their rigid, rod-shaped structure; the particles align along a director and the director profile assumes a twisted conformation, giving rise to intriguing optical properties. Liquid crystals that are confined within curved boundaries are of interest to many scientists due to their important role in optoelectronic technologies. As such, intensive research has been conducted with various types of liquid crystals constrained to droplets or cylindrical environments. Such studies are significant because the curvature of liquid crystals costs elastic energy, and hence, we observe rich physical phenomena such as change in the director field that otherwise would have been hidden. Most of the fundamental studies of liquid crystalline phase of the cellulose nanocrystals were conducted as a film type or in the cells with flat boundaries, limited to certain concentration and time points. Here, we report on cellulose nanocrystals confined to pipiamp microsphere using inverse emulsion polymerization technique with microfluidics device. The chiral nematic phase of cellulose nanocrystals are well preserved within the polymer matrix, as characterized by optical microscopy. The droplet radius, R of the microgels can be adjusted by changing the volumetric flow rate of oil phase in a microfluidics device. Notably, the fabricated CNCs-PNIPAM microgels are able to exhibit swelling-deswelling behavior upon temperature change with well-organized structure.

AGFD 233 Tuning aesthetic and mechanical properties of oleogels via formulation of enzyme-enabled stereoisomeric molecular gelators Malick Samateh2,1, Sateesh S. Sagiri1, Riliwin Samrit1, George John1,2, gjohn@ecn.cuny.edu. (1) Chemistry and Biochemistry, City College of New York (2) Ph.D. Program in Chemistry, Graduate Center of the City Univ. of New York The mechanistic resemblance of molecular gels to solid fats (trans and saturated) makes molecular gelation an ideal alternative in developing fat-based food and cosmetic products. The recent upsurge in the preference for molecular gels/structured-oils is due to being healthier than conventional solid fats. Two isomeric low molecular weight gelators (LMWGs) namely mannitol dioctanoate (M8) and sorbitol dioctanoate (S8), synthesized by bio-catalysis, showed different behaviors towards structuring vegetable oils; while M8 formed oleogels with higher gel strength, the S8 gels were more aesthetic, translucent, and appealing. This study develops a means of adjusting the mechanical robustness and aesthetic appeal of products via studying the effect of varying the M8/S8 proportions. The results showed that parameters associated with aesthetic effect (e.g. % light transmittance), gel strength (e.g. rheology) and morphology were impacted by the ratio of the gelators, which was found to be capable of upregulating: i) the degree of transparency/aesthetic appearance in cosmetic application; ii) the degree of hardness in food application—comparable to the use of partial hydrogenation, employed for decades to control the degree of hardness. Therefore, this work enables the modulation of a gel’s aesthetic and organoleptic properties via a simple formulation of stereoisomeric molecular gelators.

AGFD 234 Reclaiming phosphorus from secondary treated municipal wastewater with engineered biochar Yulin Zheng1, yulin2@ufl.edu, Bin Gao2. (1) Agricultural and Biological Eng., Univ. of Florida, Gainesville (2) Agricultural Biological Eng., Univ. of Florida, Gainesville Phosphorus (P), a vital growth limiting nutrient, is often lost in wastewater discharge, which may not only deteriorate water quality but also accelerate P depletion. In this study, laboratory experiments were conducted to investigate the reclamation and reuse of P from secondary treated wastewater (STWW) by engineered biochar loaded with aluminum oxyhydroxides (AlOOH). Biochar loaded with colloidal and nanosized AlOOH crystalline flakes was successfully produced through direct pyrolysis of hickory wood chips pretreated with aluminum salt. STWW samples were collected from a local wastewater treatment plant to evaluate the P sorption ability of the engineered biochar. The real wastewater was used in batch sorption experiments and the results showed that the engineered biochar effectively removed P from the STWW with relatively fast kinetics (~3 h) and good capacity (8,346 mg-P/kg), mainly through the electrostatic attraction mechanism. When the engineered biochar was packed in fixed-bed columns, it also effective removed P from the real STWW. The P removal efficiencies of the fixed-bed columns were affected by biochar dosage and flow rate. Various fixed-bed filtration models were applied to simulate the column experimental data and the model results matched the experimental breakthrough curves of P well. After the use, the
engineered biochar was laden with P and thus significantly stimulated seed (Vigna radiata R. Wilczek) germination and early seedling growth. Findings from this study demonstrate that engineered biochar has promising applications in wastewater treatment because it can not only reduce P level in discharge to benefit the environment but also reclaim it as an agricultural fertilizer to improve P biogeochemical cycling and sustainability.

**AGFD 235 Behavior of nanosilver anchored inside cotton fiber in laundering water** Sunghyun Nam, sunghyun.nam@ars.usda.gov, Matthew B. Hillyer, Brian D. Condon, Michael Reynolds. USDA-ARS-SRRC, New Orleans, Louisiana Silver nanoparticles (nanosilver) are the most popular nanoparticle used in the textile market (such as socks, shirts, and underwear) to inhibit the growth of bacteria causing unpleasant odor and/or infections. However, recent studies show that nanosilver-containing textiles release significant amounts of silver into laundering water—up to 20-30% of the silver mass in textiles during the first laundering—and their releasing behaviors strongly depend on the methods of nanosilver attachment. In this study, we have encased nanosilver in the interior of cotton fiber by directly synthesizing nanosilver in the microfibrillar structure of the fiber and subjected the resulting nanosilver-cotton fabric to multiple simulated household launderings. After 50 laundering cycles, the loss of the surface plasmon resonance (SPR) intensity of nanosilver-cotton fabric was only 11.4%, and the corresponding color difference deduced from the CIE LAB coordinates was 5.0. The plots of SPR intensity and color difference as a function of laundering cycle exhibited slope changes at 20 and 10 cycles, respectively, above which they became less dependent on the laundering cycle. These results indicate that the nanosilver anchored inside cotton fiber is leach-resistant and thus can minimize the potential environmental risks while maintaining its full nanoenabled benefits across the lifecycle.

**AGFD 236 Biomineralization-mimetic shape-adjustable growth** of pristine and ultrahigh-load metal-organic frameworks on inert glass fibers to prepare hybrid membranes for collecting hazards in water/organic solvents Qi Zhang1, zhangqi94@zju.edu.cn, Zhishang Li1, Huang Dai1, Lin Zhang1, Yingchun Fu1, ycfu@zju.edu.cn, Yanbin Li1,2, (1) Zhejiang Univ., Hangzhou, China (2) Univ. of Arkansas, Fayetteville The collection of chemical hazards in liquids has drawn ever-increasing attentions for food safety and environment protection. The integration of filter membranes and metal-organic frameworks (MOFs) with superior adsorbability has opened a promising avenue. However, poor processability of MOFs puts significant barriers to improve concentration capability and develop hybrid membranes on demanded matrix membranes. Inspired by biomineralization, we proposed a strategy to grow pristine and ultrahigh-load MOFs on inert glass fibers (GF) to prepare GF@MOF (ZIF-8) hybrid membrane for effective concentration of organic hazards (OH) in water and organic solvents. BSA, as the biomineralization-mediator, was modified to GF via chemical modification to trigger the in-situ growth of MOFs. Comparing with conventional direct growth method with poor coverage of MOFs, this new method induced to continuous and dense coating of ZIF-8 on GF with a coverage rate of ~100%. Interestingly, besides of conventional particle-shape, ZIF-8 also presented sheet-flower- and wheatear-shape crystals. Surprisingly, the ZIF-8 in GF@ZIF-8 showed ultrahigh adsorbability to malachite green (MG, 10000 mg g-1) up to 10000 mg g-1, while ZIF-8 powder analogues only reached the best of ca. 1667 mg g-1. In chloroform, the adsorbability of ZIF-8 in GF@ZIF-8 also reached 10000 mg g-1. Accordingly, a possible self-sacrificing mechanism was suggested. The hybrid membrane was further used to develop a filter device for MG aqueous solution (30 mg L-1) with an efficiency of 99% in 15 s. This novel method and mechanism may provide a new approach to MOF-based membrane fabrication for hazard collection.

**AGFD 237 Continuous flow formulations by fast nanoprecipitation and in silico structure determination of selected agrochemical active ingredients** Ádám Bódis2, adam.bodis@innostudio.org, Ferenc Somodi2, Tamas Bihari1, Ferenc Darvas3. (1) Tech. Development, Innostudio, Inc, Budapest, Hungary (2) Nanoformulation Laboratory, Innostudio, Inc., Budapest, Hungary (3) Thalesnano Inc, Budapest, Hungary In the recent years, many different physical and chemical methods have been developed to increase the solubility and adsorption of water insoluble pharmaceutical or agricultural active ingredients (AIs). In spite of this, at industrial level production of the aforementioned AIs, almost exclusively physical methods using solid starting materials (such as wet media ball milling, piston-gap homogenization) are applied. These methods are energy efficient, and mostly produce particles in the micrometer range. It was shown that drug AI nanoparticles had greater uptake than microparticles, therefore precise particle size control is crucially important during preparation. Chemical methods, such as solvent/antisolvent nanoprecipitation and emulsion freeze drying, based on the bottom-up synthesis approach have the potential to deliver nanoparticles by careful choosing the solvent pairs and other additives (polymer stabilizers, surfactants, etc.). By utilizing the benefits of solvent/antisolvent precipitation, smooth setting of continuous-flow parameters and in silico selecting the right components, particle size control can be achieved feasibly. In our presentation, the effect of chemical and technological parameters on the average particle size of selected agricultural active ingredients and their physicochemical characterization by molecular dynamics methods will be presented.

**AGFD 238 Diet and microbiota during adulthood in health and disease** Gary Wu, gdwu@pennmedicine.upenn.edu. Univ. of Pennsylvania, Philadelphia The human gut contains a vast number of microorganisms known collectively as the “gut microbiota”. Substances delivered from the human world into the microbial world of the gut can have an impact upon the structure and function of the gut microbiota that, in turn, may have effects on its human host. Two examples are the impact of bile acids and diet on the gut microbiota. The suppression of endogenous bile acid synthesis via FXR activation can be used as a model for the impact of bile acids on the composition of the small intestinal microbiota in humans (Friedman ES et al. Gastroenterology 2018). Diet can also have an effect on both the composition of the gut microbiota as well as its metabolome in a way that may be relevant for the treatment of inflammatory bowel disease (IBD). There is epidemiologic data associating diet with the development of IBD as well as evidence that diet can influence both the form and function of the microbiome in a manner that impacts upon the development of intestinal inflammation (Altenberg LG and Wu, GD. Gastroenterology 2014). Based on this evidence, studies are now underway to examine the effect of defined formula diets (DFDs), an effective therapeutic modality in Crohn’s disease, on both the gut microbiome and its metabolome as a therapeutic probe with the hope of better defining the “healthy” diet in patients with IBD (Lewis JD et al. Cell Host & Microbe 2015). Diet has an impact upon both the composition and function of the microbiota in part through small molecule production that may influence development of both immune-mediated and metabolic diseases (Ni, J et al. Science Translational Medicine 2017). In this regard, studies are currently underway to determine the relationship between the impact of diet on the composition of the gut microbiota and the metabolites that are produced. In total, these results demonstrate the potential promise of dietary manipulation of the gut microbiota and its metabolome as a modality to both maintain health and treat disease. In order to
accomplish this goal, there is a need for human intervention studies to demonstrate cause-and-effect relationships.

AGFD 239 Antioxidative properties of dietary quercetin in plasma and tissues in diet-induced obese mice and aged mice Masuko Kobori, kobori@affrc.go.jp. Food Research Inst., NARO, Tsukuba, Ibaraki, Japan  Accumulating evidences suggest that the dietary intake of the flavonoid quercetin prevent non-communicable diseases (NCDs). We previously showed that quercetin is mainly ingested from onions, green tea and green vegetables, and partial correlation analysis adjusted for age showed that quercetin intake was negatively correlated with diastolic blood pressure in residents of a town in Japan. Addition of quercetin to the diet prevented obesity and metabolic syndrome in diet-induced obese mice. Antioxidative effect of quercetin was suggested to be associated with alleviation of inflammation and fat accumulation in the liver and visceral adipose tissues in the mice. We also showed that quercetin enhanced memory in aged mice. Dietary 0.5 fatty acids DHA and EPA are reported to improve cognitive function and reduce plasma triglyceride levels. To know the beneficial effects of quercetin through dietary life, we examined the effect of 5% (w/w) fish oil containing DHA and EPA (DHA) in a diet on the antioxidant properties of quercetin in the plasma and tissues in diet-induced obese mice. C57BL/6J mice were fed a control diet; a Western diet high in fat, sucrose, and cholesterol; the Western diet containing 0.05% quercetin; the Western diet containing DHA; or the Western diet containing DHA and quercetin for 18 weeks. DHA enhanced the antioxidative property of quercetin in the plasma and the liver in the diet-induced obese mice, however, DHA counteracted the antioxidative and anti-inflammatory effects of quercetin in the epididymal adipose tissue in the obese mice. Quercetin did not significantly suppress the oxidative stress marker in cerebral cortex in mice fed a Western diet. However, we confirmed that quercetin improved memory and increased the expression of the antioxidant enzyme in cerebral cortex in aged mice fed a Western diet. We are now studying on the involvement of antioxidative properties in the mechanism of enhancing memory in the aged mice.

AGFD 240 Current research in intestinal microbiota, synbiotics, and obesity-related disease Hyunsook Kim1, hyuns15@hanyang.ac.kr, Kun-Ho Seo2, Dong-Hyeon Kim2, Wallace H. Yokoyama3. (1) Hanyang Univ., Seoul, Korea (Republic of) (2) Konkuk Univ., Seoul, Korea (Republic of) (3) USDA ARS Western Reg Rsrch Lab, Berkeley, California  Intestinal microbiota altered by the action of prebiotics and probiotics may confer significant health benefits against dysfunction of peripheral tissues in obesity-related metabolic diseases. Previously we demonstrated that prebiotic grape seed flour (WGF) and newly isolated probiotic kefir lactic acid bacteria improved obesity-related metabolic disease in high-fat induced obese mice. Recently, we have studied combined effects of WGF and newly isolated kefir lactic acid bacteria (LAB). Supplementation of GSF and LAB resulted in significant decreases in HF-induced weight gain, liver weight, adipose weight, and plasma total cholesterol and insulin levels. Microarray analysis results showed mechanisms related to improvement in hepatic steatosis and obesity. Next generation sequencing (NGS) analysis have revealed that combination of GSF and LAB induced dynamic changes in the intestinal microbiome that are closely associated with the regulation of diet-induced obesity, polyphenol conversion, and butyrate production. Our current researches support that health benefits derived from supplementation of GSF and LAB is in part mediated via synergistical modulation of intestinal microbiota.

AGFD 241 Epicatechin reverses aging-induced skeletal muscle dysfunction and prolongs lifespan in mice Hongwei Si1, hsi@tnstate.edu, Xiaoyong Wang1, Lijuan Zhang1, Chao-qiang Lai2. (1) Tennessee State Univ., Nashville (2) ARS/USDA, Boston, Massachusetts  Epicatechin, a bioactive compound occurs in various common foods including cocoa, beans, berries, apples, and tea, promoted general health and survival of obese diabetic mice in our recent study. It remains to be determined whether epicatechin extends healthy lifespan. In the present study, epicatechin or its analog EGCG (0.25% w/v in drinking water) was administrated to 20-month old male C57BL mice fed a standard chow for determining the effects of epicatechin on aging. Results show that supplementation of epicatechin for 37 weeks strikingly increased the survival rate from 39% to 69%, whereas EGCG was inactive. Consistently, epicatechin improved physical activity, delayed skeletal muscle degeneration and shifted the profiles of the serum metabolites in aging mice toward the metabolite profiles observed in young mice. Our analysis found that dietary epicatechin significantly reversed aging-altered mRNA and protein expressions of extracellular matrix (ECM) and peroxisome proliferator-activated receptor (PPAR) pathways in skeletal muscle tissue, and reversed the aging-induced declines of the nicotinate and nicotinamide (NAD) pathway as both serum metabolites and skeletal muscle gene expression. The present study provides novel information on natural compounds and anti-aging research in the manner that epicatechin supplementation was demonstrated to exert anti-aging and anti-sarcopenia effects in normal aging mice by mimicking exercise, as deduced by comparison to exercise intervention data. Results from this study provide direct evidence for one strategy to promote healthy aging and extend lifespan in humans simply by consuming more natural foods having high content of epicatechin.

AGFD 242 Effects of rice with different amount of resistant starch on mice fed high-fat diet: Attenuation of adipose weight gain Jiawei Wan1,2,3, jiaweew925@gmail.com, Yanbei Wu4,2,3, Quynhchi Pham2, Liangli Yu3, Ming-Hsuan Chen5, Anna M. McClung5, Stephen Boue6, Wallace H. Yokoyama7, Bin Li1, Thomas T. Wang2. (1) Huazhong Agricultural Univ., Wuhan, Hubei, China (2) Diet Genomics and Immunology Laboratory, USDA ARS, Beltsville, Maryland (3) Univ of Maryland, College Park (4) Sichuan Univ., Chengdu, Sichuan, China (5) Dale Bumpers National Rice Research Center, USDA ARS, Stuttgart, Arkansas (6) Southern Regional Research Center, USDA ARS, New Orleans, Louisiana (7) Healthy Processed Foods Research Unit, USDA ARS, Albany, California  Recent literature suggests increasing amount of resistant starch (RS) in diet may confer protective effects on chronic diseases such as obesity, CVD and diabetes. Rice is a staple food rich in starch and can be a good dietary source of RS. However, it remains unclear if RS and its amount consumed in the form of rice may have health benefit. To answer these questions, we examined the effect of rice varietal containing different levels of RS as the main carbohydrate source in a rodent diet-induced obesity model. C57BL/6J mice (n=60, male, 5 weeks old) were randomly assigned to six groups: 1) low-fat (10%) and low-RS (Tian, 0.11 wt.% RS) diet (LF-LRS); 2) high-fat (39%) and low-RS diet (HF-LRS); 3) low-fat and medium-RS (Presidio, 1.07 wt.% RS) diet (LF-MRS); 4) high-fat and medium-RS diet (HF-MRS); 5) low-fat and high-RS (Mutant, 8.61 wt.% RS) diet (LF-HRS); and 6) high-fat and high-resistant-starch diet (HF-HRS). The animals were fed the diets for 8 weeks. We found that the main fecal SCFAs (acetate, propionate and butyrate) content was significantly (p < 0.0001) higher in HRS groups than other RS groups. Also, the epididymal fat mass gain induced by high-fat diet was attenuated by MRS and HRS intake. The adipose weight changes correlated (p < 0.01) with changes in the leptin, adiponectin, and lipoprotein levels in plasma, as well as the triglyceride level in liver. Furthermore, the mRNA levels of the enzymes involved in triglyceride (ACAT1, ACOX1, FASN, LPL) and cholesterol (LCAT, HMGCR, CYP51) metabolism in the liver were also significantly (p < 0.01) correlated with the adipose weight. These data suggest that
daily intake of rice containing RS as low as 1% might attenuate fat deposit induced by high-fat diet.

AGFD 243 Western diets affect hippocampus metabolism and neuropeptides through gut-microbiota-brain axis Miao Zhang1, 541280513@qq.com, Shangxin Song2, Guanghong Zhou1, Xinglian Xu1, Chunbao Li1. (1) Key Laboratory of Meat Processing and Quality Control, MOE; (2) Key Laboratory of Meat Processing, MARA; Jiangsu Collaborative Innovation Center of Meat Production, Processing and Quality Control; College of Food Sci. & Tech., Nanjing Agricultural Univ., Jiangsu, China. Our data uncover a relationship between Western diets and hippocampus metabolism. Specifically, the expression of SIRT1 and AMPK, enzymes involved in energy metabolism and stress response, was altered in hippocampus tissue from mice on Western diets. Additionally, the abundance of certain neuropeptides, such as GABA and BDNF, was also affected. Collectively, these findings suggest a potential role for dietary factors in regulating hippocampus metabolism and neuropeptides.

AGFD 244 Activation of AMPK/SIRT1 pathway contributes to Salvinorin acid A-conferred protection against lipotoxicity in hepatocytes and NAFLD in mice Songtao Li, lisongtao@vip.126.com, Qianyu Qian, Na Ying, Jianfei Lai, Luyan Feng, sitong Zheng, Fusheng Jiang, Qianyuan Ding, Hui Chai, Xiaobing Dou, Zhejiang Medical Univ., Hangzhou, China. Salvinorin acid A (Sal A), a natural polyphenol compounds extracted from Radix Salvia miltiorrhiza (known as Danshen in China), has been shown possessing lots of potential pharmacological activities. This study aimed to investigate the hepatoprotective effects of Sal A against lipotoxicity in high-fat diet (HFD)-fed c57Bl/6 mice and cultured human hepatoma cell line (HepG2), and further explore the potential mechanisms underlying this process. Our results showed that Sal A treatment significantly attenuated HFD-induced weight gain, liver injury, and lipids accumulation in the liver of mice. Sal A incubation markedly reversed palmitic acids-induced cell death in HepG2 cells. Further mechanistic investigations revealed that Sal A treatment did not alleviate lipotoxicity-altered expressions of phosphorylated-JNK, -p38, -ERK1/2, and -PKA in cultured hepatocytes. However, Sal A robustly reversed both HFD- and palmitic acids-decreased AMPK-activated protein kinase (AMPK) phosphorylation and sirtuin 1 (SIRT1) expression. Sal A up-regulated phosphorylated-AMPK and SIRT1 expressions in a dose-dependent manner. Silencing either AMPK or SIRT1 gene expression using siRNA abolished Sal A-protected cell death-induced by lipotoxicity. AMPK silencing significantly blocked Sal A-increased SIRT1 expression, otherwise, SIRT1 silencing did not affect Sal A-upregulated phosphorylated-AMPK, indicating AMPK was involved in Sal A-increased SIRT1. Collectively, our data uncover a novel mechanism for Sal A in protecting hepatocytes against lipotoxicity-induced injury of HFD-fed mice liver and palmitic acids-exposed hepatocytes.

AGFD 245 Advancing the detection of immunoreactive cereal proteins to protect sensitive individuals Katharina Scherf, katharina.anne.scherf@gmail.com, Leibniz-Inst. for Food Systems Biology at the Technical Univ. of Munich, Germany. Wheat is one of the most important sources of nutrition for humankind. However, the prevalence of inflammatory reactions to wheat, such as celiac disease (CD), wheat allergy and non-celiac gluten sensitivity (NCGS) is increasing and may affect up to 10% of the population. The immunoreactive triggers are gluten proteins in case of CD, both gluten and non-gluten proteins in case of wheat allergy, and most likely α-amylase/trypsin inhibitors (ATIs) in NCGS. The only effective treatment for these entities is a gluten-free diet and improvements of analytical methods are urgently required to protect sensitive individuals. Therefore, the aim was to advance the detection of immunoreactive cereal proteins using enzyme-linked immunosorbent assays (ELISA) and liquid chromatography mass spectrometry (LC-MS/MS). First, improved reference materials (RM) for gluten from wheat, rye, barley and oats to be used in gluten analytical method development and validation were developed. Having studied the recognition profiles of the antibodies currently used in gluten ELISA test kits, four novel target sequences for antibody generation were identified and a new kit now enables the comprehensive detection of gluten. Further, targeted LC-MS/MS proteomics methods were developed for ATIs, selected CD-active peptides as well as gluten and the use of well-defined gluten RM allowed the first ever accurate conversion of marker peptide concentrations to gluten contents in different food products. These substantial advances in gluten analytical method development will enhance food safety for CD patients and help elucidate causes for the increasing prevalence of CD, NCGS and allergies in the population.

AGFD 246 Agnes Rimando, a pioneer in the fate of glyphosate and its primary metabolite in plants John W. Finley1, JFINLE5@LSU.EDU, Stephen O. Duke2. (1) Louisiana State Univ., Baton Rouge (2) NPURU, USDA/ARS, Oxford, Mississippi. Glyphosate is the most used pesticide on the planet because of its excellent efficacy and due to the large scale adoption of transgenic, glyphosate-resistant (GR) crops. Agnes Rimando became an expert in glyphosate analysis almost 20 years ago to support research on GR crop safety and on mechanisms of evolved glyphosate resistance by weeds. Her work was instrumental in providing support for the view that “yellow flash” symptoms in GR soybeans are due to the chemistry work on the only paper to survey the capacity of an array of plant species’ capacity to metabolize glyphosate to AMPA. Since then substantial studies demonstrate that pterostilbene have excellent efficacy and due to the large scale adoption of transgenic, glyphosate-resistant (GR) crops. Agnes Rimando became an expert in glyphosate analysis almost 20 years ago to support research on GR crop safety and on mechanisms of evolved glyphosate resistance by weeds. Her work was instrumental in providing support for the view that “yellow flash” symptoms in GR soybeans are due to the chemistry work on the only paper to survey the capacity of an array of plant species’ capacity to metabolize glyphosate to AMPA. Since then substantial studies demonstrate that pterostilbene have substantial advances in gluten analytical method development will enhance food safety for CD patients and help elucidate causes for the increasing prevalence of CD, NCGS and allergies in the population. glyphosate approached the legal limits. However, she later found that accumulating in GR soybean se...
dive diverse pharmacological activities for the prevention and treatment of diseases including inflammation, cancer, diabetes and dyslipidemia. Recent progress on health promoting properties of pterostilbene will be discussed.

**AGFD 248 Early career discovery of bioactive natural products**

Michael Appell, michael.appell@gmail.com. USDA-ARS, Dunlap, Illinois Dr. Agnes Rimando carried out important research that led to the identification of medicinal agents from plants as part of her doctoral studies in pharmacognosy at the UIC College of Pharmacy in Chicago. Novel lignans possessing anti-HIV activity were isolated from Anogeissus acuminatae and characterized. Following her graduate work, Dr. Rimando joined the USDA’s Agricultural Research Service and elucidated the mechanisms and modes of actions of several bioactive natural products, including the mycotoxin fusaric acid. The early career achievements of Dr. Agnes Rimando set a solid foundation for impactful research and serve as an inspiration to young scientists from around the world.

**AGFD 249 Methods for identifying and characterizing health-promoting compounds in fruit and other agricultural products:**

Tribute to the work of Dr. Agnes Rimando Lauren Jackson, Lauren.Jackson@da.hhs.gov. FDA, Bedford Park, Illinois Agricultural products such as fruits, vegetables and grain contain numerous bioactive compounds including natural antioxidants that demonstrate health-promoting effects. Resveratrol and other antioxidant components have demonstrated a diverse range of pharmacological activities including cancer prevention, cholesterol-lowering effects, and enhancement of insulin sensitivity. This presentation will highlight some of the exceptional and far-reaching research accomplishments of Dr. Agnes Rimando, particularly her work on identifying and characterizing health-promoting compounds in fruit and other agricultural products.

**AGFD 250 Agnes Rimando, scientist and international ambassador**

Huai N. Cheng, hnceng@ars.usda.gov. Southern Regional Research Center, USDA Agricultural Research Service, New Orleans, Louisiana It was with sadness that I prepared this abstract. Agnes Rimando was a superior scientist, a congenial colleague, and a valuable (and hardworking) volunteer for ACS and the global chemistry enterprise. Her untimely demise in July 2018 was a great loss to ACS and to her friends. I know other speakers in this special symposium in her honor will cover her scientific work. For my part, I will discuss her involvement in international activities. Indeed, she made huge contributions in this area. First, her background was international as she was born and educated in the Philippines and subsequently worked in the U.S. and Japan. Secondly, she had an international outlook and made friends all over the world. She collaborated with numerous colleagues and visited many countries in the world. She had a reputation for being “fearless about going anywhere or tackling any problem.” Thirdly, she was a member of ACS International Activities Committee (IAC) for eight years, and for a portion of that time, she was the Chair of the IAC Subcommittee on the Asia Pacific region. She made many contributions to the committee, including interactions with our Asian colleagues, organization of symposia and events, and planning for educational and outreach activities. She also travelled to Asia on behalf of IAC and was effective as an Ambassador for Chemistry. I was fortunate to have served with her on IAC. We also co-edited an ACS book, together with Diane Schmidt and Bradley Miller, on “Chemistry without Borders: Careers, Research, and Entrepreneurship.” The book, published in 2016, included 19 chapters on chemistry workforce, educational exchange, research, career development, and entrepreneurship, all in the international context. It turned out to be a memorial for her. Although she has departed, her memory will always be with us.

**AGFD 251 Healthy and tasty berry fruits from pterostilbene**

Michael C. Qian, michael.qian@oregonstate.edu. Oregon State Univ, Corvallis Nonflavonoid components in berry fruits are well known for their antioxidant activities. Stilbenes, such as resveratrol and pterostilbene, have strong antioxidant properties contributing to the protection against neurodegenerative diseases and cancer as demonstrated by Agnes Rimando. Using a plant system, Rimando et al. (2004) demonstrated stilbenes can reduce oxidative damage, as measured by electrolyte leakage, by 30-50% in comparison with the controls. Different berry species, including the cultivated varieties, are shown to contain varying amounts of stilbenes, specifically resveratrol, pterostilbene, and piccatannol. Along with the other phenolic compounds, Agnes Rimando has proved the stilbenes can add to or act synergistically to provide health benefits. The increased awareness of health benefits of berry fruits has promoted research in both horticulture and Food Sci. fields to address the fruit quality, especially in flavor quality. Over the past 18 years, we have been using flavoromics approach to assist plant breeding program to develop healthy and tasty berry fruits, including blackberry, raspberry, blueberry and other small fruits. Our research directions in this area are to identify the key aroma compounds responsible for the characteristic aroma of these fruits, understand the agronomic impact on the metabolism of key flavor compounds, and relate aroma trait with genomics to understand flavor inheritability during breeding. Using the ‘Marion’ blackberry as the gold flavor standard, we evaluated many blackberry varieties in the breeding program through both sensory evaluation and chemical analysis. Through collaborative efforts with USDA plant breeding program, many new blackberry cultivars have been released to industry, including ‘Obsidian’, ‘Metolius’, ‘Black Pearl’, ‘Nightfall’, and ‘Black Diamond’. Among these, ‘Black Diamond’ is probably the most significant release because of its high-yield and flavor quality similarity to the gold-standard ‘Marion’ blackberry. ‘Black Diamond’ has been the most abundant cultivar in Oregon. This presentation will also cover out flavor chemistry research on raspberry and blueberry, one of Agnes’s favorite small fruits.

**AGFD 252 Inactivation of pathogenic bacteria, fungi, and protozoa by phenolic and other natural compounds**

Christina Tam1, Christina.tam@ars.usda.gov, Jong Heon Kim1, Carol Levin2, Luisa W. Cheng3, Kirkwood Land4, Mendel Friedman2. (1) Foodborne Toxins Detection and Prevention Research Unit, Agricultural Research Service, USDA, Albany, California (2) Healthy Processed Foods Research Unit, Agricultural Research Service, USDA Albany, California (3) Foodborne Toxin Detection and Prevention Research Unit, Western Regional Research Center/ARS/USDA, Albany, California (4) Dept. of Biological Sciences, Univ. of the Pacific, Stockton, California, US The increase in drug and multi-drug resistant pathogenic strains of bacteria, fungi, and protozoa is a global public health issue. The protozoan pathogen, Trichomonas vaginalis, causes the sexually transmitted disease trichomoniasis in humans. The related trichomonosis diseases in food-producing (cattle and pigs) and domestic (cats) animals is caused by two different strains of the related protozoan Trichomonas foetus. Because treatment with the human drug metronidazole is often ineffective owing to antibiotic resistance, we have explored the potential of plant extracts and their bioactive molecules to inhibit the growth of various pathogenic organisms. We have found that the tomato glycoalkaloid α-tomatine is highly effective in inhibiting all three trichomonads with IC50 values in the low mM range and that extracts from various parts of a wild tomato plant had specific anti-protozoal, anti-fungal, and anti-bacterial activity. The potato glycoalkaloids α-chaconine and α-
AGFD 253 Agnes Rimando’s studies of sorgoleone, a weed-fighting quinone  Stephen O. Duke1, stephen.duke@ars.usda.gov, Zhijiang Pan1, Franck E. Dayan2, Scott Baerson1.  (1) NPURU, USDA/ARS, Oxford, Mississippi, US (2) BSPM, Colorado State Dept., Fort Collins  Agnes Rimando co-authored more than a dozen papers and was co-inventor of three patents involving sorgoleone, a quinone produced by Sorghum spp. She was involved in showing that this phytoalexin is produced only in the root hairs of Sorghum spp. and that it is a good inhibitor of photosystem II of photosynthesis. Sorgoleone is used by the producing plant as an allelochemical to inhibit competing weeds. Her amazing skills in natural products and analytical chemistry were instrumental in verifying the sorgoleone biochemical pathway and identifying the genes encoding the enzymes of that pathway. Some of these findings were useful in her work on pterostilbene, when a group with her assistance showed that the gene for the unique O-methyl transferase in the sorgoleone pathway can be used as a transgene, along with a stilbene synthase gene, to impart pterostilbene production into other plant species. Work with the sorgoleone pathway is leading to transgenically imparting sorgoleone production into other crops to enhance their weed-fighting capabilities. Her talents and scientific insights will be greatly missed.

AGFD 254 Subcritical hydrolysis of ice-cream wastewatere for value-added applications  Maryam Enteshari2, maryam.enteshari@sdsstate.edu Sergio Martinez-Montagueudo1, Sergio.MartinezMontagueudo@sdsstate.edu. (1) Dairy and Food Sci., South Dakota State Univ., Brookings (2) Dairy and Food Sci., South Dakota State Univ., Brookings  The generation of wastewater (WW) in ice-cream manufacturing results from cleanup operations. It is estimated that around 8-12 L of WW is generated per kg of product. The protein content in the ice-cream WW significantly contributed to its high content of organic load, which has proved to be problematic for the receiving effluent treatment plant. The goal of this study was to investigate the subcritical hydrolysis of ice-cream WW to produce a feedstock of amino acids for value-added applications. The influence of time (0-200 min), temperature (170-230°C), and pH (3-9) was studied in a continuous stirred-tank reactor operated at 40 bar. The extent of hydrolysis was monitored by measuring the degree of hydrolysis (DH), recovered total amino acids and individual amino acids in the hydrolyzed fraction. The reaction time and temperature significantly increased the DH, reaching maximum values between 85-98% depending on the pH. The highest value of recovered amino acids in the hydrolyzed fraction was ~50 mg of amino acid per g protein, depending on the pH and gradually decreased with time and temperature (15-20 mg amino acid per g protein). The production of amino acids strongly depends on the hydrolysis conditions (time, temperature, and pH). Glutamic acid was the predominant amino acid in the hydrolyzed fraction (27-32%), followed by proline (11-15%), leucine (8-10%), and valine (6-8%). The recovery of amino acids such as aspartic acid, serine, cysteine, methionine, and histidine was less than 5%. The outcomes of this research indicate that subcritical hydrolysis is a controlled pathway to convert an otherwise waste material into valuable industrial feedstock.

AGFD 255 Biomolecular interactions between myoglobin, mitochondria, and metabolites governing fresh meat color  Ranjith Ramanathan, ranjith.ramanathan@okstate.edu. Animal and Food Sci., Oklahoma State Univ., Stillwater  Consumers associate bright-red lean of beef with freshness and wholesomeness. Discoloration of meat has resulted in an annual loss of $1 billion to the US meat industry. In postmortem muscle, mitochondria remain active and can influence beef color by two important biochemical processes such as oxygen consumption (related bloom) and metmyoglobin reduction (related to minimizing brown color). Enzymes involved in glycolysis and tricarboxylic acid cycle can generate reducing equivalents such as succinate or reduced nicotinamide adenine dinucleotide to influence beef color. Moderate mitochondrial activity is critical to have steaks that are bright cherry-red and to have longer color stability. However, various pre- and post-harvest factors can impact mitochondrial activity. The current presentation will focus on the role of interactions between mitochondria, myoglobin, and metabolites in fresh beef color stability. More specifically on how metabolite and mitochondrial interaction can affect bloom and muscle-specific differences in color stability. Recent research our laboratory has utilized metabolomics techniques to characterize the metabolite profile differences between normal and dark-cutting beef. The results suggest that dark-cutting beef has fewer metabolites and greater mitochondrial concentration. The ability of the heme to undergo reduction and/or oxygen binding ability is dependent on amino acid composition. Traditional spectrophotometric techniques will not allow characterizing ligand binding or heme reduction properties. Hence, electrochemistry approach was utilized to investigate the changes in the microenvironment to the atomic level of heme and at the active site. In summary, biomolecular interactions between myoglobin, mitochondria, and metabolites can influence fresh meat color.

AGFD 256 Evolution and future needs of food chemistry in a changing world  John W. Finley, jfinley5@lsu.edu Louisiana State Univ., Baton Rouge  The agriculture system is tasked with the responsibility to deliver adequate quantities of food that provides health benefits and meets national needs in an environmentally sustainable way. Efforts by the food industry to deliver safe and nutritious foods, which also improve health and wellness, are complicated by a constantly changing landscape. For example, in the 80’s and early 90’s fat was an evil component in foods and in response the industry developed zero and low-fat foods. The dietary guidelines in the 2000’s have evolved to a greater concern over simple sugars and starches as negative sources of calories in an environment of increasing obesity. Prebiotic and probiotic interactions are now an increasing emphasis to promote health. Concomitant interest in foods rich in antioxidants evolved to food bioactives that reduce markers for inflammatory diseases. Concern over additives and agrochemicals has spurred the market of “natural” and “organic” foods which must be part of sustainable food production. With the world population approaching 9 billion individuals by 2050, food production, which relies on large amounts of water and energy, must become more efficient. Food production and delivery also must find innovative ways to reduce food waste and environmental pollutants, including greenhouse gas production. The Nexus of Food, Energy and Water is and will continue to be a major research, political, and communication emphasis for the scientific community. We must find clear and consumer friendly communications to explain the utilization of modern Tech. in food production. Solutions to these issues must include sustainably produced safe and wholesome foods with appealing tastes. The evolution of food production and delivery must also consider culinary input.
AGFD 257 Utilizing the organization of nanocellulose and semiconducting polymers towards next generation bio-based electronics Bailey Ristineen, Elsa Reichmanis, elsa.reichmanis@chbe.gatech.edu. Georgia Inst. of Tech., Atlanta Here we discuss ongoing research towards developing renewably-sourced and recyclable devices by utilizing the self-assembly of cellulose nanocrystals (CNCs) and their interactions with functional polymers. CNCs are naturally-abundant, bio-derived, rodlike nanoparticles with a high aspect ratio that give rise to liquid crystal phases. These bio-based liquid crystal systems can provide a basis for temperature-based sensors by grafting a thermoresponsive polymer from the particle surface or even serve as soft "templates" for enhanced ordering of water-soluble conjugated polymers. More recently, we have demonstrated the ability of polymer-grafted-CNCs to act as structure-directing agents for the semiconducting polymer, poly(3-hexylthiophene) (P3HT). CNCs were functionalized with either polystyrene, P3HT, or poly(N-isopropylacrylamide) and were blended with P3HT in solution to study the effect on conjugated polymer self-assembly. The presence of polymer-grafted-CNCs resulted in an increase in P3HT semicrystalline aggregate formation due to unfavorable polymer-polymer interactions at the CNC surface and spatial confinement effects imposed by phase separation. Furthermore, films cast from the polymer-grafted-CNC/P3HT blends exhibited higher charge-carrier mobilities—in some cases a 6-fold increase—when tested in an organic field-effect transistor. These bio-derived particles constituted a significant volume (~30%) of the deposited P3HT thin films with an increase in performance, showing promise as a method for reducing costs and improving the recyclability of organic electronics.

AGFD 258 Bio-derived molecular materials: Ability to adapt, clean, energy storage and therapeutic George John, gjohn@ccny.cuny.edu. City College of New York, Dept. Chem. Developing functional materials from renewable resources would be fascinating yet demanding practice, which will have a direct impact on industrial applications, and economically viable choices. This talk discusses an emerging model of generating new chemicals, intermediates and materials in a ‘biorefinery’. Our continued efforts in this area have led us to develop new molecular materials through non-covalent synthesis of amphiphilic molecules derived from industrial by-products and co-products. The family of new materials generated include emulsions, molecular gels, solid bilayers, scintillating gels, battery components and liquid crystals. More recently, harnessing the availability of ‘chiral pool’ of carbohydrates and selectivity of enzymes catalysis, our laboratory produced an array of amphiphilic molecules from simple sugars and sugar alcohols conjugating with appropriate fatty acids. Intriguingly, following the principles of green and supramolecular chemistry, we have developed building blocks-to-assembled materials viz vegetable oil structuring agents and green battery components. Redox-active organic compounds are re-emerging in the energy storage community bringing with them interesting opportunities such as design flexibility, lightweight, low cost and/or restrained environmental burden. These results will lead to efficient molecular design of next generation multifunctional materials from underutilized plant/crop-based renewable feedstock.

AGFD 259 Graft-modification of chitosan biopolymer with phosphonated polymer via nitroxide-mediated polymerization Xavier Solimando1,3, Pascale Champagne1,3, champagne@civil.queensu.ca, Michael Cunningham2. (1) Civil Eng./Chem. Eng., Queens Univ., Kingston, Ontario, Canada (2) Chem. Eng., Queen's Univ., Kingston, Ontario, Canada (3) Beatty Water Research Centre, Queen's Univ., Kingston, Ontario, Canada Over the past decade, research on the development of new chitosan-based bio-source materials has continued to increase. Interest in this renewable amino-polysaccharide comes from its biocompatible, biodegradable or antibacterial properties. Chitosan (CTS) is a deacetylated (> 50%) chitin, the second most abundant biopolymer on earth; primarily from crustacean shells, but also fungal biomass and insect cuticles). Unmodified CTS has been reported to exhibit some beneficial properties for water and wastewater treatment, medical, cosmetic or agricultural applications. As such, recent research has focused on the modification of CTS to improve and tune its properties; improved solubility in organic solvents, miscibility with other matrices or affinity for molecules of interest, producing innovative materials with specific properties. Controlled radical polymerization (CRP) is a powerful tool for designing new CTS-based materials grafted with well-defined and functional (co)polymers. Phosphorous-containing polymers are a class of synthetic polymers that have been the focused of interest for the materials community due to their unique and interesting properties. They are found in a wide range of applications, including biomedical, metal complexation, fire retardant additives, fuel cell membranes, etc. In this work, we described the synthesis of hybrid material (bio-/synthetic polymers) obtained by graft modification of CTS, from the primary hydroxyl group, with poly(dimethyl(methacryloyloxy)methyl phosphonate) (PMAPC1) via grafting touting nitrooxide-mediated polymerization (NMP). First, well defined PMAPC1 was prepared via NMP with the blockbuilderTMalkoxyamine. Separately, CTS was functionalized with glycidyl methacrylate (GMA). Finally, PMAPC1 was grafted onto CTS-GMA via intermolecular radical 1,2-addition in aqueous media. The reversible complexation of CTS-GMA with sodium dodecylbenzenesulfonate (SDBS) allowed the grafting tereaction to be performed also in organic solvent.

AGFD 260 Customization of chemical structure and reactivity of agro-based materials for applications in coatings Vijay M. Mannari, vmannari@emich.edu. Eastern Michigan Univ, Ypsilanti Agro-based materials such as vegetable and plant oil, rosin, and their derivatives have been historically used in coatings. The availability of petro-based raw materials with consistent quality and at low cost replaced many agro-based products from their applications in coatings. However, in the recent years, due to the increased awareness and consumer preference for sustainable and safe products, there is an opportunity to develop agro-based raw materials supply chain. For their commercial acceptance in coatings and related products, they must be chemically modified to mitigate their inherent limitations and customized to suit the needs of the current and emerging technologies. We have developed novel polyols by chemically combining flexible soybean oil derivatives with hard gum rosin, besides other materials. The thermost coatings and UV-curable nail-gels based on these polyols show very promising results. We have also developed Bisphenol-A (BPA) free epoxy resin from sorbitol-based commercial raw materials and have demonstrated the feasibility of replacing toxic BPA from epoxy resins. This presentation will also highlight the performance of some end-use coatings to illustrate applications of customized agro-based raw materials.

AGFD 261 Characterization of carbohydrate polymers using molecular rotor as a structural probe Yuan Yao, yao1@purdue.edu. Purdue Univ., West Lafayette, Indiana Molecular rotor (MR) is a group of special fluorophores that typically consist of an electron donor, an electron receptor, and a π-π-conjugation system (denoted as the D-π-A motif). After being excited, a MR has two distinct states: (1) a planar conformation termed as locally exited state (LE) and (2) a twisted conformation termed as twisted intramolecular charge transfer state (TICT) (Haidekker & Theodorakis, 2010. Journal of
absorbance capacity and photostability of FSG (λmax 328 nm) was λ personal care and health and beauty industries. The total UV applications, thus FSG is beginning to be used in formulations in the empirical benefit as an emulsifier and moisturizer in a (FSG) are plant use of U.S. agriculture commodities a paradigm shift to food, feed, (4.5 fuel). Historically, the farm production yield of soybeans has increase produced domestically in large supply, a majority of which are used laboratories, we have looked at s woody tissues, and byproducts such as cottonseed hull. In our hemicellulose is xylan, which can be extracted from plant cell walls, in order to add value to this agro nature, it is currently under-utilized as a raw material for commercial applications. It would be desirable to find new uses for hemicellulose in order to add value to this agro-based material. A common type of hemicellulose is xylan, which can be extracted from plant cell walls, woody tissues, and byproducts such as cottonseed hull. In our laboratories, we have looked at several approaches whereby this agro-based raw material can be utilized in new ways. In this presentation, two approaches will be described. One approach involved the reaction of xylan with tolylene-2,4-diisocyanate (TDI) to form a polyurethane. Because xylan had multiple OH groups on each chain, the TDI/xylan molar ratio had to be adjusted in order to produce a soluble polymeric product. The reaction products were characterized by 13C NMR, FTIR, thermogravimetric analysis, and differential scanning calorimetry. The xylan polyurethane was shown to exhibit improved thermal stability when compared to xylan alone. In the second approach, xylan was derivatized with appropriate reagents to render them cationic and anionic. The polymers were characterized by 13C NMR, FT-IR, size exclusion chromatography, and rheology. Interestingly, the combination of the cationic and the anionic xylan was found to increase the dry strength of paper. Each excited MR molecule can relax through either the LE or TICT state. If the MR is in a free space, it relaxes through TICT state by releasing heat without emitting any photon. If the MR is in a local environment with spatial restriction, the transition from LE to TICT state is blocked and the relaxation is completed through the photon emission from LE state. For a given polymeric matrix, the overall spatial restriction governs the amount of MR molecules undergoing fluorescent emission. Therefore, the measurement of the fluorescence intensity of MR in a specific polymeric system can help to characterize the structural properties of this polymer. In this seminar, we will introduce our work of using MR to differentiate the supramolecular structures of two types of highly-branched carbohydrate polymer from plants, that is, amylopectin and phytoegyceen. In addition, we will describe our work on creating a micro-analysis method of using MR to rapidly evaluate the physical properties of starch materials at the milligrain level. Using carbohydrate polymers as models, our overall goal is to establish MR as a unique approach in the study of biopolymers.

AGFD 262 Preparation and characterization of hemicellulose-derived materials Huai N. Cheng1, ln.cheng@ars.usda.gov, Atanu Biswas.2. (1) Southern Regional Research Center, USDA Agricultural Research Service, New Orleans, Louisiana (2) National Center for Agricultural Utilization Research, USDA Agricultural Research Service, Peoria, Illinois Although hemicellulose is found widely in nature, it is currently under-utilized as a raw material for commercial applications. It would be desirable to find new uses for hemicellulose in order to add value to this agro-based material. A common type of hemicellulose is xylan, which can be extracted from plant cell walls, woody tissues, and byproducts such as cottonseed hull. In our laboratories, we have looked at several approaches whereby this agro-based raw material can be utilized in new ways. In this presentation, two approaches will be described. One approach involved the reaction of xylan with tolylene-2,4-diisocyanate (TDI) to form a polyurethane. Because xylan had multiple OH groups on each chain, the TDI/xylan molar ratio had to be adjusted in order to produce a soluble polymeric product. The reaction products were characterized by 13C NMR, FTIR, thermogravimetric analysis, and differential scanning calorimetry. The xylan polyurethane was shown to exhibit improved thermal stability when compared to xylan alone. In the second approach, xylan was derivatized with appropriate reagents to render them cationic and anionic. The polymers were characterized by 13C NMR, FT-IR, size exclusion chromatography, and rheology. Interestingly, the combination of the cationic and the anionic xylan was found to increase the dry strength of paper.

AGFD 263 Cosmeceutical ingredients from commodity crop oils David L. Compton1, david.compton@ars.usda.gov, Kervin O. Evans1, Michael Appell1, John R. Goodell.2 (1) USDA-ARS, Dunlap, Illinois (2) iActives Naturals, Peoria, Illinois Soybeans are produced domestically in large supply, a majority of which are used in high volume, low value applications (e.g. food, animal feed, biofuel). Historically, the farm production yield of soybeans has increase 4.5-fold over the past century while the price/bushel of soybeans remains at or near historic lows in inflation adjusted dollars. To enhance the economic viability and competitiveness and increase the use of U.S. agriculture commodities a paradigm shift to food, feed, fuel and bioproducts must be adopted. Feruloylated soy glycerides (FSG) are plant-based, naturally derived compounds synthesized by the transesterification of soybean oil with ethyl ferulate in a continuous, enzymatic, packed-bed bioreactor. A small, limited, independent laboratory clinical trial determined that FSG has an empirical benefit as an emulsifier and moisturizer in anti-wrinkling applications, thus FSG is beginning to be used in formulations in the personal care and health and beauty industries. The total UV absorbance capacity and photostability of FSG (λmax 328 nm) was determined and proved a fungible replacement for the industry’s petroleum-based UVB absorber, Octinoxate (λmax 310 nm). The antioxidant capacity of FSG was determined via DPPH* assay and was 1/10 the antioxidant capacity of Vitamin C and E. Vitamin C and E used in topical formulations are susceptible to UV degradation. FSG was shown to be equivalent to slightly better than the commercial Octinoxate in protecting the vitamins’ antioxidant capacities from UV degradation. FSG possessed intrinsic antioxidant capacity that ONX did not, which may have contributed to its better performance when mixed with the vitamin’s in the DPPH* assays.

AGFD 264 Protein hydrolysates and biopeptides from seafood and processing by-products thereof Fereidoon Shahidi, fshahidi@gmail.com. Biochem Dept, Memorial Univ of Newfoundland, St. John’s, Canada The harvest of aquatic species includes by-catch of unwanted species and these together with processing discards as well as those from the aquaculture fisheries provide an excellent source of raw material for further processing to value-added products. The protein components so produced may be separated and used as such or further hydrolyzed to products that can be used in a variety of applications. These hydrolysates may also be fractionated and used in food as well as non-food application. The isolated biopeptides with different molecular weight and amino acid sequence provide health-promoting components that are good ACE inhibitors and hence may have a positive effect on cardiovascular health and when used in food may serve as good phosphae replacers in minimizing the cooking loss due to their moisture retention properties. The presentation provides examples to demonstrate the production, properties and application of such secondary value-added products from fisheries discards.

AGFD 265 Pea protein-derived peptides as inhibitory agents against carbohydrate and lipid-digesting enzymes Temitola Awosika1, Rotimi Aluko1,2, rotimi.aluko@umanitoba.ca. (1) Food and Human Nutritional Sciences, Univ. of Manitoba, Winnipeg, Canada (2) Richardson Centre for Functional Foods and Nutraceuticals, Univ. of Manitoba, Winnipeg, Canada Excessive calorie intake in the form of glucose and fatty acids is a causative factor in the development of obesity and diabetes. Therefore, agents that reduce the activities of carbohydrateases and lipases could be used to prevent or treat these chronic diseases. In this work, enzymatic hydrolysis of pea proteins was used to produce peptides that inhibited activities of lipase, α-amylase, α-glucosidase. The protein hydrolysates were obtained using each of the following enzymes: alcalase, chymotrypsin, pepsin or trypsin. Each hydrolysate was then fractionated into peptides of different sizes (~1, 1-3, 3-5, 5-10 kDa) using membrane ultrafiltration and their activities compared with those of the protein hydrolysates. Results showed alcalase hydrolysis produced the highest protein hydrolysate yield (58.2%) while trypsin yielded the least (44.0%). Alcalase was also the most efficient in producing small (<5 kDa) peptides while pepsin was the least. The higher proteolytic efficiency of alcalase was confirmed with identification of the most content of di- and tripeptides when compared to the chymotrypsin, pepsin and trypsin hydrolysates. The protein hydrolysates were used in vitro activities of α-amylase and α-glucosidase activities at levels that were similar to the peptide fractions. However, the protein hydrolysates and peptide fractions had stronger (μg concentrations) inhibitions of α-amylase activity than α-glucosidase (μg concentrations). For lipase inhibition, the unfractonated hydrolysates (IC50 =4.2 mg/mL) were more potent than the fractionated peptides (IC50 >4.2 mg/mL). Double reciprocal plots revealed competitive and non-competitive inhibitions of α-amylase and α-glucosidase activities, respectively by the pea protein-derived peptides. The results suggest that the pea peptides may serve as useful ingredients to formulate functional foods that reduce the release of calories from diets.
AGFD 266 Computational approach to mimic gastrointestinal digestion and predict novel peptides with angiotensin converting enzyme-I (ACE-I) inhibitory activity  Saugata Hazra2, Kaustav Majumder1, kaustav.majumder@unl.edu. (1) Food Sci. & Tech., Univ. of Nebraska, Lincoln (2) Dept. of BioTech., Indian Inst. of Tech. Roorkee, India Hypertension or high blood pressure is one of the primary causes of morbidity and mortality, worldwide. Renin-angiotensin-aldosterone system (RAAS) is one of the significant pathways of blood pressure regulation and Angiotensin-converting enzyme-I (ACE-I) is a critical component of the RAAS pathway. Inhibition of ACE-I is a well-known method of regulating blood pressure. Food-derived peptides with ACE-I inhibitory activities are receiving significant research attention due to the global prevalence of hypertension. However, identification and characterization of ACE-I inhibitory peptides from different food proteins are a labor-intensive and time-consuming process. To quickly predict the ACE-I inhibitory peptides from different food proteins, bioinformatics, and dynamic molecular docking-based web server has been developed in this study. This independent web server (AHTPG: Anti-Hypertensive Peptide Generator) can take input in FASTA format or through UniProt ID to perform the in silico gastrointestinal digestion and then screen the resulting peptides for ACE-I inhibitory activity. The web server also provides the structural features of the active peptides and their interaction with ACE-I through dynamic molecular docking method. Therefore, this web server can instantly identify and characterize novel ACE-I inhibitory peptides produced after gastrointestinal digestion of different food proteins. Furthermore, we have applied the approach of machine learning to predict novel ACE-I inhibitory peptides from the concerned food proteins. This is enabling us to develop an advanced platform for generating and predicting food-protein based ACE-I inhibitory peptides with antihypertensive activity. This platform predicts novel antihypertensive peptide at an amazing confidence level of 88%.

AGFD 267 Chemistry and biological significance of food-derived pyroglutamyl peptides  Chibuike Udenigwe, cudenigw@uottawa.ca. Univ. of Ottawa, Ontario, Canada Pyroglutamyl (pGlu) peptides have been reported in different food sources, including dry cured ham, cheese, Japanese rice wine, soy sauce, and hydrolyzed wheat gluten and potato proteins. pGlu (5-oxo-prolyl) residues have a γ-lactam ring formed from intramolecular cyclization of glutaminyl or glutamyl residues at the N-terminal of peptides. The cyclization process can occur endogenously in plant tissues in a reaction catalyzed by glutamyl-peptide cyclotransferase or glutamyl cyclase, or spontaneously during processing of foods containing the precursor peptides. The spontaneous cyclization reaction rate in pGlu formation is higher for N-terminal glutamine compared to glutamic acid residues. This modification has been found to increase peptide hydrophobicity, among other physicochemical changes. Physical factors such as heat, pressure and enzymatic modifications of proteins contribute to pGlu formation in food. Reported pGlu peptides contain 2-20 amino acid residues, although more than half are dipeptides and tripeptides. Considering the spontaneity of their formation and significant physiochemical features, pGlu peptides can play crucial roles in food applications. For instance, pGlu peptides are thought to have different tastes, especially bitter and umami tastes, and therefore can alter the sensory properties of food products. In addition, health-promoting properties have been demonstrated for food-derived pGlu di- and tripeptides, including hepatoprotective, antidepressant and anti-inflammatory activities in cultured cells and animal models. Although the role of pGlu residue in these bioactivities is not clear, the N-terminal γ-lactam ring plays a major role in preventing degradation of the peptides by gastrointestinal proteases and exopeptidases.

AGFD 268 Investigation of the concept of refreshing perception, related flavor components, and its application in sugar-reduced beverage by flavor instrumental analysis and sensory evaluation  Xiaofen Du, xdu@twu.edu. Nutrition and Food Sci.s, Texas Woman's Univ., Denton There is increasing interest for the food industry to develop products that are perceived as being refreshing, especially flavored water with high nutritive value as a hydration option. Very few studies have focused on refreshing perception and associated mechanisms which might involve multiple sensory attributes such as appearance, odor, taste, texture, or mouthfeel. Very few studies have explored the relationship between the refreshing value and flavor components in foods and drinks. Sugar reduction in processed foods and beverages is a prominent global trend. Reducing sugar concentrations in foods and beverages decreases palatability and consumer acceptance. The hypothesis was refreshing perception would compensate sensory quality for sugar-reduced beverages. The objective of this study included investigating consumer view of refreshing perception by an online survey, screening refreshing perception related aroma-active compounds in selected fruits by gas chromatography-mass spectrometry/olfactometry (GC-MS/O), and testing the screened aroma-active compounds in sugar-reduced beverages by quantitative descriptive analysis (QDA). The refreshing concept was vague for consumer; however, some fruits and herbs were commonly associated with refreshing perception including mint, lemon, lime, orange, grapefruit, melon, watermelon, and cucumber. GC-MS/O study indicated that C6 compounds with green notes and certain aldehydes with green, peely, and waxy notes in the gourd family, while certain aldehydes and terpenes in the citrus family were highly related to refreshing perception. QDA of reconstituted fruit flavors including cucumber, watermelon, and lemon showed a significant difference in refreshing perception between the control and sugar-reduced beverages contained with these flavors. These results increased knowledge of refreshing perception and associated flavor compounds, which will direct beverage product development in the food industry.

AGFD 269 Considerations in the hydrolysis of insect proteins to improve their bioactivity and decrease allergenicity  Andrea Liceaga, aliceaga@purdue.edu. Food Sci., Purdue Univ., West Lafayette, Indiana Insects are nutritional, sustainable protein alternatives. It is estimated there are about 2,000 edible insect species that include beetles, caterpillars, wasps, ants, bees, grasshoppers, locusts, crickets, cicadas, termites, dragonflies and flies. As efforts continue to encourage entomophagy in North America via insect-derived ingredients, protein functionality, bioactivity and tropomyosin cross-reactive allergenicity remain important factors. Protein hydrolysates are commonly used food ingredients due to their high nutritive value and improved bioactivity arising from the production of short peptides and free amino acids. Protein extraction and fractionation are crucial steps to produce insect protein ingredients with adequate functionality. Factors such as solid to water ratio, pH, ionic strength and thermal treatment used are known to affect insect protein extractability and yield. In addition, extent of hydrolysis, amino acid composition, and protein solubility are important considerations in the evaluation of hydrolysates’ biological activities. This presentation gives an overview of the bioactive properties of protein hydrolysates obtained from different insect species and different hydrolysis/extraction conditions reported in literature. Examples of how different extraction methods and/or hydrolysis conditions affect the bioactivity and allergenicity of insect protein hydrolysates will also be discussed.

AGFD 270 Recent progress in enzymatic release of food-derived peptides and assessment of bioactivity  Fidel Toldra,
There is a wide variety of peptides in foods with relevant bioactivity like angiotensin converting enzyme (ACE) inhibition, antioxidant, anti-inflammatory, hypoglucemic or antithrombotic activity, among others. This lecture is presenting an overview of recent advances on enzymatic mechanisms for the release of bioactive peptides from food proteins, strategies followed for their isolation and identification through advanced proteomic tools, assessment of bioactivity and specific food applications. The lecture will start with the types of enzymes and mechanisms of action involved, for endo-peptidases, which are the first enzymes to act on food proteins, followed by the successive action of a wide number of exo-peptidases like tri- and dipeptidylpeptidases, aminopeptidases and carboxypeptidases. It will be discussed how proteins are hydrolysed by endogenous enzymes in ripened foods and the additional action of microbial enzymes in fermented foods, describing the sequential proteins and peptides breakdown and smaller released peptides. In this sense, there will be an in-depth discussion on the use of advanced proteomic tools available for the identification of released peptides with different sequences and lengths, the challenges with its relative and absolute quantification, and strategies for the assessment of bioactivity. Examples of results will be presented for processed meat and fish where numerous peptides with antioxidant, anti-inflammatory, hypoglucemic and angiotensin I-converting enzyme (ACE) inhibitory activity have been determined as well as its effects in vivo with laboratory rats and with humans. Finally, the hydrolysis of isolated food proteins, like collagen from marine sources and proteins from meat by-products, with peptides from different sources such as certain lactic acid bacteria, and the determination of resulting peptides and associated bioactivity will be also presented.

**AGFD 271 Microbial metabolism of glycated amino acids**

Michael Hellwig, Michael.Hellwig@chemie.tu-dresden.de, Thomas Henle, thomas.henle@tu-dresden.de. Technische Universität Dresden, Germany Glycation (Maillard reaction, non-enzymatic browning) is an important chemical reaction in food, and products of this reaction have been quantitated in food items such as milk and bakery products, honey, pasta, and malt. Amadori products such as fructosyllysine are taken up with the daily diet in amounts up to 1000 mg, while 25-75 mg of glycated amino acids from the late stage of the Maillard reaction (e.g., pyrraline, carboxymethyllysine (CML), and maltosine) are ingested daily. When ingested with the normal human diet, glycated amino acids are released from food proteins, but only a small proportion is transported into circulation. The greater part of glycation compounds is transferred into the colon where they are subject to microbial fermentation. Strong interindividual differences were observed between gut microbiota inocula of different human subjects in their ability to degrade CML. Investigations using probiotic E. coli model strains revealed the first bacterial metabolites of glycated amino acids: the biogenic amine N-carboxymethyladenavrine (CM-CAD), and the fatty acid N-carboxymethylaminopentanoic acid (CM-APA). Moreover, glycated amino acids from malt are potential substrates of brewer’s yeast Saccharomyces cerevisiae during the brewing process. Investigations on the use of glycated amino acids by S. cerevisiae in a model system led to the identification of higher alcohols and α-hydroxy acids derived from the Ehrlich pathway as the first known fungal metabolites of glycated amino acids. The novel higher alcohols pyrralolin (up to 200 μg/L) and formylnol (up to 50 μg/L) were quantitated in beer for the first time. The concentrations were particularly high in wheat beer. Metabolites of glycated amino acids are a new class of glycation compounds whose bioactivity in fermentation processes and human (patho)physiological processes needs to be explored.

**AGFD 272 Combined proteomics and transcriptomics analysis of Lactococcus lactis under different culture conditions**

Liang Li, liliangmeau@163.com, Xiaoyu Yang, Rui Hong. Northeast Agricultural Univ., Harbin, China In food industry, Lactococcus lactis (L. lactis) need to adapt for different culture conditions by regulating metabolic pathways. The study were the fist to identify differentially expressed genes and differentially expressed proteins and then analyse bioinformatics information to reveal the regulation mechanism of L. lactis under different culture condition by integrating transcriptomics and proteomics. Transcriptome and proteome studies indicated that different culture conditions (fructose, calcium ion, palmitic acid, low pH) had an important impact on the expressed genes and proteins. Differentially expressed proteins were not significantly correlated with gene expression level in L. lactis. The results indicated the importance of comparative analysis of transcriptome and proteome. In this study, fructose and pH have a significant effects on sugar metabolism of L. lactis. When lactose was replaced by fructose, fructokinase was promoted and fructose metabolism was accelerated, but “starch and sucrose metabolism” and “galactose metabolism system” were inhibited. Low pH was may be beneficial to homoygous fermentation of L. lactis. L.Lactis may metabolize galactose through “Tagatose pathway” and "Leloir pathway". Fatty acid metabolism and fatty acid biosynthesis were significantly downregulated under calcium ion and palmitic acid. The “purine metabolism” was up-regulated under fructose treatment and was down-regulated under palmitic acid. This study would deeply understand the regulation mechanism of biological function of L.Lactis under different culture conditions, and wound promote the practical application of L.Lactis.

**AGFD 273 Comparative kinetics of soy protein gel digestion**

Role of mechanical structure and spatial organization Yingyi Guo, Paul Takhistov, ptakhist@gmail.com. Rutgers Univ., New Brunswick, New Jersey The structure of food matrix plays an important role in digestion process, where biochemical conditions (pH, ionic concentration, and enzymes’ activity) and mechanical forces are the major GIT environmental factors. However, quantification of digestion process is still challenging task that requires sophisticated in vitro systems. To address this issue, we have developed a modular parallel-plate microfluidic system with automated image analysis, where droplets of food samples can be printed onto substrate and digested by simulated gastric fluid flow under physiologically relevant conditions. Digestibility of several model food matrices was tested and compared using new microfluidic system under simulated gastric conditions. For this purpose, various soy protein gel formulations (gel, emulsion gels, micro-gel etc.) were prepared using combination of cold-induced gelation, sonication processing and emulsification. It was observed that structural and mechanical properties of the gels determine their digestion mode. Well-structured gels digested via surface erosion mechanism demonstrating formation of unique fractal-like defragmentation structures, while sonicated micro-gels demonstrated classical reaction-diffusion degradation kinetics. Digestion process of emulsion-structured gel has significantly different kinetics that accompanied by destabilization of the emulsion well described in terms of Lifshitz-Ostwald ripening theory. Image analysis data were supported by the rheological characterization and real-time Raman measurements. This novel technique allows budget-friendly direct analysis and visualization of structural changes in solid and semi-solid food matrices during simulated gastric digestion process, providing unique method for formulation screening and accelerated product development.

**AGFD 274 Consequences of superfine grinding treatment on structure, physicochemical, and rheological properties of transglutaminase-crosslinked whey protein isolate**

Chunyan Wang, ftoldra@iata.csic.es. Food Sci., Instituto de Agroquimica y Tecnologia de Alimentos (CSIC), Paterna, Valencia, Spain There is a wide variety of peptides in foods with relevant bioactivity like angiotensin converting enzyme (ACE) inhibition, antioxidant, anti-inflammatory, hypoglucemic or antithrombotic activity, among others. This lecture is presenting an overview of recent advances on enzymatic mechanisms for the release of bioactive peptides from food proteins, strategies followed for their isolation and identification through advanced proteomic tools, assessment of bioactivity and specific food applications. The lecture will start with the types of enzymes and mechanisms of action involved, for endo-peptidases, which are the first enzymes to act on food proteins, followed by the successive action of a wide number of exo-peptidases like tri- and dipeptidylpeptidases, aminopeptidases and carboxypeptidases. It will be discussed how proteins are hydrolysed by endogenous enzymes in ripened foods and the additional action of microbial enzymes in fermented foods, describing the sequential proteins and peptides breakdown and smaller released peptides. In this sense, there will be an in-depth discussion on the use of advanced proteomic tools available for the identification of released peptides with different sequences and lengths, the challenges with its relative and absolute quantification, and strategies for the assessment of bioactivity. Examples of results will be presented for processed meat and fish where numerous peptides with antioxidant, anti-inflammatory, hypoglucemic and angiotensin I-converting enzyme (ACE) inhibitory activity have been determined as well as its effects in vivo with laboratory rats and with humans. Finally, the hydrolysis of isolated food proteins, like collagen from marine sources and proteins from meat by-products, with peptides from different sources such as certain lactic acid bacteria, and the determination of resulting peptides and associated bioactivity will be also presented.
AGFD 275 Phenolic composition of blue honeysuckle and its protective effect against oxidative damage following gastrointestinal digestion and gut microbiota fermentation  
Tao Bao, taobao@zju.edu.cn, Zhejiang Univ., Hangzhou, China (1) School of Biosystems Eng. and Food Sci., Zhejiang Univ., Hangzhou, China (2) Key Laboratory of Dairy Science, Northeast Agricultural Univ., Harbin, PR, China

Blue honeysuckle, a berry fruit, was reported to have antioxidative properties. Therefore, our results suggest that blue honeysuckle is protective against EC-induced cytotoxicity and can be used for dietary supplementation.

AGFD 276 Evaluation of trans-resveratrol levels in grape wine using laser-induced graphene-based electrochemical sensors  
Chao Zhang1, Jianfeng Ping2, Yibin Ying1, ybying@zju.edu.cn. (1) School of Biosystems Eng. and Food Sci., Zhejiang Univ., Hangzhou, China (2) School of Biosystems Eng. and Food Sci., Zhejiang Univ., Hangzhou, China

The preparation sensor with excellent repeatability, stability, reproducibility, and reliability, displays a wide linear response within the TRA concentration range of 0.2-50 µmol L-1 and a low detection limit of 0.16 µmol L-1. Finally, the developed sensor is applied to detect the TRA level in real red wines successfully and the satisfactory results are obtained.

AGFD 277 Food-borne toxins and Proposition 65: Formation and analysis  
Michael Granvogl1,2, michael.granvogl@ch.tum.de. (1) Technical Univ. of Munich, Garching, Germany (2) Inst. of Food Chemistry, Univ. of Hohenheim, Stuttgart, Germany

In the past, many studies have been undertaken to identify so-called “food-borne toxins” and elucidate their formation pathways during food processing or food storage. Therefore, reliable analytical techniques are needed, which are mostly based on gas-chromatography-mass spectrometry or liquid chromatography-mass spectrometry in combination with stable isotopically labeled standards. Some of these undesired compounds are listed in Proposition 65. Thus, the lecture will present an overview of recent studies of selected food-borne toxins, e.g., acrylamide, furan, styrene, MCPD, and glycidol. In addition, it will be shown that lowering the amounts of undesirable compounds should always be combined with the maintenance of desired sensorial properties, such as the overall aroma, which is expected by consumers. The lecture will demonstrate that this is a challenging task, but mitigation strategies of the "bad guys" can be advised after getting the knowledge of their formation pathways.
of these contaminants, including methodologies developed in our laboratory at the U.S. FDA (FDA). In addition, the results of several occurrence studies conducted in our laboratory, which show a wide range of bound 3-MCPD and glycidol concentrations across a variety of edible oils, infant formulas, and food products, will be presented.

**AGFD 280 Free 2- & 3-MCPD as urinary biomarker of exposure**

for 2- & 3-MCPD fatty acid esters: Controlled exposure study in humans Jan Kuhlmann, Jan.kuhlmann@sgs.com, Bernhard Monien, Alfonso Lampen, Klaus Abraham. (1) SGS Germany GmbH, Hamburg (2) Federal Inst. for Risk Assessment, Berlin, Germany. Fatty acid esters of 2- & 3-monochloropropanediol (MCPDE) are formed during the deodorization of vegetable oils. After consumption, lipase-catalyzed hydrolysis in the gastrointestinal tract releases 2- & 3-MCPD. The International Agency for Research on Cancer (IARC) has classified 3-MCPD as possibly carcinogenic to humans. As many foods may contain MCPDE, the estimation of the external exposure is difficult. Therefore, the assessment of the internal exposure may be an alternative to estimate the external exposure more reliably. To identify possible urinary biomarkers of exposure for 2- & 3-MCPD, twelve non-smoking participants consumed a single portion of 12 g hazelnut oil containing relatively high amounts of MCPDE (54.5 mg bound 3-MCPD/kg, 24.2 mg bound 2-MCPD/kg). During the two days before and after the controlled intake, 24-h urine samples from all participants were collected and analyzed for their levels of free 2- & 3-MCPD using GC/MS analysis with 3-MCPD-d5 as internal standard and derivatization by phenylboronic acid. In comparison to the background excretion on the days before (up to a few μg per day), the urinary excretion was largely increased on the day of controlled exposure to between 19.7 and 46.3 μg 2-MCPD and to between 13.3 and 35.0 μg 3-MCPD. The mean 3-MCPD excretion was about 3.7% of the dose applied, whereas relative 2-MCPD excretion was about 11.3% of the dose. The data of this study indicates the possibility to use the urinary levels of free 2- & 3-MCPD as biomarkers of exposure for dietary 2- & 3-MCPD.

**AGFD 281 Toxicokinetics and metabolism of 3monochloropropane 1,2-diol dipalmitate in Sprague-Dawley rats**

Guoren Huang, Boyan Gao, Raphael Huang. (1) SGS Germany GmbH, Hamburg (2) Federal Inst. for Risk Assessment, Berlin, Germany. Fatty acid esters of 3-monochloropropane 1,2-diol (3-MCPD) are a group of thermal processing-induced toxicants. The absorption, distribution, metabolism, and excretion conditions of 3-MCPD esters need to be investigated to better clarify their possible toxicological effects and mechanisms. In this study, the kinetic parameters of 3-MCPD dipalmitate in Sprague Dawley (SD) rats plasma were determined using ultraperformance liquid chromatography–triple quadrupole mass spectrometry (UPLC-Q TOF MS). As the results, the metabolic parameters of 3-MCPD dipalmitate, including a Cmax of 135.00 ng/mL, a T1/2 of 3.87 h, a Tmex of 2.5 h, an MRT of 5.08 h, a CL of 3.50 L/h/g, and a Vd of 21.34 L/g have been determined. Besides, a total of 17 metabolites were tentatively identified, and 16 of them were reported for the first time. Furthermore, these metabolites were examined for their presence in rats’ liver, kidney, testis, brain, spleen, thymus, intestine, plasma, feces, and urine samples 2, 6, 12, 24, and 48 hours after orally administrated of 3-MCPD dipalmitate. The results represented that 3-MCPD dipalmitate could be absorbed and distributed to organs and tissues, including the brain and tests. It could also be metabolized to other 3-MCPD diesters, 3-MCPD monoesters, glycidyl ester, 3-MCPD or endogenous substance conjugation metabolites, as well as excreted through both feces and urine.

**AGFD 282 Styrene, the undesired and toxicologically relevant**

brother of the desired key aroma compounds of wheat beer Valerian Kalb, valerian.kalb@tum.de, Thomas Hofmann, Michael Granvøg, (1) Technical Univ. of Munich, Freising, Bavaria, Germany (2) Leibniz-Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Bavaria, Germany (3) Technical Univ. of Munich, Freising, Bavaria, Germany (4) Inst. of Food Chemistry, Univ. of Hohenheim, Stuttgart, Baden-Württemberg, Germany. Cinnamic acid derivatives, traditionally called phenolic acids, are important biological building blocks for flavanoids, stilbenoids, and lignin as well as cross-linking molecules for cell wall polysaccharides and, therefore, ubiquitous in malts of barley and wheat. In wheat beer, a specialty beer type very popular in the German speaking area of Europe that has to be brewed with a wheat malt content of at least 50%, these building blocks are substantial for the formation of its characteristic aroma. During fermentation, the key aroma odorants 2-methoxy-4-vinylphenol and 4-vinylphenol are mainly formed by decarboxylation of the corresponding free phenolic acids in presence of yeast, leading to the desired clove-like and slightly phenolic aroma of wheat beer. However, this metabolism is accompanied by the release of the undesired toxicologically relevant styrene from cinnamic acid. As a reaction on the classification of styrene as possibly carcinogenic to humans by the “International Agency for Research on Cancer” in 2002, brewing companies in Germany commissioned studies on the reduction of the styrene content in wheat beer. Within a current project, evaluating the influence of malting parameters on the release of phenolic acids, a study was performed to analyze a large number of commercially available wheat beers to ascertain to what extent the knowledge from previous studies to mitigate the styrene content was implemented by breweries. Therefore, the desired and undesired vinyl aromatics were quantitated in wheat beers via HSSPME in combination with a GxGC-ToF-MS system based on stable isotope dilution analysis (SIDA). The respective desired and undesired precursors were determined by LC-MS/MS, also based on SIDA. Beside the analyzed pale and unfiltered wheat beers, 2 dark, 2 light, and 2 alcohol-reduced wheat beers helped to additionally evaluate the impact of the roasting degree, the type of yeast, and the deaceloholization process on the vinyl aromatic and phenolic acid pattern.

**AGFD 283 Polymethoxylflavones from citrus:**

Chemistry, metabolism and selected bioactivity Chi-Tang Ho, ho@aesop.rutgers.edu, Shiming Li. Food Sci., Rutgers Univ., New Brunswick, New Jersey. Polymethoxylflavones (PMFs) from citrus genus are of particular interest because of their broad spectrum of biological activities, including anti-inflammatory, anti-carcinogenic and anti-atherogenic properties. There is increasing interest in the exploration of health beneficial properties of PMFs in citrus fruits. We will discuss the extensive metabolism of PMF by gut microbiota as well as in liver. Tissue distribution indicates that PMF can penetrate blood-brain-barrier and exists in brain tissue in relatively high concentration. Recent research on anti-obesity effects and mechanism of PMF will be reviewed, particularly on their interaction with gut microbiota. PMF have strong prebiotic effect as indicated by the elevated production of short chain fatty acids and the bloom of Lactobacillus and Bifidobacterium in the high fat diet-induced obese mice. Moreover, the inhibition of PMF on Acetatifactor and Bilo species was suggested that the fat-bile-gut interaction may contribute to the anti-obesity of PMFs.

**AGFD 284 Variability of bioactive compounds and antioxidant capacity of three morphotypes of Mauritia flexuosa L. f.**

from the Amazon region of Peru Ivan Best, Ibest@usl.edu.pe, Sandra Casimiento, Alan Portugal2, Jose Gomez-Mendoza2, Luis Oliver2,
Raul Nakandakare1, Fernando Ramos-Escudero2, Ana Maria Muñoz2. (1) Grupo de Ciencia y Tecnologia de Alimentos, Univ. San Ignacio de Loyola, Lima, Peru (2) Unidad de Investigación en Nutrición, Salud, Alimentos Funcionales y Nutracéuticos (UNUSAN), Univ. San Ignacio de Loyola, Lima, Peru. Mauritius flexuosa L. is a palm tree of great social and economic relevance in the Peruvian Amazon, because its fruit presents a high demand for its nutraceutical, pharmaceutical and nutritional properties. This palm presents great morphological variability (morphotypes), represented mainly by the mesocarp color of its fruits. The objective of the study was to characterize the physicochemical and antioxidant properties of the Mauritius flexuosa L. f. morotypes of greater economic importance in the Peruvian Amazon. Three Mauritius flexuosa L. f. morotypes classified by the color of the mesocarp: "Yellow" (yellow mesocarp), "Colour" (mesocarp red on the outside and yellow on the inside) and "Shambo" (red mesocarp); were collected in the Amazon River Basin, Iquitos, Peru (4° 39’ 19.5” S, 73° 49’ 27.9” W). After extraction with supercritical fluids (SFE), defatted flour was obtained, which was then extracted sequentially with methanol (50% v/v) and acetone (70% v/v). The content of total phenolic compounds and flavonoids was determined by the Folin-Ciocalteu method and aluminum chloride colorimetric method, respectively. Total carotenoids and antioxidant activity were evaluated using the AOAC method and DPPH assay, respectively. Statistical analysis of the experimental data were carried out using ANOVA followed by Tukey test (P<0.05). Correlation between the different variables were conducted using the Pearson’s method. According to our results, "Shambo" presented a higher antioxidant activity and total carotenoid content compared with the “Yellow” and “Colour” morotypes (P<0.05, Table 1). Pearson correlation coefficient of total phenolic, flavonoid, and carotenoid content of Mauritius flexuosa L. f. extract with IC50 of DPPH was r=0.974 (P<0.01). Our results suggest that the carotenoid compounds in extracts of Mauritius flexuosa L. f. were important contributors in their capacity antioxidant with the DPPH method, being "Shambo”, the morotype that presented the greatest nutraceutical and antioxidant potential.

AGFD 285 Microbiota facilitates tea polyphenols to trap deleterious reactive endogenous metabolites Shuwei Zhang1, shwzhang.simma@gmail.com, Yiantao Zhao1, Christian Oihland3, Christian Jobin3, Shengmin Sang2. (1) North Carolina A&T State Univ., Kannapolis (2) Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis (3) Univ. of Florida, Gainesville The in vivo mechanism of tea polyphenol-mediated prevention of many chronic diseases is still largely unknown. Studies have shown that accumulation of toxic reactive cellular metabolites, such as ammonia and reactive carbonyl species (RCS), is one of the causing factors to the development of many chronic diseases. In our lab, we investigated the in vivo interaction between tea polyphenols including (-)-epigallocatechin 3-gallate (EGCG), theaflavin (TF), and TF-digallate (TFDG), and the deleterious reactive endogenous metabolites including ammonia and RCS. We found that EGCG could be oxidized to EGCG quinone in mice, and then rapidly react with ammonia to generate the aminated EGCG metabolite, 4′-NH2-EGCG. Both EGCG and its aminated metabolite could further scavenge RCS, such as methylglyoxal (MGO), malondialdehyde (MDA), and trans-4-hydroxy-2-nonenal (4-HNE), to produce the RCS conjugates of EGCG and the aminated EGCG in mice and in humans. In addition, we demonstrated that gut microbiota facilitate the formation of the aminated metabolite of EGCG, the RCS conjugates of EGCG, and the RCS conjugates of the aminated EGCG. Our study also demonstrated that, the major black tea polyphenols, theaflavins, could trap the endogenous metabolites including ammonia and methylglyoxal to form aminated metabolites and MGO adducts as well as their combination in mice. By exposing theaflavin to germ-free (GF) mice and specific-pathogen-free (SPF) mice, the gut microbiota was demonstrated to play an important role to mediate the amination and MGO conjugation of theaflavin. Altogether, our study provides in vivo evidences that tea polyphenols act as the house-keeping agent to scavenge toxic reactive metabolic wastes. This finding opens a new window to understand the underlying mechanisms by which drinking tea could prevent the development of chronic diseases.

AGFD 286 Protective effects of flaxseed oil and fish oil on TMAO-exacerbated atherogenesis Zouyan He, Zhen-Yu Chen, zhenyuchen@cuhk.edu.hk. Chinese Univ. of Hong Kong Plasma trimethylamine-N-oxide (TMAO) is a risk factor for development of atherosclerosis in humans. It is known that that consumption of ω-3 polyunsaturated fatty acids (PUFAs) is beneficial to cardiovascular health. The present study was to compare the protective effects of flaxseed oil rich in ω-3-linolenic acid (ALA, 18:3n-3), and fish oil rich in eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) in TMAO-exacerbated atherosclerosis in mice. Forty-five male ApoE−/− mice were randomly divided into five groups and fed a low-fat diet (LFD), a western diet (WD), a WD plus 0.2% TMAO (WD+TMAO), or one of two experimental TMAO-containing WDs with half of lard substituted by flaxseed oil (FLO+TMAO) or fish oil (FIO+TMAO), respectively. After 12-week feeding, results showed that 0.2% dietary TMAO raised plasma TMAO concentration by approximate three folds compared to WD, accompanied by elevated plasma levels of pro-inflammatory cytokines, disturbance in cholesterol homeostasis, and more severe atherosclerotic plaque formation. Compared to flaxseed oil, fish oil showed more potent activity to lower plasma levels of total cholesterol (T-C) and pro-inflammatory cytokines, leading to a larger reduction in atherosclerotic plaque area. Both oils were able to reverse the TMAO-induced declines in excretion of fecal acidic sterols via up-regulating the expression of hepatic cholesterol 7α-hydroxylase (CYP7A1). In addition, fish oil promoted the fecal output of neutral sterols and down-regulated the expression of hepatic cholesterol synthesis by hepatic down-regulating 3-hydroxy-3-methylglutaryl-CoA reductase (HMGCR), contributing to its more effective cholesterol-lowering capacity. The 16S rRNA analysis revealed that fish oil but not flaxseed oil decreased the ratio of Firmicutes to Bacteroidetes. Both oils raised the abundance of short-chain fatty acid (SCFA)-producing bacteria in mice, leading to a higher microbial generation of SCFA. It was concluded that fish oil was more effective than flaxseed oil in ameliorating the TMAO-exacerbated atherogenesis at least in ApoE−/− mice.

AGFD 287 Inhibition of colonic inflammation and colon tumorigenesis by strawberry and cranberry Yanhui Han, Xian Wu, Hang Xiao, hangxiao@gmail.com. Food Sci., Univ. of Massachusetts, Amherst There are growing interests in using whole food-based approach to prevent chronic diseases due to potential synergistic interactions among different bioactive components within the whole foods. Our recent research aimed to promote colon health by using whole berries to prevent colonic inflammation and colon tumorigenesis. In dextran sulfate sodium (DSS)-treated colitic mice, dietary whole strawberry (WS) reduced the disease activity index (DAI), prevented the colon shortening and spleen enlargement, and alleviated the colonic tissue damages. The abundance of pro-inflammatory immune cells was reduced by dietary WS in the colonic mucosa, which was accompanied by the suppression of overproduction of pro-inflammatory cytokines. Moreover, dietary WS partially reversed the alteration of gut microbiota in the colitic mice by increasing the abundance of potentially beneficial bacteria and decreasing the abundance of potentially harmful bacteria. In azoxymethane (AOM) and DSS-treated mice, dietary administration of whole cranberry (WC) significantly suppressed colon...
tumorigenesis as indicated by the reduced tumor incidence, multiplicity, burden and average tumor size in WC-fed mice compared to the positive control mice. Both gene and protein expression levels of pro-inflammatory cytokines IL-1β, IL-6 and TNF-α were markedly attenuated by WC treatment in the colon of AOM/DSS-treated mice. Moreover, WC profoundly modulated multiple signaling pathways/proteins related to inflammation, cell proliferation, apoptosis, angiogenesis and metastasis in the colon, which was closely associated with the inhibitory effects of WC on colon tumorigenesis. Overall, our results demonstrated the chemopreventive effects of WS and WC against colonic inflammation and tumorigenesis in mice, respectively, providing a scientific basis for using whole berries as a functional food to promote colon health in humans.

AGFD 288 Renal function improvement of diabetic nephropathy mice with ethanol extract of Pueraria lobata (Willd.) Ohwi Fuxin Chen, chenfuxin1981@163.com. Xi’an Univ. of Science and Tech., Shaanxi, China The protective effect of ethanol extract of Pueraria lobata (Willd.) Ohwi (PU) on renal function in diabetic nephropathy was investigated. A mouse model of diabetic nephropathy was constructed by intraperitoneal injection of cadmium chloride in combination with high-fat and sugar diet. Then the protective group was given the extract of PU, and the model group and the control group were given the same volume of normal saline. After modeling, serum samples and kidney tissue analysis were taken. The results showed that the fasting blood glucose level of the model group was significantly higher than that of the blank group (P<0.001) serum creatinine and blood urea nitrogen levels increased significantly (P<0.001) and N-acetyl β-glucosaminidase activity was significantly enhanced (P<0.001) and hematoxylin-eosin staining pathological sections of kidney tissue showed clear lesion structure under light microscope. After the rats were given the ethanol root extract of PU, the physiological and biochemical indexes of the mice in the protected group were restored compared with the model group, and the tissue lesions were also relatively relieved. It was proved that PU can effectively alleviate the renal injury process in mice with diabetic nephropathy and maintain its renal function to normal level. Therefore the ethanol root extract of PU is expected to be developed into a special dietary food for patients with diabetic nephropathy.

AGFD 289 In vivo acrolein-trapping capacities of tea EGCG and soy genistin were mainly mediated by individual bioavailability and biotransformation Yingdong Zhu1, yzhu1@ncat.edu, Qiju Huang2,1, Lishuang Lv2, Shengmin Sang1. (1) Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis (2) Dept. of Food Sci. & Tech., Nanjing Normal Univ., China Acrolein is a highly toxic unsaturated aldehyde. Humans are both endogenously and exogenously exposed to acrolein. Endogenous ACR is mainly liberated from lipid peroxidation and oxidation of some amino acids, while exogenous sources include tobacco smoke, exhaust gas emission, wood combustion, and food thermal processing. Gut microbial metabolism of certain food ingredients, such as glycerol, can also be an additionally important source of endogenous ACR. Long-term exposure to acrolein leads to various chronic disease states, such as cardiovascular diseases, diabetes mellitus, cancers, and Alzheimer diseases. Dietary polyphenols have been reported to be able to attenuate acrolein-induced toxicity in vitro via formation of acrolein-polyphenol conjugates. However, whether, and how, dietary acrolein-trapping abilities of polyphenols can be maintained under in vivo environments is still unknown. In the present study, two most commonly-consumed dietary polyphenols, (-)-epigallocatechin-3-gallate (EGCG) from tea and genistin from soy, were used to evaluate for their anti-acrolein behaviors both in vitro and in mice. Tea EGCG exerted much higher capacity to capture acrolein than soy genistin in vitro. But translation of in vitro anti-acrolein activity into in vivo was mainly mediated by bioavailability and biotransformation of individual polyphenols. We observed that absorbed polyphenols could be rapidly metabolized, and most likely, certain metabolites retained anti-ACR bioactivity of parent compounds. On the other hand, non-absorbed polyphenols had ability to scavenge ACR in the gut when travelling through gastrointestinal tract. In addition, microbial metabolites of dietary polyphenols could also display in vivo anti-ACR ability via enterohepatic cycling. Our findings demonstrate that in vivo anti-acrolein ability of dietary polyphenols can not be reflected solely based on their in vitro ability. The bioavailability and biotransformation of individual polyphenols as well as gut microbiome contribute to in vivo anti-acrolein ability of dietary polyphenols.

AGFD 290 Honey of Apis cerana Fabricius from China: Structures, biological functions and emerging health benefits Wei Cao, caowei@nwu.edu.cn, Haoan Zhao. College of Food Sci. & Tech., Northwest Univ., Xi’an, China Honey, a natural food of nutritional and medicinal value, has been favored by consumers in recent years. Based on the identification of bioactive components from honey of Apis cerana Fabricius (A. cerana honey) and discovery of biomarkers, this study was dedicated to investigate the bioactivity of A. cerana honey including antibacterial, antioxidant, hepatoprotective and anti-colitis. The results showed that A. cerana honey inhibits the growth of Gram-negative and Gram-positive bacteria, prevents alcohol/chemical-induced liver damage and defenses dextran sulfate sodium (DSS)-induced colitis via improving biochemical indicators, inflammatory-related proteins and genes, or modulating gut microbiota, etc. These new insights conducd to studying the biological functions and emerging health benefits of A. cerana honey.

AGFD 291 Food safety: Critical consideration in reducing food losses and waste Rosa Rolle, Rosa.Rolle@fao.org. Nutrition and Food Systems Division (ESN), Food and Agriculture Organization of the United Nations (FAO), Rome, Italy Today, an estimated one third of food produced globally is lost and/or wasted. With population growth, increasing urbanization, climate change, stagnation of land resources for food production and increasing scarcity of water resources, a critical challenge facing our world today is ensuring that the nearly 10 billion people living on this planet in 2050 will have access to sufficient supplies of safe, nutritious food. Reducing food losses and waste while ensuring food safety represents an opportunity of significant magnitude to address this critical challenge. However, necessitates effectively addressing the multiple food safety risks and hazards that can occur across food supply chains from production, harvesting, transportation, storage, and manufacturing and at the consumer level. This paper will take a developmental perspective in reviewing food safety risks and hazards that can contribute to food loss and waste across the supply chain, and will highlight work being undertaken in the areas of advocacy, policy, consumer education, and scientific advice to address the issues.

AGFD 292 Advanced oxidation process to enhance microbial safety of fresh produce Xuetong Fan, xuetong.fan@ars.usda.gov. USDA, ARS, Eastern Regional Research Center, Wyndmoor, Pennsylvania Microbial contamination continues to pose a major challenge in ensuring microbial safety of fresh produce despite scientific effort and progress in developing antimicrobial interventions in recent years. Most intervention technologies and treatments that have been evaluated have limited effectiveness in reducing populations of foodborne pathogens on/in fresh and fresh-cut fruits and vegetables. New approaches in the development of interventions are needed to achieve additional efficacy in minimizing
the microbiological hazards associated with fresh produce. Advanced oxidation process is a method relying on the efficient generation of reactive radical species, such as hydrogen radicals. In general, hydroxyl radicals are produced from primary oxidants (e.g. ozone and hydrogen peroxide) and/or energy sources (e.g. cold plasma and ultraviolet light). The process is mostly studied and applied to treat wastewater and degrade organic pollutants. In the present presentation, the last developments in advanced oxidation process applied in gaseous or aerosolized phase to enhance microbial safety of fresh produce will be reviewed. Results will be presented on combinations of aerosolized hydrogen peroxide with cold plasma, gaseous ozone and ultraviolet light. Advantages and challenges for its commercial application will be discussed.

**AGFD 293 High pressure processing (HPP) as an innovative approach in value-added product development of superfruits with aronia berry as the main model** Changmou Xu, cxu13@unl.edu. Univ. of Nebraska-Lincoln High pressure processing (HPP) as a non-thermal food preservation technique has been successfully commercialized on many food products recently, such as on juices, sauces, meats, and seafood. As its effectiveness in killing microorganisms and minimal effect on the physiochemical, sensory, and nutritional properties of foods, HPP is an ideal food preservation technique for products (e.g. juice and puree) of superfruits, on which consumers usually have high expectation of quality and healthy benefits. Superfruit is a marketing term for fruits with supposed health benefits which usually are rich in phytochemicals and antioxidants, but also come along with unfavorable taste (e.g. bitterness and astringency). Aronia berry is such a superfruit and being grown as a specialty crop primarily in the Midwest and throughout the north of US in recent 10 years. However, unlike other berries, majority of aronia berries are not consumed freshly due to their sour and astringent taste. If couldn’t been processed into value-added products, they would be turned into food waste or leaving on the bush without harvesting. Therefore, it is in urgent need to find a processing Tech. which not only can process aronia berries into a value-added and safe product such as juice, but also should maximally maintain its prime quality, the biggest selling point of this berry. This presentation, with aronia berry as the main model, will address how high pressure processing Tech. compared with traditional pasteurization would affect the overall quality of superfruit juice, such as physiochemical properties, microbial counts (including spores), enzymes activities, bioactive compounds, antioxidant capacities, and flavor. The effect of HPP on the efficiency of masking Tech., which is employed to enhance the favor of aronia juice, also will be discussed. The successful application of HPP Tech. together with masking Tech. on aronia juice will contribute to a viable and sustainable aronia industry, and these technologies also can be applied to other superfruit industries.

**AGFD 294 Waterless gaseous antimicrobial intervention for produce safety** Vivian Wu, vivian.wu@ars.usda.gov. USDA ARS WRRC, Albany, California With an increase in consumption of fresh fruits and vegetables, it has come an increased frequency of foodborne outbreaks associated with raw and minimally processed fruits and vegetables. Most fresh produce requires no additional preparation or cooking before consumption, therefore, the contamination of fresh produce by pathogens is a significant public health hazard. Good Agricultural Practices and Good Manufacturing Practices (GMPs) are being encouraged for produce production and distribution. The FDA is seeking more effective microbial reduction strategies during food processing and in retail food establishments. In response to the public health concerns with the microbiological safety of fresh and fresh-cut produce, researchers have investigated the efficiency of numerous physical, chemical, and biological methods for reducing the microbiological load of produce. Additionally, interest in seeking sustainable and eco-friendly solutions that aim at reducing water and energy footprints of postharvest processes related to food, while improving or maintaining the level of food safety and quality is on the rise. This presentation will provide an overview of the use of waterless gaseous antimicrobials for fresh produce with a particular emphasis on gaseous chlorine dioxide and gaseous ozone, which not only address microbial contamination, but also save in water and energy resources and may reduce food loss/waste.

**AGFD 295 Nature inspired synergistic antimicrobial approaches for enhanced microbial inactivation** Nitin Nitin, nnitin@ucdavis.edu, Xu Yang, Erick F. Oliveria, Coung Nguyen Hiu. Univ. of California, Davis Reduction of microbial load in food and water systems is critical for their safety and shelf-life. To complement the high intensity non-thermal technologies, there is a need to develop low-medium intensity non-thermal processing technologies for diversity of food applications. These innovations can significantly improve food quality and safety as well as reduce the cost of processing. This presentation will focus on our efforts to develop nature inspired synergistic non-thermal low intensity food processing approaches for enhanced microbial inactivation. This novel approach is based on discovery and translation of synergistic interactions between natural food grade compounds and low intensity non-thermal technologies. Two case studies will be presented. The first part of the presentation will focus on a synergistic combination of sub-lethal levels of stresses induced by UV-A light and food grade bioactives. The results will demonstrate enhanced and rapid inactivation of both E.coli O157:H7 and Listeria spp.) in the presence of organic matter as well as on the surface of fresh produce. The second part of the presentation will focus on synergistic combination of ultrasonic processing with food grade compounds to inactivate target bacteria in liquid systems. The results of mechanistic investigations for both the synergistic low intensity non-thermal processing technologies will be presented. These studies will include changes in membrane permeability, intracellular thiol content, metabolic activity and antioxidant competition assays. In summary, the presentation will illustrate novel approaches to enhance efficacy of non-thermal processing technologies for improving safety and quality of food systems.

**AGFD 296 DBD and GlidArcs in plasma agriculture and food safety** Gregory Fridman, gregfridman@gmail.com. Nyheim Plasma Inst., Drexel Univ., Camden, New Jersey Food safety is the ever expanding global need. An important concern is the presence of bacteria and other pathogens on the surface of fresh produce. Plasmas, of course, are well-known for their strong antimicrobial properties. In the field of plasma medicine, a number of discharges known for their high energy are being used for enhanced microbial inactivation—usually within a few seconds of treatment. However, delivering plasma treatment to a 3-dimentional complex surface of foodstuffs, specifically of fresh produce, can be quite challenging: produce surface is complex and frequently multi-layered (e.g. a bag of spinach leaves), and the industrial processing rates are very high. For this reason, we have developed two systems to address this issue: 1) plasma jet-like system where an air stream containing small droplets of water is passed through the discharge and onto the surface of produce; and 2) gliding arc plasmatron system used for treatment of large volume of flowing liquid (the liquid is subsequently used for produce washing). The key challenges, addressed in this talk, are the control of temperature of air and water passing through the discharge, and the resulting chemistry generated in the liquid.
AGFD 297 Best practices in teaching food chemistry  Michael H. Tunick, mht39@drexel.edu. Center for Food & Hospitality Management, Drexel Univ., Philadelphia, Pennsylvania  Food chemistry and food analysis are more complicated than other branches of chemistry since many compounds are present in non-homogeneous mixtures. As a result, teaching the subject is also difficult. This symposium will feature some ways of going about educating students in this field, along with ideas from some students about what seems to work for them.

AGFD 298 Teaching analytical chemistry to Food Sci. students  Alyson E. Mitchell, aemitchell@ucdavis.edu. Food Sci. Tech., UC Davis  The goal of any Food Sci. program is to educate students to ensure that there is a safe, healthy, high quality and abundant food supply. The general Food Sci. curriculum includes advanced understanding in food chemistry and biochemistry, food safety and microbiology, food processing and preservation, and sensory science. Students within a Food Sci. major have diverse interests (e.g. sensory science, food microbiology, etc.) and only a small percentage will actually be focused on the field of food chemistry. Nonetheless, all students must master knowledge in basic principles of food chemistry, and in the chemical and physical analysis of foods. This can present a challenge to instructors. How do you persuade a student interested in a career in microbial food safety, to master an advanced analytical technique such as HPLC or GC? This presentation will identify approaches that are useful for engaging students with broad and diverse interests in analytical chemistry. Ideas and tools that help promote and encourage student learning and participation in laboratory classes will be presented and include laboratory manual design, pre-lab homework, laboratory reports and rubric design.

AGFD 299 Learning outcome of food analysis for undergraduate students in Food Sci. & Tech. Michael C. Qian, michael.qian@oregonstate.edu. Oregon State Univ., Corvallis  Food Analysis is a core knowledge area for Food Sci. major students. It is also an elective class for students in other disciplines who may have a career interest in food industry. My objective for this class is to prepare students to meet food industry’s growing demands, with knowledge and skills to work in food quality control as well as research and product development areas. Specifically, the class is designed to help students to be proficient in knowledge and skills in analyzing macro- and micro-component in food systems commonly performed in food quality laboratories. These include traditional analysis of moisture, protein, fat, ash, fiber as well as instrumental analysis of fatty acid methyl ester (GC), sugar composition (HPLC) and organic acid profile (HPLC). In addition, the course will help students to develop advanced knowledge and skills in IR/NIR, GC-MS and flavor analysis. At the conclusion of the course, our students are (or should be) capable of naming and describing the general principle of a range of methods available for common analytical problems including nutritional food labeling, describing in detail the basis and application of methods practiced in laboratory, demonstrating laboratory proficiency in the application of traditional methods of analysis, and exercising judgment in the selection of a suitable method for specific analytical situations - taking into account sample preparation, necessary analytical equipment/instrumentation, required detection limit, sensitivity and interferences. In addition, students will increase their skills in reading and writing technical papers. At advanced level, students are capable of designing experiment(s) to solve practical concerns related to foods and agricultural products. This lecture will share my 19 years of experiences to deliver the learning outcomes.

AGFD 300 Learning food chemistry as a graduate student and a teaching assistant  Kathleen Luo, kkluo@ucdavis.edu. Food Sci. & Tech., UC Davis  Food chemistry covers a broad array of topics, and learning this discipline may seem overwhelming for someone from another field. The major challenge of learning food chemistry as a graduate student with no Food Sci. background was connecting analytical chemistry with food chemistry and to understand the natural complexity of food systems. Being a graduate student provided an opportunity to be a teaching assistant for food analysis courses. Teaching in a laboratory setting gives the teaching assistant a unique opportunity to interact with students in hopes of sparking interest in the area and training practical laboratory skills. This talk will cover the challenge of learning food chemistry from a different background as a graduate student and tips that may help learning the discipline. This talk will also cover tips for teaching students in laboratory setting and what resources work well for graduate student teaching.

AGFD 301 My path from chemist to food scientist  Zhuzhu Wang, zhuzhuw2@illinois.edu. Food Sci. and Human Nutrition, Univ. of Illinois at Urbana-Champaign, Urbana  My name is Zhuzhu Wang, and I am currently a PhD student in the Dept. of Food Sci. and Human Nutrition at Univ. of Illinois at Urbana-Champaign. I have a Bachelor’s in chemistry, and Masters’ degrees in Molecular Chemistry and Pharmaceutical Science. Prior to admission to the PhD program, I worked for two years as a Research Scientist for Archer Daniel Midland (ADM). I would like to attend the “Teaching and Learning Food Chemistry and Analysis” symposium and share with people my path of from chemist to a food scientist.

AGFD 302 Learning industry standard methods of food analysis as a student, and learning to emphasize critical material for making confident, knowledgeable, industry-bound Food Sci. graduates as a teaching assistant  Quintin Ferraris, ferrarisquintin@gmail.com. Food Sci. & Tech., Oregon State Univ., Port Reading, New Jersey  Understanding fundamental food chemistry methods of analysis was critical to my entry and future success in Food Sci. With a background in molecular biology and research experience in analytical instrumentation applications of the pharmaceutical industry, I initially walked into my degree in Food Sci. narrow-sighted with respect to how I would and should answer the question of analysis in a food system. While seated in the chair as a student in food chemistry and food analysis courses, I quickly learned that methods I was once trained to rely on are not food industry standard accepted methods because they are cost prohibitive or simply do not provide relevant information to the food processor. Methods like Kjeldahl, Mojonnier, and muffle furnace ashing were new concepts to me, however, they are corner-stone methods developed and used for decades in food systems because they provide chemical information essential to processing and nutrition. Moreover, many targeted analytical methods involving instrumentation that I was familiar with could be used in food systems. I needed to recognize the specific challenges that a food matrix can present and the required steps during sample preparation or analysis that combat those obstacles. Stepping into an instruction role, specifically a teaching assistant, makes one consider what information can be added outside of the lecture to create unique and powerful laboratory experience for the students. Understanding that the curriculum already exists to focus and emphasize core food compositional analysis, what additional experiences could benefit the students such as hands-on instrumentation and personalized learning experiences. Additional challenges must be addressed to maximize student learning experiences and objective outcomes of the course. Examples include class size, available facilities, and ranging student learning levels.

AGFD 303 Enhancement, characterization of phenolic compounds by Agaricus biturgus (Quél.) Sacc. ZJUCDMA12 and its
anti-proliferation activity. Hui Kuang1, 11813032@zju.edu.cn, Di Gu1, Yingchun Jiao2, Qihe Chen1. (1) Dept. of Food Sci. and Nutrition, Food Sci., Hangzhou, China (2) Agriculture and Animal Husbandry College, Food Sci., Xining, Qinghai Province, China

Edible fungi are rich sources of phenolic compounds (PMs) and exhibit a wide variety of biological activities, especially its anti-proliferation effects have been widely reported. PMs were extracted from Agaricus bitorquis (Quél.) Sacc (ABSC) ZJUCDMA12 by solvent extraction method using ethanol solution. To improve the production of PMs from ABSC, a Plackett-Burman design and response surface methodology were used to optimize the culture conditions. The optimized culture consists of 10 g/L glucose, 18.00 g/L fructose, 10 g/L sucrose, 18.00 g/L maltose, 5 g/L peptone, 0.1 g/L CaCl2, 0.03 g/L Vitamin C, 1 g/L KH2PO4H2O and 0.5 g/L MgSO47H2O, pH=2.95. Subsequent verification revealed that the production of PMs could be 2.79±0.17 mg/mL. High Performance Liquid Chromatography-Time of Flight Mass Spectrometry (HPLC-Triple TOF) method was employed to analyse the compositions of PMs and the results illustrated that twenty three kinds of PMs were isolated from ABCS, including rutin, citrus flavonoids, naringin, hesperidin, neohesperidin. Then PMs from the fruiting bodies, intracellular and extracellular of ABCS were analyzed by CCK-8 assay for in vitro anti-proliferation activity in HepG2 cells, respectively. More significant anti-proliferation activities were observed in intracellular PMs possessed much lower IC50 values. The PMs from ABCS could be a novel resource of natural anti-proliferation agents for use in the functional food or medicine.

AGFD 304 Nutrient utilization of a gut microbial community: Metabolic analysis of the distinct regional communities in vitro Jenni Firman, jenni.firman@ars.usda.gov. USDA, Wyndmoor, Pennsylvania It is well known that the gut microbiota plays an important functional role through catabolism of undigested nutrients, fermentation of indigestible fibers, and subsequent release of metabolic byproducts. These released metabolites not only effect human colon cells and other microbes in the surrounding environment but can exert a global effect by entering the blood stream and traveling to accessory tissues and remote organs. Studies of the gut microbiota metabolome thus far have produced interesting and significant results; however, these studies are typically performed on blood or fecal samples from an in vivo model, and therefore are unable to discern between metabolites produced by the gut microbiota, and those that are either directly produced by the mammalian cells, or are altered by the mammalian cells, during the entero-hepatic circulation. In addition, this fails to discern between metabolites produced in the different regions of the colon, each of which contains a unique microenvironment that inimitably shape the microbiota into region specific communities. In order to gain a deep understanding regarding nutrient availability, community structure, and metabolites produced by the gut microbiota requires region-specific analysis in the absence of mammalian components. Here, the region-specific gut microbial communities were cultured using an in vitro system capable of simulating the conditions of the gastrointestinal tract. Samples were harvested from each colon region and used to determine community structure using Shotgun sequencing, metabolites produced using LC-MS, and short chain fatty acids released using GC-MS. The differences and similarities between regions were identified to generate region specific profiles. Finally, data from these analyses were combined to provide a comprehensive description of the gut microbiota in terms of community structure and metabolome. For the first time, the connection between nutrient utilization, community structure, and the metabolome was analyzed for the in vitro, region specific communities of the gut microbiota.

AGFD 305 Impact of Stevia leaf extract on the human gut microbiota: analysis of in vitro and mucosal interactions with the human colon Karley K. Mahalak1, Karley.Mahalak@ars.usda.gov, Jenni Firman1, Audrey Thomas-Gahring1, Jung-Jin Lee3, Lin Liu2. (1) ARS, USDA, Glenside, Pennsylvania (2) USDA ARS ERRC, Wyndmoor, Pennsylvania (3) Univ. of Pennsylvania, Philadelphia Stevia is currently used as a natural alternative to other non-nutritive sweeteners such as aspartame and sucralose. Once banned in the US and Europe amid cancer fears, it is now considered GRAS in leaf extract form and is frequently combined with the sugar alcohol erythritol when used as a table sugar substitute. Because of its bacteriostatic properties, there are conflicting views in the research community on whether or not consumption of Stevia impacts the bacterial community in the gut and potentially affects gut health. Our present work aimed to study the impact of stevia on a whole human gut microbial community in vitro using a mixed-flow bioreactor to mimic the human colon over a period of 5 days, using a commercially available product (stevia mixed with erythritol). We also performed analysis of single-bacterial strain growth of representatives of the gut community in response to the stevia leaf extract components and break-down products, Rebaudioside A, Stevioside, Steviol, and Glucose. Our results show that treatment with the stevia and erythritol mix did not greatly affect the bacterial community composition. However, there was an increase in abundance of two Short-Chain Fatty Acids, Butyric and Pentanoic Acid, with treatment. Steviol was the only component that showed any impact on one of the individual bacterial strains and that affect was minimal. Our results indicate that use of stevia combined with erythritol had a minimal impact on the gut microbial community and production of SCFAs. However, research into other metabolites produced by the gut microbiota and the impact of these on human cells is still in progress.

AGFD 306 Modulation of the luminal and mucosal gut microbiome of cats and dogs by a novel short-term colonic fermentation model Pieter van den Abbeele, pieter.vandenabbeele@prodigest.eu. Prodigest, Ghent, Belgium The current study involved the evaluation of the effect of five different yeast-derived formulations on microbial metabolism and composition of the canine and feline colonic microbiota. To do so, a novel short-term colonic batch incubation approach (48h) was developed. Both model validation and treatment effects were evaluated through analysis of microbial metabolic activity via determination of the pH decrease of the medium, the pressure build-up inside the bottles, and the quantification of SCFA, BSCFA, lactate, and ammonium. The influence on the colonic microbiota composition was studied through qPCR using primers targeting the Firmicutes, Bacteroidetes, Bifidobacteria, Lactobacilli, and Enterobacteriaceae and through 16S-targeted Illumina sequencing coupled to flow cytometric quantification of the total bacterial population. Firstly, it followed that the novel fermentation model allowed growth of the complete spectrum of canine and feline-derived bacteria present in the original inocula thus offering a relevant Tech. platform to evaluate the effect of dietary interventions. With respect to treatment effect it followed that specific supplementation of yeast supplements differentially increased production of acetate, propionate, butyrate and also differentially modulated proteolytic fermentation resulting in increased production of ammonium and BSCFA. Further, while qPCR was not able to reveal great insights in microbiota modulation,16S-targeted Illumina sequencing coupled with flow cytometry revealed great insight and showed that the effects on propionate could be corroborated by alterations within the Prevotellaceae, Tannerellaceae, Bacteroidaceae and Veillonellaceae families, whereas effects on butyrate production could be explained by changes in the Erysipelotrichaceae, Lachnospiraceae, Ruminococcaceae and Fusobacteriaceae families.
**AGFD 307 Stabilization of liposomes by incorporation of block copolypeptide** Yoshihiro Ito, y-ito@riken.jp, Nano Medical Eng. Laboratory, RIKEN CPR, Wako-shi, Saitama, Japan Hybrid assemblies composed of phospholipids and amphiphilic polymers have been investigated previously as a biomimetic model of biological cells. However, these studies focused on the functions of polymers in a sea of membrane lipids. Here, we prepared a highly stable peptide-lipid hybrid vesicle from a combination of an amphiphilic block co-polymer composed of hydrophilic and hydrophobic blocks and the phospholipid, 1,2-dimyristoyl-s- 

**AGFD 308 Transcriptomics of L. monocytogenes treated with olive leaf extract** Yanhong Liu, yanhong.liu@ars.usda.gov, Gian Marco Baranzoni, Vujuan Luo, Lindsay McKeever. Molecular Characterization of Foodborne pathogen Diseases Research Unit, USDA-ARS-ERRC, Wyndmoor, Pennsylvania Listeria monocytogenes is an important foodborne pathogen that can cause listeriosis with high mortality rates. Olive leaf extract is a plant antimicrobial that has been shown to inhibit the growth of foodborne pathogens such as L. monocytogenes. However, the adaptation mechanism of L. monocytogenes to olive leaf extract remains unclear. In this paper, the growth/survival of L. monocytogenes was determined with sublethal dose of olive leaf extract (7.8 mg/ml) treatment. RNA-Seq was conducted to compare the transcriptional profiles between cells cultured in Brain Heart Infusion (BHI) broth with and without olive extract at different time points (3.5 hr and 24 hr) to identify differentially expressed genes (DEGs). DEGs (171 and 490) including up- and down-regulated genes were identified using RNA-Seq analysis in response to 3.5 hr and 24-hr olive leaf extract treatments, respectively. RNA-Seq data were validated using quantitative reverse transcription PCR (qRT-PCR) assays. The DEGs included but not limited to genes encoding for signal transduction, ABC transporters and PTS systems. Interestingly, virulence-related genes were down-regulated, suggesting that olive leaf extract may decrease the virulence potential of L. monocytogenes. Our study provides insight on the adaptation mechanism of L. monocytogenes with treatment of olive leaf extract, and may aid in searching for strategies to inhibit L. monocytogenes in food.

**AGFD 309 In vitro and in vivo studies on anti-inflammatory effects of traditional Okinawan vegetable methanol extracts** Junichi Nagata1, j-nagata@fit.ac.jp, Hiroiuki Yokodera1, Goki Maeda2. (1) Life, Environment, and Applied Chemistry, Fukuoka Inst. of Tech., Fukuoka, Japan (2) Okinawa Prefectural Agricultural Research Center, Itoman, Okinawa, Japan To clarify anti-inflammatory effect of Okinawan vegetable methanol extracts, we examined the nitric oxide production and some kinds of pre-inflammatory markers such as IL-6 and TNF-α from mouse macrophage cells (RAW264) by the addition of Nishi-yomogi collected at Isigaki and Kume Island and Hosoba-wadan extracts. In addition, we studied the anti-inflammatory impact of extracts using carrageenan-induced footpad edema animal model. In the case of in vitro study, NO and cytokine concentrations of supernatant were assayed with Griess method and ELISA kit, respectively. Gene expressions of iNOS, COX-2, and NF-kB were estimated by quantitative PCR. In the study of footpad edema animal model, 6 week-old male SD rats were treated with intraperitoneal administration of extracts, and induced edema by injection of carrageenan on right footpad. Footpad volume before and after administration of carrageenan was measured. Data are presented as means±SEM. The statistical significance of difference was evaluated by Tukey-Kramer HSD test. Differences at P <0.05 were considered to be significant. NO and TNF-α productions of the Kume Nishi-yomogi group were significantly lower (P <0.05) than those of other groups, and also IL-6 production of the Kume Nishi-yomogi group was significantly lower (P <0.05) than that of control. The iNOS and COX-2 gene expressions of Kume Nishi-yomogi group were significantly downregulated (P <0.05) compared to those of other groups. While, the footpad edema of rats administered extract showed no significant difference between groups, but the tendency of decreased edema was observed in Kume Nishi-yomogi group. From these results, it is expected that Nishi-yomogi from Kume Island might be effective in the alleviating inflammation.

**AGFD 310 Different sources of glucomannans protects against immunosuppression in cyclophosphamide-induced mice** Mingzhi Li, Limingzhirjyk@163.com, Xiaojun Huang, Jie-Lun Hu, Shaoping Nie, Mingyong Xie. State Key Lab. of Food Sci. & Tech., Nanchang Univ., China The protective effects of glucomannans from different sources against cyclophosphamide (CTX)-induced immunosuppression were investigated from the aspects of cellular and humoral immunity. Results showed that glucomannans enhanced the secretion of T helper type 1 (Th1) cytokines and the proportion of CD4+ T lymphocytes, promoted the subpopulation of T lymphocytes by up-regulating T-beta and GATA-3 mRNA expressions. Meanwhile, glucomannans increased the secretion of immunoglobulins, stimulated the differentiation of plasmocytes by up-regulating IRF4, Blimp-1 and XBP-1 mRNA expressions. Furthermore, Dendrobium officinale polysaccharide showed great ability in enhancing the number of T lymphocytes and the mRNA expression of plasmacytic differentiation to increase the secretion of immunoglobulin. konjac glucomannan showed great ability in increasing the secretion of cytokines to stimulate immune systems while aloe vera polysaccharide showed great ability in enhancing the mRNA expression to stimulate Th1 type immune response. These results suggested that three kinds of glucomannans improved the immunoregulation capacity with different mechanisms.

**AGFD 311 Strategy for acrylamide reduction in different bakery products:** Breads, cookies, and muffins Malgorzata Starowicz1, m.starowicz@pol.olsztyn.pl, Zuzana Ciesarova2, Henryk Zielinski1. (1) Chemistry and Biodynamics of Food, Inst. of Animal Reproduction and Food Research, Olsztyn, Warminski-Mazurskie, Poland (2) National Agriculture and Food Centre – The Food Research Inst., Bratislava, Slovakia According to FAO/WHO data, bakery products, such as bread and rolls, have 10-30% of contribution on total exposure of acrylamide (AA) in peoples’ diet. Therefore, there is a need to search for appropriate AA reduction strategies. These strategies are mostly focused on eliminations of AA precursors, modification of recipes and evaluation of processing parameters. One of less known methods of AA mitigation, with insufficiently described mechanism of reaction, is the addition of antioxidants. In our studies, the influence of flour type (wheat, spelt, rye), baking time and temperature (200°C/ 30 min; 200°C/ 35 min; 240°C/ 30 min and 240°C/ 35 min), addition of selected spices (as a natural source of antioxidants), and usage of fermentation process were addressed. Acrylamide content was examined in three different bakery products such as; breads, cookies and muffins. The studies showed an impact of flours origin on AA formation in breads with the following rank: rye> spelt> wheat. Moreover, lower AA content was achieved in products prepared in lower baking temperature with longer baking time. The AA formation in rye breads was at least fivefold higher as compared to wheat and spelt breads, thus indicating the impact of fermentation used for rye bread preparation. Furthermore, addition of selected spices to cookies formula such as
closes, allspice and vanilla were the most efficient in acrylamide mitigation strategy (8-11% of acrylamide reduction). Moreover, good correlation coefficient was calculated between cookies' total phenolic content and AA (r = 0.66) and their antioxidant activity measured by ABTS method vs AA (r = 0.62). The provided results make indications for the proper selection of raw material, formulation and process Tech. to obtain bakery products with low AA level.

AGFD 312 Testing the next generation of handheld devices for screening acrylamide in high-risk products Luis E. Rodriguez-Saona, luis.e.rodriguez-saona.1@osu.edu, Dept. of Food Sci. & Tech., The Ohio State Univ., Columbus In 2002, significant amounts of acrylamide were detected in some foods processed at high temperatures, notably in potato products, cereal foods and coffee. Acrylamide is a known animal carcinogen and human neurotoxicant and it is classified as “probable carcinogen to humans”. Acrylamide in food has become a significant issue for the FDA, appearing on the FDA Center for Food Safety and Applied Nutrition Program Priority list since 2003. Acrylamide has been included in California’s Proposition 65 list of chemicals that can potentially cause cancer or reproductive harm. Current assays for acrylamide rely on GC-MS or LC-MS/MS. These methods are time-consuming, expensive, and labor-intensive, requiring complex procedures of sample pretreatment and well-trained technicians to operate the instrumentation. Generally, these methods require food producers to send samples out rather than perform in-house acrylamide testing. Thus, it is of paramount importance to develop simpler, low-cost, and sensitive methods for routine monitoring of acrylamide in foods. Handheld vibrational spectroscopic techniques (NIR, FT-IR and Raman) can help to establish reliable monitoring program(s) for acrylamide levels. The Tech. can allow detection and quantification of acrylamide through spectral signature profiles enabling for real-time and field-based measurements for controlling the product stream, addressing risk management, assessing safety and brand equity.

AGFD 313 Acrylamide levels in commercially available baby biscuits Stephen Elmore, j.s.elmore@reading.ac.uk, LIpi Das, Shams Arafa, Maria Jose Oruna-Concha. Univ. of Reading, UK. Acrylamide levels in 34 different types of baby biscuit commercially available in the United Kingdom were measured, with reference to the European Commission’s benchmark value of 150 µg/kg. Of these 34 samples, 19 were purchased on two occasions, six months apart, giving 53 samples in total. Concentrations of acrylamide in the biscuits ranged from 15 to 747 µg/kg. Acrylamide levels in 18 of the 53 samples were above the benchmark value. Six of the repeat purchases exceeded the benchmark value on both occasions. Results are discussed with regard to dietary exposure and the effect that the ingredients of the biscuits may have on their acrylamide content. Biscuits underwent a straightforward extraction with water, followed by centrifugation and syringe filtration to provide a clear sample, prior to analysis by liquid chromatography with tandem mass spectrometry (LC-MS/MS).

AGFD 314 Influence of matrix and coatings in the analysis of acrylamide in nuts and nut products Alyson E. Mitchell1, aemitchell@ucdavis.edu, Kathleen Luo2, Elizabeth Nojima2. (1) Food Sci. Tech., UC Davis (2) Food Sci. & Tech., UC Davis. Acrylamide is classified as a probably carcinogen to humans and is on the Proposition 65 list of chemicals known to cause cancer or reproductive toxicity in California. In most foods, acrylamide is formed through a reaction between asparagine and a reducing sugar in first steps of the Maillard reaction. Acrylamide formation generally occurs at cooking temperatures above 120 °C (e.g. roasting and baking) in low moisture conditions. Nuts, such as almonds, are naturally a low moisture food that have relatively high levels of free asparagine. Roasted nuts and their products (e.g. nut butters) have been shown to contain > 200 µg kg⁻¹ (ppb) acrylamide. To date, the FDA recommends that manufacturers be aware of acrylamide levels in their products and most manufacturers would like to achieve levels below 200 ppb. Acrylamide levels can vary significantly between products due to many factors including variable heat exposure within a roaster and sample variability (e.g. cultivar selection, moisture content, product age, etc.). To date, little data is available on the ranges of acrylamide in nut and nut products as extensive sampling is required. Often, manufacturers only measure acrylamide levels in a single product in response to litigation and only a few samples are measured to determine levels of acrylamide across a product line. Additionally, little is known on how various coating processes influence measured acrylamide levels in foods. Herein, acrylamide levels were measured in a range of roasted nuts with variable coatings (e.g. salted, flavored, etc.) and in roasted nut butters. Acrylamide was extracted using QuEChERS and quantified using a Hypercarb column (Thermo Scientific, US) and a 1290 Infinity ultrahigh-performance liquid chromatography system (UHPLC) interfaced to a 6460 triple-quadrupole mass spectrometer (MS/MS) with electrospray ionization (ESI) (Agilent Technologies, Santa Clara, CA). Quantification was achieved using an internal calibration curve. The linear range was from 0.1-250ng/mL with linearity of R² = 0.999. The recovery was 98.2 ± 3.6% among different matrix tested.

AGFD 315 Reducing the acrylamide-forming potential of wheat, rye, and potato: From crop management to variety selection and genome editing Nigel Halford, nigel.halford@rothamsted.ac.uk, Rothamsted Research, Harpenden, UK. Acrylamide is a processing contaminant and Group 2a carcinogen which was discovered in foodstuffs in 2002. Wheat, rye and potato products are major sources of dietary acrylamide, with biscuits, breakfast cereals, bread (particularly toasted), crisps/bread, batter, cakes, pies, crisps/bread, French fries, chips and snack products all affected. The European Commission recently revised its risk management measures for acrylamide in food, introducing new, lowered Benchmark Levels and compulsory mitigation measures that must be adopted by all food businesses. These regulations came into effect in April 2018. The Commission has also threatened the imposition of Maximum Levels; i.e. levels above which it would be illegal to sell a food product. Acrylamide forms from free (non-protein) asparagine and reducing sugars (glucose, fructose and maltose), and the concentrations of these metabolites are affected by genetic (G) and environmental (E) factors, and G × E interactions. The free asparagine concentration of wheat grain, for example, is very sensitive to crop management, and sulphur deficiency, excessive nitrogen application and poor disease control must be avoided. Varieties of wheat, rye and potato have been identified with consistently low free asparagine concentration in the grain under good growing conditions, but the wheat varietal rankings break down under low sulphur conditions or in response to pathogen infection. We have used genetic, biochemical and RNA-seq analyses, together with mathematical modelling, to identify the genes that affect asparagine synthesis, accumulation and turnover in wheat. We have characterised the asparagine synthetase (TaASN1) gene family and are targeting the TaASN2 gene, which is highly expressed specifically in the grain, using CRISPR/Cas9. A range of editing events are being characterised by NGS. We have also identified TaASN2 mutations in lines from a mutant wheat population produced by chemical mutagenesis.

AGFD 316 Pyrrolizidine alkaloids: Occurrence, properties, and analysis Jan Kuhlmann, jan.kuhlmann@sgs.com, SGS Germany GmbH, Hamburg. Pyrrolizidine alkaloids (PA) are potentially harmful plant metabolites that frequently occur in nature. There are strong indications that plants produce these substances in order to
defend themselves against damage by herbivorous animals or other invasive organisms. Thousands of plant species are known to produce PAs, of which several hundred different structures have been identified. They consist commonly of structurally non-diverse alkaloid bases that are esterified with a broad variety of one or two organic acids. The pyrrolizidine core structures might be classified as pyrrolidine derivatives. From the perspective of food safety, especially 1,2-unsaturated pyrrolizidine derivatives, are of high relevance as several studies have indicated with evidence that they might have genotoxic effects. Since years, PAs have been known to occur in honey but recently it seems also other foods, food supplements and pharmaceuticals of plant origin can be contaminated. The reason appears to be the accidental co-harvesting of PA producing weeds together with the target crop. This makes a food-related estimation of potential contamination difficult as in most cases it is impossible to say what kind and amount of weeds might have been included. Risk assessment seems to be difficult due to limited availability of occurrence data. Analytical challenges raise from the large number of existing PAs and, at the same time, there are limitations in the availability of reference compounds. This presentation focuses on occurrence and toxicology of PAs as well as on the availability of analytical methods, their scope and comparability.

AGFD 317 WITHDRAWN

AGFD 318 Chungkookjang, a fermented soybean food, fermented with Bacillus amyloliquefaciens SRCM100730 and SRCM100731 protected against ischemic stroke and post-hypoglycemia by improving blood flow in gerbils. Jim Daily1,2, jdaily3@yahoo.com, Sumin Park2. (1) Daily Manufacturing, Inc., Rockwell, North Carolina (2) Dept. of Food and Nutrition, Hoseo Univ., Asan, Korea (Republic of) Chungkookjang with potent thrombolytic activity may have anti-stroke activity. We hypothesized that chungkookjang made with B. amyloliquefaciens SRCM100730(CKJ730) and SRCM100731(CKJ731) would protect against ischemic stroke and post-stroke hyperglycemia. The hypothesis was evaluated in Mongolian gerbils with transient occlusion of the carotid arteries, and its mechanism was explored. Gerbil had 4.3% dextrin(control and normal-control), CSB, CKJ730, or CKJ731 in 40 energy% fat diets for 3 weeks after which gerbils, except normal-controls, had artery occlusion for 8 min and continued taking the assigned diet. CKJ730 and CKJ731 supplemented diets had thrombolytic activity and prevented neuronal cell death the most. Consequently, they improved short-term memory and spontaneous alteration compared to the control. Neurological symptoms including drooped eyes, crouched posture, flexor reflex, walking patterns and active time improved the most in CKJ730 and CKJ731 over time. The force to grip the grid was also increased in CKJ730 and CKJ731 the most. Blood flow measured by Doppler was increased in CKJ730 and CKJ731 compared to the control. Post-stroke glucose metabolism, as measured by OGTT and IPITT, was deteriorated in the control more than the normal-control and CKJ730 improved glucose metabolism better than the normal-control, and was associated recovery of β-cell mass which was decreased by β-cell apoptosis due to artery occlusion. Along with the disturbance of glucose metabolism, serum TNF-α and IL-1β levels were lower in CKJ730 and CKJ731 than the control. CSB also improved glucose metabolism and decreased inflammatory cytokines but its effects were smaller than CKJ730 and CKJ731. Clostridia increased and Bacteriodia slightly decreased in the control group, compared to the normal-control. CKJ730 and CKJ731 increased the amounts of Bacteriodia and Clostridia as similar to normal control. In conclusion, CKJ730 and CKJ731 may be useful as a preventive measure for ischemic stroke by improving blood flow, inflammation, and gut microbiome.

AGFD 319 Modulation of energy sensing targets by natural products: Effects on health span Michael B. Zemel, mzemel@msuirm.com. R&D, NuSirt Biopharma, Knoxville, Tennessee Caloric deficit from fasting and/or exercise increases NAD+ and AMP levels, resulting in activation of Sirt1 and AMPK, respectively. These two energy-sensing systems work cooperatively in a finely tuned network to stimulate mitochondrial biogenesis and fuel metabolism, and mediate, in part, the salutary effects of caloric restriction on lifespan and healthspan. We have shown that leucine activates Sirt1 by lowering the activation energy for NAD+, thereby serving as a partial mimetic of caloric restriction and enabling synergy with sirtuin co-activators. Resveratrol is a widely recognized activator of Sirt1; however, poor bioavailability and rapid metabolism limit effective translation of the high concentrations (>50 mM) in pre-clinical models. We found that combining low resveratrol doses (200 nM) which exerted no independent effects on any measured parameter synergized with leucine (0.5 mM) to increase median lifespan ~50% in C. elegans (p=0.0095), increase murine skeletal muscle and adipocyte Sirt1 activity, mitochondrial biogenesis and fatty acid oxidation ~50%, and markedly reduced insulin resistance by 55%, inflammatory markers ~50%, and weight and visceral adiposity 31% (all p<0.01) in diet-induced obese mice. To translate these data from mice to humans, we assessed the effects of resveratrol (50 mg)/leucine (1.11 g; sufficient to achieve 0.5 mM plasma concentration) on glucose dynamics in a 4-week placebo-controlled trial of 36 pre-diabetic subjects. Leucine-resveratrol reduced insulin resistance (HOMAIR) 33% with corresponding reductions in glucose and insulin area under the curve (p<0.01) in oral glucose tolerance test. We have extended these concepts in preclinical studies using other direct Sirt1 activators (NAD+ precursors) and Sirt1 pathway activators. Low-dose (10 nM) NAD+ precursors (nicotinic acid, nicotinamide mononucleotide, nicotinamide riboside) synergized with leucine to increase Sirt1 activity in adipocytes, hepatocytes and muscle cells (30-100%, p<0.01) and median and maximal lifespan in C. elegans (25%, p=0.025) and to reduce circulating lipids and significantly regress atherosclerotic lesion size and macrophage infiltration in a mouse model of atherosclerosis (LDL-receptor knockout). Thus, synergistic activation of Sirt1 using leucine and a co-activator exerts pleiotropic effects impacting cardiometabolic endpoints; further, these data provide evidence of successful clinical translation of this concept.

AGFD 320 Oxidative fragmentation of aspalathin leads to the formation of dihydrocaffeic acid and the related lysine amide adduct Marcus A. Glomb, marcus.glomb@chemie.uni-halle.de, Nils Mertens. Inst. of Chemistry - Food Chemistry, Martin-Luther-Univ. Halle-Wittenberg, Halle, Germany Rooibos tea is a popular herbal tea infusion rich in bioactive phenolic phytochemicals originating from South Africa. During production the plant material undergoes a fermentation process to convert the original green parts into the red. The major chemical process is reminiscent of the black tea production, the major chemical process is not based on the enzyme catalyzed degradation of catechins. In Rooibos the main phenolic ingredient is the C-glycosidic dihydrochalcone aspalathin, which is significantly reduced during fermentation. Our working group has already elucidated this compound as the key reactive stucture in the browning reaction. On the one hand oxidative degradation leads to the formation of orientin and isoorientin via eriodictyols. On the other hand, oxidation induces the formation of higher molecular tamine-like compounds such as dimers and colored dibenzofuran derivatives. Here, we report for the first time on the formation of dihydrocaffeic acid from aspalathin. The identity of this hydroxycinnamic acid was unequivocally verified after isolation and silylation via GC-MS from aspalathin-lysine reaction mixtures. The formation was strictly dependent on oxidative
conditions. We propose a fragmentation mechanism based on hydrolytic cleavage of a 1,3-dicarbonyl intermediate. This implies also the formation of a phloroglucinol derivative as the putative counterpart. However, the mechanism was supported by the detection of the corresponding lysine amide adduct at much lower yields. It is known that in presence of amines the hydrolytic 1,3-dicarbonyl cleavage is paralleled by an amine induced alternative. The nature of the amide was verified after independent synthesis of the authentic reference material. The formation of the amide was also verified in incubations of asparthain in presence of proteins after enzymatic hydrolysis. Thus, this is the first time that phenolic browning reactions lead to discrete covalent protein modifications.

AGFD 321 Mechanistic investigation of methylglyoxal adducts of 5-hydroxytryptamine in mice Tang Yao, tongyao886@hotmail.com, Changling Hu, Shengmin Sang. Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis Methylglyoxal (MGO) is one of the highly toxic dicarbonyl species and extensively distributed both in food and in humans. Its deleterious effects on neurotransmitters such as serotonin have been recently reported. However, mechanisms underlying the observed damaging effects of MGO on serotonin in vivo are not known yet. To understand the behavior under in vivo environments, MGO and serotonin were incubated under a stimulated physiological condition, and the adducts formed in the system were investigated. As a result, total five major products were identified. Among them, three new adducts, and one known compound, were purified and determined using LC-MS and NMR, and subsequently used as authentic references in mouse study. Four of the five adducts were produced through Pictet–Spengler condensation, whereas one adduct was formed via nucleophilic substitution. After oral administration of MGO and serotonin to mice, four adducts were found to be excreted into mouse urine and mouse feces. These results demonstrated that MGO may impair biologic roles of neurotransmitters by formation of MGO adducts via Pictet-Spengler reaction and nucleophilic substitution in the body.

AGFD 322 Quantitative analysis, bioactive evaluation, and biotransformation of oatavenanthramides with two double bonds Fandong Sun, jiezhi1989@163.com, Jie Liu, jieliu19@163.com, Yiming Hao, liujiyan8866@gmail.com, Changling Hu, Shengmin Sang. Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis Epidemiological studies have suggested that a high intake of whole grain foods is associated with a lower risk of chronic diseases, such as type 2 diabetes, obesity, cancer, and cardiovascular diseases. Oat, a cereal grain belonging to the family of Poaceae/ Gramineae, is the third leading crop produced in the US and the fourth most important crop worldwide. Oats contain a unique type of compounds,avenanthramides (AVAs), which are the group of substituted N-cinnamoylanthranilic acids with a single double bond (e.g. 2p, 2c and 2f) and N-avenalumoylanthranilic acids with two double bonds (e.g. 2pd, 2cd and 2fd) in structures. All AVAs are composed of an anthranilic acid moiety and a cinnamic acid or an avenalumic acid residue, where the substitution pattern on anthranilic acid or avenalumic acid moiety is what distinguishes the different AVAs from each other. N-cinnamoylanthranilic acids have been reported to have a variety of biological activities, such as anti-oxidative, anti-inflammatory, anti-itching, and anti-cancer activities. Biotransformation studies showed that N-avenalumoylanthranilic acids have a higher bioavailability than N-cinnamoylanthranilic acids in human plasma. However, no studies have been conducted on the bioactivity and biotransformation of N-avenalumoylanthranilic acids. We recently isolated and identified several N-avenalumoylanthranilic acids with two double bonds from sprout oat. Using these purified AVAs as standards, we developed a LC-MS method to establish the chemical profile of N-avenalumoylanthranilic acids with two double bonds and further quantify their levels in commercial available sprout and regular oat products. We studied the biotransformation of 2pd, one of the major N-avenalumoylanthranilic acids with two double bonds in oat, in mice. Microbial metabolism of 2pd by human gut microbiota was also investigated. The major metabolites of 2pd, including phase I and phase II metabolites in mice as well as microbial-derived metabolites from human gut microbiota, have been identified and will be discussed in this presentation.

AGFD 323 Isolation and purification of 5-n-alkylresorcinols from 21 different wheat varieties and its inflammation inhibitory potential under LPS induced RAW264.7 macrophages Jie Liu, liuliejiantang@163.com, Yiming Hao, liujiyan8866@gmail.com, Changling Hu, Shengmin Sang. Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis The characteristic constituent and anti-inflammatory activity of 5-n-alkylresorcinols (ARs) from 21 wheat bran samples in China were investigated in this study. The amount of ARs ranged from 697 µg/g to 1732 µg/g in the tested samples, which were composed of five different homologues. Among these homologues, C19:0 and C21:0 were the most abundant, followed by C17:0, C23:0 and C25:0. Moreover, the mRNA expression of IL-1β, IL-6 and TNF-α in LPS-activated RAW264.7 macrophage cells were significantly inhibited by ARs supplementation. The molecular mechanisms behind its anti-inflammatory activity could result from the suppression of nuclear factor-xB (NF-xB) and JNK/MAPK activation. ARs treatment notably decreased NF-xB p65 nuclear translocation and inhibitor xB (IxB) kinase and JNK phosphorylation. Additionally, ARs homologues C17:0 had been proven to be the main active constituent. The results from this study could be used to promote the comprehensive utilization of wheat and its by-products in improving human health.

AGFD 324 Phytochemical investigation, biological assessment, and quantitative analysis of Ziziphus jujuba resources from China Naisheng Bai, nsbai@nwu.edu.cn, Sen Guo, Lu Bai, Tianyi Wang, Shanshan Zhang. College of Food Sci. & Tech., Northwe Univ., Xian, Shaanxi, China Ziziphus jujuba Mill., belonging to the Rhamnaceae family, is native to China. The earliest cultivation and domestication of Z. jujuba could be dated back 4000 years along the Yellow River Canyon in the North Shaanxi and Shanxi Provinces of China. Thus, this area is usually considered as the origin center of Z. jujuba. Nowadays, Z. jujuba spreads out in Europe, southern and eastern Asia, as well as Australia. Its fruits also called hongzao in Chinese, is commonly used as food and has been used in Chinese folk medicine for the treatment of fatigue, anorexia and other health problems. In addition, the seeds, bark, roots and leaves of Z. jujuba can also be used as medicine. Jujube leaves have also been used as a commercial herbal tea for its capacity to improve sleep. Thus, bioactive constituents and quantitative analysis of Z. jujuba resources from China were studied. Our results are as follows: 1) Twenty-seven known compounds were isolated and identified as the main constituents from fruits of Z. jujuba, including triterpenic acids, polyphenols and flavonoids, triterpenic acids and flavonoids had strong growth inhibitory effects on human tumor cell lines (MCF-7, A549, HepG2 and HT-29). 2) The EtOH-water extract of Z. jujuba leaves significantly alleviated liver damage induced by CCl4, a quantitative analysis of fifteen major constituents of the bioactive extract was conducted by HPLC-DAD. 3) A validated HPLC-DAD was applied to the simultaneous characterization and quantification of sixteen main constituents in thirty samples, which comprised the whole life stage of Z. jujuba leaves from six cultivars in Yulin, Shanxi Province, China. 4) Triterpenic acids, polyphenols, flavonoids and steroids were isolated and identified from the flowers, seeds and roots of Z. jujuba. Some of these compounds showed hepatoprotective activity and acetylcholinesterase, α-glucosidase, tyrosinase inhibitory activity. Contents of the bioactive constituents
from different parts of Z. jujuba were analyzed by HPLC-DAD method.

AGFD 325 Physicochemical characterization and antioxidant
capacity of four native populations of fine or flavour cocoa (Theobroma cacao L.) from Peru Ivan Best1, ibest@usil.edu.pe, Katherine Grabiel1, Claudia Plasencia1, Luis Mendoza2, Francisco Pérez-Canó3, Margarida Castell3, Santiago Pastor-Soplin1. (1) Univ. Científica del Sur, Lima, Peru (2) Peruvian Association of Cocoa Producers (APPCACAO), Lima, Peru (3) Faculty of Pharmacy and Food Sci., Univ. of Barcelona, Spain Peru is one of the centers of origin of Cocoa in the world, currently produces and exports 115,000 and 50,000 tons, respectively. It is the second producer and exporter worldwide of organic Cocoa, 75% of its production is related to fine or flavour Cocoa. The objective of the study was to evaluate the content of bioactive compounds and antioxidant capacity of four populations of fine or flavour Cocoa better characterized agronomically in Peru and compare these with a bulk Cocoa (CCN-51). Four populations of fine or flavour Cocoa from different geographical regions of Peru were evaluated: "White" from Piura (Coast), "Amazonas Peru" from Amazonas (Forest), "Criollo de Montaña" from Junin (Forest) and "Chuncho" from Cusco (Forest). After extraction with hexane, Cocoa powder was obtained, which was then extracted with acetone (50% v/v). The content of total phenolic compounds and total flavonoids was determined by the Folin-Ciocalteu method and aluminum chloride colorimetric method, respectively. The antioxidant capacity was evaluated using DPPH and FRAP assay. Statistical analysis of the experimental data were carried out using one-way ANOVA followed by Dunnet test (P<0.05). Correlation between the different variables were conducted using the Pearson’s method. According to our results, the “Amazonas Peru” showed a significant increase in the levels of total polyphenols, total flavonoids and antioxidant capacity (FRAP, DPPH) compared to the bulk cocoa (P<0.05), while the “Criollo de Montaña” presented higher levels of total polyphenols and flavonoids compared to the bulk Cocoa (P<0.05) (Table 1). Pearson correlation coefficient of total phenolic and flavonoid content of extract Cocoa with DPPH and FRAP activity were r=0.740 (P<0.01), r=0.542 (P<0.05) and r=0.696 (P<0.01), r=0.674 (P<0.01), respectively. Our results suggest that “Amazonas Peru” and “Criollo de Montaña”, in addition to its improved organoleptic characteristics, have better nutraceutical and antioxidant properties compared to bulk Cocoa.

AGFD 326 Glabrous canary seed: Novel and functional food ingredient Elsayed M. Abdelaal, elsayed.abdelaal@canada.ca. Guelph Research and Development Centre, Agriculture and Agri-Food Canada, Ontario, Canada Glabrous (hairless) canary seed is a true cereal grain that received novel food approval from Health Canada in 2016 and GRAS status from the US FDA in 2015. It is a highly nutritious grain containing exceptionally high amount of protein (19-23%) compared with common cereal grains. The canary seed proteins are gluten-free and contain bioactive peptides which are found to provoke hypotensive, anti-diabetic and antioxidant effects in human cell lines. The grains are also rich in other bioactive compounds such as phenolic acids and carotenoids. Phenolic acids are present in hairless canary seed at levels of 155-207 µg/g with ferulic acid being the dominant polyphenol. Ferulic acid is a potent antioxidant which is found to diminish the damaging effect of free radicals and to curb high cholesterol and high blood pressure in vitro and in vivo. The carotenoids in hairless canary seed are present at higher levels (15.2-19.5 µg/g) than that in durum semolina (7.1 µg/g). Lutein and zeaxanthin, the main carotenoids in canary seed, are associated with reduced risk of eye diseases such as age-related macular degeneration and cataract. The grains also possess concentrations of starch (55-60%) and oil (5-7%) comparable to other grains. The dehulled hairless canary seeds (also called groats) can be used as whole-grain flour in many food formulations such as baked goods, breakfast cereals, pasta, snacks, etc. The grain can also be fractionated into its chemical components as a sustainable source of protein, starch and phytomolecules for use in both food and non-food applications. Details about the development of glabrous canary seed as a novel and functional food and its potential in health-promotion and disease-prevention will be highlighted.

AGFD 327 Introduction of food waste reduction & recovery program in San Diego Geertje Grootenhuis, geertje@sdfs.org. Food Waste Reduction & Recovery, San Diego Food System Alliance, California 40% of food in America gets wasted from farm to fork. Food loss occurs at every stage of our food system – production, transportation, storage, preparation, and consumption – resulting in a cumulative financial loss of $218 billion annually. At the same time, 1 in 8 Americans are food insecure. Food waste is a colossal problem, encompassing negative environmental, economic, and social impacts. As national attention to this issue mounts, innovative solutions including Tech., policy, and grass-roots community efforts are being developed. This presentation will outline the causes of food loss and describe methods for addressing food waste at each stage in the food system. Being a non-profit collaborative, the San Diego Food System Alliance will highlight local data-driven and relationship-driven success stories with opportunities for scalable impact.

AGFD 328 Systems approach to reducing postharvest losses of fresh fruits due to rot- causing pathogens Chang-Lin Xiao, Chang-Lin.Xiao@ars.usda.gov. USDA – Agricultural Research Service (USDA-ARS), San Joaquin Valley Agricultural Sciences Center, Parlier, California Postharvest fruit rot diseases, caused primarily by fungal pathogens, result in significant losses of fresh fruits during storage and in the market. Some rot-causing fungal pathogens also produce mycotoxins on decayed fruit that are carcinogenic. Some postharvest diseases can also pose trade barriers for export of fresh fruits to certain overseas markets. Controlling postharvest fruit rot diseases is important to food safety/security and the profitability of the fresh fruit industry. Various methods, including biological, physical, and chemical control, have been explored or developed to reduce postharvest fruit rots on fresh fruits. Challenges and prospects of individual approaches as well as pre- and postharvest integrated approaches in the context of systems approach for postharvest fruit rot disease control will be presented.

AGFD 329 WITHDRAWN

AGFD 330 Edible coating to keep fresh-cut fruits fresh and safe Tony Z. Jin, tony.jin@ars.usda.gov. USDA-ARS-ERRC, Wyndmoor, Pennsylvania It is estimated that fresh-cut fruits and vegetables make up more than 15% of all fresh produce marketed in the USA at $10-12 billion annually. However, there are safety concerns associated with fresh cut fruits and vegetables as these foods are consumed as fresh. During past 10 years, 72 foodborne illness outbreaks were associated with the consumption of fresh produce. Of these produce related outbreaks, 25 percent implicated fresh-cut fruits and vegetables. In addition, the retail value of fresh-cut produce losses may exceed $1 billion annually due to quality deterioration. These situations have heightened the need for an antimicrobial coating that is safe, extend shelf-life by inactivating spoilage microorganisms; and prevent recontamination during storage, transportation.
AGFD 331 Novel biocidal materials for prevention of foodborne disease contaminations Gang Sun1, gysun@ucdavis.edu, Nitin Nitin2, Yue Ma1, Zheng Zhang1, Luxin Wang2. (1) Textiles and Clothing, Univ. of California, Davis (2) Univ. of California, Davis Foodborne disease outbreaks occur frequently and impose great threats to public health. Control and prevention of the outbreaks need concerted efforts from all related areas of research and development. Here we report the developments of both chlorine-rechargeable and light-rechargeable antibacterial polymers for intended applications as food packaging and contact materials in prevention and reduction of bacterial contaminations and produce. The chlorine-rechargeable polymers contain halamine structures as biocidal sites and utilize diluted chloride solutions as a recharging agent, which can provide rapid, durable, and everlasting biocidal functions on products made of the polymers. These polymers are especially useful in produce processing and packaging materials. Samples of the halamine polymers, their biocidal performance and potential products will be presented. The light-rechargeable antibacterial materials are made of polymers containing natural based chemicals or components which can adsorb daylight and produce reactive oxygen species as biocides. These chemicals all possess unique light-interactive functions that can be predicted by using computational modeling and potentially edible based on the sources, making them ideal in food packaging and prolonging food storage and reducing potential spoilage.

AGFD 332 Light-activated antimicrobial plastic material with chitosan: Characterization and reusability Luis J. Bastarrachea, luis.bastarrachea@usu.edu, Andrew Gagon. Nutrition, Dietetics and Food Sci., Utah State Univ., Logan Traditional methods of food preservation involve heat, cooling or freezing, and the use of preservatives to control microbial growth. These methods often require high amounts of energy, can have detrimental effects on the sensory quality of foods, and the safety of some common preservatives to human health has been questioned. This has increased the interest for alternative technologies for food preservation. The commonly used materials found in the processing, handling and storage of foods are usually chemically inert. A variety of techniques can be employed to impart antimicrobial properties to organic and inorganic materials. Reactive blending is a technique in which polymeric materials are mixed through heat-curing. This requires the use of compatibilizers to make polymers miscible. One type of compatibilizer can be cyclic anhydrides, which are widely available and safe. In this study, Polypropylene (PP) was mixed with a maleic anhydride grafted PP to produce a reactive blend (PP-MA). This reactive blend was coated with Methyl vinyl ether/maleic anhydride (MEV, food ingredient commonly used in the production of bubble gum), and Chitosan (antimicrobial polycation of natural origin). The coated PP-MA was heat-cured for 1 h at 185 °C to create an antimicrobial plastic blend (PP-MEV-CHI). Infrared spectroscopy confirmed successful cross-linking between the maleic anhydride groups of PP-MA and MEV, and the amine groups of Chitosan. The antimicrobial plastic demonstrated to be stable in extreme levels of pH, without damage to its chemical integrity. In addition, it showed to be biocidal against Escherichia coli K12 and reusable, being able to reduce the microbial population between 1 and 1.5 logarithmic cycles for at least 10 cycles in aqueous suspensions and under UV-A light. This approach could represent an attractive alternative to the traditional methods of food preservation, and reusable antimicrobial materials could reduce the environmental impact from the agriculture and food industries.

AGFD 333 Targeted inactivation of antibiotic-resistant Escherichia coli and Pseudomonas aeruginosa in a soil-lettuce system by combined polyvalent bacteriophage and biochar treatment Ye Mao1, yemao@issas.ac.cn, Sun Mingming2. (1) Inst. of Soil Science, Chinese Academy of Sciences, Nanjing, China (2) Nanjing Agricultural Univ., China High abundances of antibiotic-resistant pathogenic bacteria (ARB) and antibiotic resistance genes (ARGs) in agricultural soil-plant systems have become serious threats to human health and environmental safety. Therefore, it is crucial to develop targeted Tech. to control existing antibiotic resistance (AR) contamination and potential dissemination in soil-plant systems. In this work, polyvalent bacteriophage (phage) therapy and biochar amendment were applied separately and in combination to stimulate ARBP/ARG dissipation in a soil-lettuce system. With combined application of biochar and polyvalent phage, the abundance of Escherichia coli K-12 (tetR) and Pseudomonas aeruginosa PA01 (ampRfosR) and their corresponding ARGs (tetM, tetQ, tetW, ampC, and fosA) significantly decreased in the soil after 63 days’ incubation (p < 0.05). Similar results for endophytic K-12 and PA01, and ARGs, were also obtained in lettuce tissues following combined treatment. Additionally, high throughput sequencing revealed that biochar and polyvalent phage synergistically improved the structural diversity and functional stability of the indigenous bacterial communities in soil and the endophytic ones in lettuce. Hence, this work proposes a novel bioTech. that combines biochar amendment and polyvalent phage therapy to achieve targeted inactivation of ARBP, which stimulates ARG dissipation in soil-lettuce systems.

AGFD 334 Chain conformation and biological activities of fungal polysaccharides Lina Zhang1, zhangln@whu.edu.cn, Xiaojuan Xu2. (1) Wuhan Univ., Wuhan Hubei, China (2) College of Chemistry and Molecular Sciences, Wuhan Univ., China Polysaccharides were isolated and purified from lentinus edodes and black fungus, respectively, by “green” Tech. Lentinan was identified to consist of a β-(1→3)-D-glucan with two β-(1→6)-D-glucosyl branchings for every five β-(1→3)-D-glucosyl linkages, and it existed as a three helical chain conformation in water. The triple helical β-glucan (THG) significantly inhibited tumor growth in mice, and a new antimutagen mechanism through the ingestion and biodegradation by macrophages to activate immune cells in mice was proposed. Glucan isolated from black fungus (BFP) was identified as a β-(1→3)-D-glucan with two β-(1→6)-D-glucosyl residues for every three main chain glucose residues. The results of static/dynamic light scattering, viscometry, atomic force microscopy (AFM), and molecular dynamics (MD) simulation confirmed that this β-glucan also existed as a three helical chain conformation in water. The β-glucan formed easily hollow nanotubes in water, which could be used to load aggregation induced luminescence (AIE) fluorescent dyes, anticancer drug DOX and selenium nanoparticles (SeNPs), respectively, for the applications of bioimaging, drug release and anti-tumor.

AGFD 335 Silver nanoclusters embedded zein films as antimicrobial coating materials for food packaging Lei Mei, leimei@umd.edu, Qin Wang. Nutrition and Food Sci., Univ. of Maryland at College Park Highly efficient antimicrobial agents with low toxicity and resistance have been enthusiastically pursued to address public concerns on microbial contamination in food. Silver nanoclusters (AgNCs) are known for their ultrasmall sizes and unique optical as well as chemical properties. Despite extensive studies of AgNCs for biomedical applications, their application as antimicrobials remains to be explored. Here, for the first time, by incorporating AgNCs (~ 2 nm in diameter) to zein films that are widely used as food packaging materials, we developed a novel antimicrobial coating material with potent antimicrobial activity, low toxicity to human cells, and low harm to the environment. In addition, we systematically evaluated the antimicrobial activities and
cytotoxicity of AgNC-embedded zein films and compared them with zein films embedded with AgNO3 or Ag nanoparticles with diameters of 10 nm and 60 nm (AgNP10 and AgNP60, respectively). At the same concentrations of silver equivalents, AgNCs and AgNO3 solution exhibited comparable antimicrobial activities that were dramatically higher than those of AgNP10 and AgNP60. Moreover, AgNCs presented less cytotoxicity to human cells than AgNO3, with half maximal inhibitory concentration (IC50) of 34.68 mg/mL for AgNCs compared to 9.14 mg/mL for AgNO3. Altogether, the high antimicrobial efficacy, ultrasmall sizes and low cytotoxicity of AgNCs demonstrated their great potential in antimicrobial applications.

AGFD 336 Development of functional packaging for food application Monique Lacroix, monique.lacroix@iaf.inrs.ca. Inrs Armand-Frappier/Crma-Cic, Laval, Quebec, Canada Cellulose nanocrystals (CNCs), highly recognized for its reinforcing properties, are an organic nanosized material extracted from natural cellulose sources. CNCs were used for the development of edible active packaging with antimicrobial properties. They were encapsulated in natural hydrophilic materials such as caseinate, chitosan, alginate, or biodegradable polymers like polyacrylate. Bio-polymeric nanocomposite films and nanocomposite films encapsulated with CNCs were developed for the inhibition of pathogenic fungi and yeasts. The antimicrobial activity of CNCs as reinforcing filler improved significantly the tensile strength of the nanocomposite based films and decreased water barrier properties. In addition, combined treatment of bioactive films with an irradiation treatment showed more pronounced insecticidal, antifungal and antimicrobial properties than treatment with the bioactive film alone. The effect of γ-irradiation on the surface chemistry of CNCs was also evaluated in order to develop films with antioxidant properties. Finally, CNCs was used to develop a biopolymer support membrane for the detection of E. coli O157: H7 and L. monocytogenes. The presentation will summarize the most important results obtained in these studies.

AGFD 337 Molecular structure, physicochemical characterization, and in vitro degradation of cereal protein films for edible food packaging application Lingyun Chen, lingyun.chen@ualberta.ca, Zhigang Tian, Ashley Xia. Univ. of Alberta, Edmonton, Canada Cereal protein films were prepared by thermo-pressing using glycerol as a plasticizer. The combined effects of heating temperature and the amount of plasticizer interacted to determine protein conformation subsequently the properties of the film matrix. The film barrier and mechanical properties were systematically investigated using Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), SDS-PAGE and protein solubility tests. These experiments demonstrated that heating treatment induced protein unfolding and then protein aggregation and the formation of covalent disulfide bonds to enhance film strength. Increasing the amount of plasticizer reduced protein denaturation and limited protein interactions, resulting in significantly improved film flexibility at the cost of reduced film moisture barrier property and tensile strength. In vitro degradation experiments demonstrated that protein films were resistant in gastric conditions, yet can still be completely degraded by intestinal enzymes, and they possess low cytotoxicity to Caco-2 cells. The prepared cereal films have potential for the development of edible packaging systems for food applications due to their safety, good barrier capacity, and excellent biodegradability.

AGFD 338 Characteristic evaluation of natural plant-derived dyes in food freshness indicator system: Color sensitivity, stability, and security Shaoyun Huang,1,2, Huamin Lin,1, Xinghai Liu,1, Houbin Li1, lhb@whu.edu.cn. (1) School of Printing and Packaging Eng., Wuhan Univ., Hubei, China (2) Dept. of Printing Eng., Jingu University of Tech., Jinhua, Hubei, China pH-sensitive colorimetric indicator, also known as chemical barcode, can provide consumers with food freshness information during storage and logistics through visible color change of indicator system. Because of its rapid, compact size, low-cost and non-destructive, it has aroused great interest in food industry. The principle of this system is based on specific chemical interactions between spoilage metabolite and acid-base dye. At the outset, some chemical reagents such as bromophenol blue, bromocresol green and bromocresol purple have been chosen as acid-base dyes. But the application of synthetic chemical dyes in intelligent food packaging is limited because of possible toxicity and potential risk to human health. Thus, the natural-plant-derived dyes attract more and more attention in recent years. In this study, two natural dyes, extracted from Arnebia euchroma (Royale) Johnst root and grape skin respectively, were incorporated into a polysaccharide matrix to constitute food freshness indicator system. These two natural plant-derived dyes respectively represent hydrophilic and hydrophobic substance. They showed different properties because the nature of color change of dye is proton transport process and the speed of this process depends on the relative humidity of the exposure environment. The color sensitivity, stability and security of these two plant-derived dyes in food freshness indicator system were researched. The results showed that the hydrophilic dye has higher color response efficiency but poor stability and security compared with hydrophobic dye.

AGFD 339 Anti-glycation effect and advanced glycation end-products protein cross-links breaking ability of Psidium guajava leaf extracts Oluwaseye Efunmi I. Adeniran, seyefunmiadeniran@gmail.com, Motetelo A. Mogale. Biochemistry, Sefako Makgatho Health Sciences Univ., Pretoria, Gauteng, South Africa Advanced glycation end-products (AGEs) are implicated in the pathogenesis of diabetes and age-related diseases such as Alzheimer’s disease. There is no clinically approved anti-glycation agent yet. The objectives of the study were to investigate and compare the anti-glycation effect of Psidium guajava leaf extracts (PGLETs) with that of aminoguanidine (AG) and to assess the PGLETs’ AGE-cross-link breaking ability. Bovine serum albumin (BSA) was incubated with glucose in the presence of hexane, ethyl acetate, methanol and water PGLETs at 37°C for 40 days. Total immunogenic AGEs (TIAGs), carboxymethyllysine (CML), carboxymethyllysine (CEL) and fluorescent AGEs (FAGEs) formed were measured using enzyme-linked immunosorbent assay (ELISA) and spectrophotofluorometry and the percentage anti-glycation activity of each plant extract was calculated. The ability of PGLETs to break BSA-AGE-collagen cross-links was also investigated by means of ELISA. After 40 days’ incubation, hexane, ethyl acetate and methanol PGLETs demonstrated higher anti-glycation activity against TIAGs while hexane and the polar extracts (methanol and water) demonstrated higher anti-glycation activity than AG against CEL. Only the methanol and water PGLETs demonstrated higher anti-glycation activity than AG against CML and FAGEs. With regard to the ability of PGLETs to breakdown AGES-protein cross-links, hexane and ethyl acetate PGLETs demonstrated higher ability to break AGE-protein cross-links than methanol and water PGLETs. Crude PGLETs have the ability to inhibit the formation of AGES and to breakdown AGE-protein cross-links. Work is underway in our laboratory to isolate bioactive compounds from PGLETs.

AGFD 340 Natural anthocyanin ameliorates type 2 diabetes through targeted inhibition of α-glucosidase activity and coordinately regulating autophagy pathway and gut microbiota composition Wei Chen, zjuchenwei@zju.edu.cn, Hongming Su. Food Sci. and Nutrition, Zhejiang Univ., Hangzhou, China Type 2 diabetes
mellitus (T2D), as a chronic metabolic disease affecting millions of people worldwide, has become a major public health threat. Anthocyanins are phenolic compounds ubiquitously distributed in berry fruits including blueberry, raspberry, bayberry, mulberry and blackberry. Recently, increasing evidence indicates a positive relationship between increased consumption of anthocyanin-rich food and lowered diabetes complications. However, the anti-diabetic effect of purified anthocyanins as well as its molecular mechanisms remain largely unknown. In the present study, six major types of anthocyanidins from berry fruits were obtained including delphinidin, petunidin, malvidin, cyanidin, peonidin and pelargonidin as well as their derivatives. Our study screened natural anthocyanins targeted for α-glucosidase inhibition and identified a potent α-glucosidase inhibitor pelargonidin-3-O-rutinoside (Pg3R) that can improve postprandial hyperglycemia both in vivo and in vitro. The structural determinants for α-glucosidase inhibition by Pg3R and the structure activity relationship (SAR) of natural anthocyanins were further revealed by enzymatic kinetics and molecular docking analysis. On the other hand, we examined the effect of pelargonidin-3-O-glucoside (Pg3G) on high-glucose/high-fat (HG+HF)-induced hepatocytes and db/db mice. Our results showed that Pg3G treatment contributed to a significant increase in glucose uptake in HG+HF-induced hepatocytes. In addition, Pg3G suppressed HG+HF-induced oxidative stress by inhibiting excessive ROS, reversing mitochondrial membrane potential disruption and preventing glutathione depletion. Moreover, Pg3G induced autophagy in HG+HF-induced hepatocytes, whereas autophagy inhibitor abrogated the anti-hyperglycemic effect of Pg3G. In consistent with the in vitro study, administration of Pg3G contributed to the improvement of glucose tolerance, insulin sensitivity and induction of autophagy. Furthermore, Pg3G not only modified the gut microbiota composition, but also strengthened the intestinal barrier integrity. Collectively, our results unveil novel mechanisms for Pg3R by targeted inhibition of α-glucosidase activity, and for Pg3G by coordinately regulating autophagy pathway and modulating gut microbiota composition, suggesting the potential application of anthocyanins for T2D therapeutics.

AGFD 341 Functional foods: Advancement of definition and evaluation of scientific investigations  Danki M. M. Martirosyan, ffc_usa@sbcglobal.net. Functional Foods, Functional Food Center/Functional Food Inst., Dallas, Texas In order to create functional food (FF) products based on scientific evidence, we must first define functional foods. Previous definitions simply state that FF improve health and mitigate disease. However, more refined definitions provide a reason for their efficacy – through the activity of bioactive compounds and the measurement of biomarkers, which are the essential tools for gauging the effectiveness of functional foods. Generally, FF are linked to health promotion. The physiological effects of FF or bioactive compounds may vary, but their categories of action include: cognitive, behavioral, and psychological function, and combating chronic disease. Therefore, establishing a formal definition for these foods will help bring legitimate functional foods to the market. The addition of bioactive compounds, or biochemical molecules that improve health through the physiological mechanisms, improves the definition of functional foods. Overall, the advancement of the FF definition by Functional Food Center (FFC) has grown to provide clarity and a more comprehensive understanding of its meaning. The advancement and research in the mechanisms of bioactive compounds, specific biomarkers, and the progress, development and definition of functional foods for health promotion as well as disease management and its symptoms has evolved at the Functional Food Center. As research continues, the progress in functional foods will evolve proving new definition(s). With this latest definition of functional food evolving from FFC’s 2007 definition and clinically proven health benefits, the latest definition now includes utilizing specific biomarkers and treating chronic disease or its symptoms. FFC’s updated definition defines functional foods as “natural or processed foods that contains known or unknown biologically-active compounds; which, in defined, effective non-toxic amounts, provides a clinically proven and documented health benefit utilizing specific biomarkers for the prevention, management, or treatment of chronic disease or its symptoms.” The FDA’s evidence-based review system for health claim and FFC’s proposed standards will be used to evaluate functional food in several cases.

AGFD 342 Probiotic characteristics of Lactobacillus plantarum E680 and its effect on hypercholesterolemic mice Zhi-yao Zheng1, Wei-Jun Wang2, Jianxin Liu1, Jenni Firrmann3, John Renye3, Daxi Ren1, dxren@zju.edu.cn. (1) College of Animal Science, Zhejiang Univ., Inst. of Dairy Science, Hangzhou, China (2) Zhejiang Yiming Food Co. Ltd, Wen Zhou, China (3) USDA Agricultural Research Service, Eastern Regional Research Center, Philadelphia, Pennsylvania Hypercholesterolemia is considered a major risk factor of cardiovascular disease (CVD), the potential for lactic acid bacteria (LAB) to lower serum cholesterol has reported before. Therefore this study aimed at identity LAB strains of with optimal cholesterol lowering ability and probiotic properties. A total of 75 LAB strains from traditional fermented pickles and infant feces were investigated on cholesterol-lowering ability by gas chromatography method, and Lactobacillus acidophilus ATCC 43121 used as the control strain. Lactobacillus plantarum E680, with high cholesterol-lowering ability and good probiotic properties in vitro, was selected for further study. Results showed that L. plantarum E680 reduced the total cholesterol level by 66.84 % in broth culture, which was significantly higher (P<0.05) than that of ATCC 43121 (58.31 %); showed the highest acid and bile tolerance (tolerance rate were all over 80 %); was sensitive to five of eight antibiotics tested (ampicillin, cefazolin, erythromycin, sulfamethoxazole, and chloramphenicol); inhibited the growth of four pathogenic bacteria, with Staphylococcus aureus being most sensitive, and Salmonella typhimurium the least sensitive. Animal model was also used to test the efficacy of strain. Mice were randomly divided in control group (gavage of sterile saline), model group (gavage of high-fat emulsion), and E680 group (gavage of high-fat emulsion plus E680 (109 CFU/mouse/d)). In vivo testing found that L. plantarum E680 suppressed body weight gain of mice without effect the food intake; prevented elevation of the total cholesterol and low-density lipoprotein cholesterol levels, which were 10.71 % and 16.47 % lower than levels observed in model mice; was no effect on high-density lipoprotein cholesterol and triglyceride levels. In conclusion, L. plantarum E680 has optimal cholesterol lowering ability and probiotic properties, which have potential to development functional food for improving human health.

AGFD 343 Lactobacillus rhamnosus GG components exert protective effects on mouse macrophages upon lipopolysaccharide challenge Haifeng Wang1, haifengwang@zju.edu.cn, Sirui Q1,3, tianjintanxi@163.com, Xin Luo. (1) Zhejiang Univer., Hangzhou, China (2) Virginia Polytechnic and Science Univ., Blacksburg (3) Zurich A&F Univ., Hangzhou, China Background/Purpose: We previously showed that Lactobacillus rhamnosus (LGG) could modulate macrophage activation in vitro. The purposes of this study were to determine whether unmethylated CpG oligonucleotides (CpG-ODN) could mimic LGG gDNA in modulating immune response and to evaluate the immunomodulation and signaling mechanisms in response to different LGG components (gDNA, surface protein/SLP, or both) in mouse macrophage RAW264.7 cells challenged with lipopolysaccharide (LPS). Methods: Different combinations of LGG components (SLP, gDNA, CpG-ODN, SLP plus gDNA, SLP plus CpG-ODN) were used to treat RAW264.7 cells before LPS stimulation. Cytokine production and toll-like receptor
An increase (P < 0.05) in the milk fat content was observed with RPB
mixed ration (TMR). Two supplements were added to the TMR to
dietary supplementation of rumen
College of Animal Science and Tech., Zhejiang A & F Univ., Lin'g
College of Animal Science, Zhejiang Univ., Hangzhou, China (2)
dairy cows
performance of dairy goats fed with amino acids
by RPM. In summary, RPM increased milk yield, FCR, milk
DMI treatments. Meanwhile, feed conversion rate (FCR) calculated as
increased milk yield. The fat corrected milk (FCM) was increased in
RPM) on lactation performance of dairy goats fed with amino acids
studies. Moreover, the mRNA abundance of five genes related with milk
was found among three treatments of dry matter intake (DMI). However, no differences were
fat content (BTN1A1, XDH, ADFR) and
ion. It is suggested that RPM may improve lactation
and 5-wk formal trial: (1) MP-adequate diet (C; positive metabolic
a pattern recognition multivariate analysis between the control
-0.5) under Met deprivation or Met sup
mediated Met
negatively upregulated the expression of ASCT2 gene (sodium-dependent neutral amino acid transporter (P < 0.05) and seryl-rRNA synthetase (SARS) protein (P < 0.05) in BMECs. Furthermore, with the inhibitor of ASCT2 (GPNA) and SARS inhibition, cells were treated with Met-starved and Met-sufficient medium (0.6 mM Met) for 6 h to evaluate the relative gene and protein abundance. When Met was deprived, there was a reduction in β-casein synthesis (P < 0.05), and this reduction was further exacerbated when Met transport (ASCT2 activity) was inhibited or when SARS expression was depressed in BMECs (P < 0.05). In addition, when the protein expression of ASCT2 or SARS was depressed, the other one’s protein abundance was decreased (P < 0.05) under Met deprivation or Met supplementation. This work suggests that ASCT2 is involved in the SARS-mediated Met-stimulation of β-casein synthesis in BMECs, and this stimulation may be regulated by higher mammary Met uptake. The study expanded the understanding of the mechanisms underlying AA regulation of milk protein synthesis in mammary gland.

AGFD 345 Effects of dietary supplementation of rumen-protected betaine on lactation performance and serum metabolites of dairy cows Caihong Wang1, 11617003@zju.edu.cn, He Liu1, Chong Wang2, Jianxin Liu1, Hongyun Liu1, hyliu@zju.edu.cn. (1) College of Animal Science, Zhejiang Univ., Hangzhou, China (2) College of Animal Science and Tech., Zhejiang A & F Univ., Lin’an, Zhejiang, China The experiment was conducted to investigate the effects of dietary supplementation of rumen-protected betaine (RPB) on dairy cows. Thirty-six Holstein dairy cows were randomly assigned to 3 blocks of 12 cows each according to their previous milk yield and days in milk (DIM). All cows were fed a corn silage-based total mixed ration (TMR). Two supplements were added to the TMR to produce 3 dietary treatments: 1) control, 2) 20 g/d RPB, and 3) 15 g/d rumen-protected methionine (RPB, positive control supplement). The milk composition and plasma parameters were analyzed to reflect the milk production of the dairy cows. Blood metabolites were analyzed with a high-throughput gas chromatography time-of-flight mass spectrometry (GC-TOF/MS) metabolomics strategy coupled with a pattern recognition multivariate analysis between the control and RPB groups. Overall, the milk yield was higher (P < 0.05) in cows fed RPB or RPB than in those fed the control diet. The milk protein content was improved (P < 0.05) after RPB supplementation. An increase (P < 0.05) in the milk fat content was observed with RPB

AGFD 346 Reliable analysis of bisphenol A in beverage, food, infant formula, feed and dietary supplement matrices Katerina Mastovska, kmastovska@yahoo.com, Sheng Li, Jeffrey Shippar. Eurofins Food Integrity & Innovation, Madison, Wisconsin Bisphenol A (BPA) is an organic synthetic compound used as a starting material for the synthesis of plastics, mainly certain polycarbonates and epoxy resins, which both have been utilized as food contact materials. BPA is an endocrine disrupting chemical with estrogenic activity and is listed under Proposition 65 as a substance causing female reproductive toxicity. Due to exposure concerns for small children, BPA-based materials are no longer to be used in baby bottles, sippy cups, and infant formula packaging in the US, EU or Canada. Low-level analysis of BPA is quite challenging because it requires careful control of laboratory contamination and elimination of any potential BPA sources from reagents and other materials. We developed and validated a simple, reliable, and cost-effective approach to determine BPA in beverage, food, infant formula, feed and dietary supplement matrices. The methodology combines a salting-out assisted liquid/liquid extraction with acidified acetonitrile and freeze-out removal of co-extracted lipids before the analysis by liquid chromatography-tandem mass spectrometry (LC-MS/MS) in negative electrospray ionization mode. The validated limits of quantification range from 0.3 µg/L in beverages to 5 µg/kg in very
complex matrices, such as feed or botanical extracts. The method was approved AOAC First Action Official method 2017.15 for the determination of BPA in commercially packaged ready-to-consume carbonated and noncarbonated water and non-alcoholic beverages.

**AGFD 348 Plasticiser residues in edible oils and fats: occurrence & analysis** Jan Kuhlmann, jan.kuhlmann@sgs.com. SGS Germany GmbH, Hamburg  Plasticisers represent a complex group of world-wide and in large scale applied chemicals. They ensure important properties to plastic materials. Furthermore, they are a used as auxiliaries in various medical and personal care products and other household items. Trace contamination of edible oils and fats might occur during harvesting, processing, bottling and storage. Certain plasticisers, especially some phthalic acid esters (phthalates), are suspected to have adverse health effects such as possibly causing cancer. In this regard, some authorities have started to set regulations on specific phthalates. Also, NGOs have picked up the absence of certain plasticisers as quality criteria for foods such as edible oils and fats. Very likely these compounds will raise increasing intention of authorities and consumers in the future. In order to determine trace amounts of plasticisers for monitoring purpose or to control internal or official limits there is an obvious need for reliable and validated analytical methods. However, analysis of plasticiser residues in foods is challenging as the number and diversity of compounds is increasing while at the same time the ubiquity of plasticisers being present in laboratory devices and utilities raise the possibility of cross-contamination and significant background levels. This presentation highlights the relevance of the issue in terms of food safety and trace analysis. A new analytical approach for the parallel determination of 24 plasticisers in oils and fats by on line coupled LC-GC-MS-MS technique is introduced. Occurrence data for refined and non-refined edible oils and fats will be presented.

**AGFD 349 Non-targeted screening of nuts and nut products for Proposition 65 compounds** Jerry Zweigenbaum1, j_zweigenbaum@agilent.com, Alyson E. Mitchell2. (1) Agilent Technologies, Wilmington, Delaware (2) Food Sci. Tech., UC Davis Proposition 65 (Prop 65) is a list of compounds and substances from furfural alcohol to certain pesticides to gasoline engine exhaust. Compounds listed on Prop 65 are those known to cause cancer or reproductive toxicity. Numerous food products have come under scrutiny as they contain compounds listed on Prop 65 including acrylamide and furfural alcohol. Acrylamide and furfural alcohol are formed in first steps of the Maillard reaction, which begins, with a reaction between asparagine and a reducing sugar. Nuts and nut products are subject to processing such as roasting, pasteurization and applied coatings. Little is known with regard to how cultivar selection, farm practices and processing contributes any of the compounds listed in Prop 65 in nuts and nut products. One way of partially answering this question is to analyze extracts using both a targeted and non-targeted approach with chromatography combined with high resolution accurate mass spectrometry. This presentation will evaluate methods involving both GC and LC/MS for the determination of this specific and non-specific list of compounds. A general extraction of nuts such as almonds and products thereof is made using methanol, acetone and DMSO and the extracts are analyzed by both GC and UHPLC Q-TOF MS targeting furfural alcohol and select pesticides while simultaneously evaluating the extracts for a non-targeted database comprised of the compounds listed in Proposition 65.

**AGFD 350 Distinguishing between natural and industrial lead in consumer products and other environmental matrices** Arthur Flegal1, flegal@ucsc.edu, Kingsley Odigie2. (1) UCSC, Santa Cruz (2) 2. Earth Science, Univ. of California, Riverside  Distinguishing between natural and industrial lead in consumer products is an important consideration in California because of its Safe Drinking Water and Toxic Enforcement Act of 1986, commonly referred to as Proposition 65, which was designed to enable the public to make informed decisions about their exposure to materials containing potentially toxic levels of chemicals. The state has set the maximum exposure of lead in foods and nonfoods (e.g., drinking water and supplements) at 0.5 mg/day, and requires businesses to provide warnings if lead concentrations in their products exceed that level – with one exception. The exception is that “human consumption of food shall not constitute an ‘exposure’ for purposes of [Proposition 65] to the extent that the person responsible for the exposure can show that the chemical is naturally occurring in the food”. Consequently, arguments in Prop 65 cases involving elevated concentrations of lead in consumer products are often based on whether that lead is natural or industrial. Here we briefly summarize some of our efforts to address that argument in several cases, as well as in other studies of lead contamination in the environment. Much of that effort has involved the use of stable lead isotopic compositions to characterize the potential of various sources of natural and industrial lead that could be sources of contamination. In addition, we have sought to determine the “natural” concentrations of lead in some environmental matrices (e.g., blood and plants), using organisms raised in an ultraclean laboratory where ambient lead levels in air, soil, water, and food approximate “preindustrial” conditions. The results of these and other studies indicate that most of the lead in products exceeding Proposition 65 standards is derived from industrial sources.

**AGFD 351 Toxic elements in food in the US** Jennifer Fong Sam, jennifer.fongsam@fda.hhs.gov. FDA, College Park, Maryland Heavy metals such as arsenic, cadmium, mercury, and lead are ubiquitous in the environment from both natural and anthropogenic sources. As a result, heavy metals have the potential to enter the food supply through natural means (i.e. plant uptake) and during process and transport. These elements are known to have deleterious effects on human health, with dietary intake being an important route of human exposure. There is on-going attention and concern with regard to toxic metals in food products and it is important to continually monitor and establish safe levels. As a part of the U.S. FDA’s (FDA) mission to protect public health, concentrations of chemical contaminants in food products are routinely monitored. These data are used to inform researchers on specific routes of exposure and current prevalence, and to provide quantitative data for risk assessments, which together help determine the most effective ways to reduce human exposure. Findings from FDA testing for products such as rice, juice, and chocolate and how those results compare to relevant regulatory limits will be discussed. In addition, the methodologies, instrumentation, and testing procedures which are needed to achieve low levels of detection required for trace metal analysis in foods will be presented.

**AGFD 352 Prop 65: Analysis of As, Se, Cd, Hg, & Pb in traditional foods and “new foods” using inductively coupled mass spectrometry (ICPMS)** Jenny Nelson, jenny_nelson@agilent.com, Craig Jones. Agilent, Berkeley, California  Increased regulations regarding the presence of toxic metals in food and beverages have become a fast growing analytical requirement which ultimately ensures their safety prior to consumption. Stricter regulations have been placed such as the Safe Drinking Water and Toxic Enforcement Act, also known as Prop 65, providing guidelines for food and beverage safety. The low detection limits achieved by ICPMS, along with ORS Tech. provide a reliable means of determining such toxic elements simultaneously and reliably. High Matrix Analysis of As, Se, Cd, Hg, & Pb in various Food Digestates using ICPMS will be
presented. New foods hitting the market in recent years, and how they are analyzed, will also be discussed.

**AGFD 353 Antioxidant activities of potato peel extractives**

Changqing Wu, changwu@udel.edu, Kai Yang1,3, Jiayao Li1, Elvis Ebikade2, Dionisios G. Vlachos2. (1) Animal and Food Sci.s, Univ. of Delaware, Newark, Delaware, US (2) Catalysis Ctr for Energy Innov, 250M ISE Lab, Univ. of Delaware, Newark (3) College of Ocean, Zhejiang Univ. of Tech., Hangzhou, China Global food waste is currently estimated to be 133 billion pounds annually and it is approximately one-third of global food production. Currently 83% of food waste ending up in landfills in the US (US), and the food wastage's carbon footprint is estimated at 3.3 billion tons of CO2 equivalent, posing a huge environmental problem especially from methane liberated at landfills. Potatoes are the 4th most produced crop globally and are the most consumed vegetable in the US. Approximately two million tons per year of potato peels waste (PPW) are produced accounting for 3% of the total food waste stream in the US. PPW has about 55% carbohydrates, 20% extractives, 15% lignin and 10% ash (on a weight basis). The objective of our study is to determine the antioxidant activities of PPW to prove value added products. The dried and powdered peels of Russet Burbank potatoes were extracted by 50:50 methanol/water. The potato peel extractives (PPE) were evaluated by test of total phenolics contents (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay, hydrophilic oxygen radical absorbance capacity (ORAC) assay, and HPLC analysis. TPC (29.998 ± 0.539 mg gallic acid equivalent (GAE) per g PPE) were higher than reported values. Chlorogenic acid, caffeic acid, p-coumaric acid and ferulic acid, were quantified in our extracts, with the former two being dominant. Our PPE showed high antioxidant capacity as measured using the ORAC and DPPH assays. Further studies were conducted to evaluate whether potato variety and extraction method affected the antioxidant activities. Two kinds of potatoes, russet potatoes (Solanum tuberosum 'Russet Burbank') and petite red potatoes (Solanum tuberosum 'Ruby Red') were extracted by two extraction methods (stirring and ultrasonic) and three solutions (methanol, water, and 50:50 methanol/water). The TPC were determined in these PPE. The data showed that extraction methods resulted in statistically significant different TPC (p<0.05), with the ultrasonic method resulting in higher TPC. More study is ongoing with our collaborators to develop sustainable biofinery capitalizing on abundant and underutilized food waste for manufacturing value added products in order to achieve a “circular economy”.

**AGFD 354 Microbial volatile biomarkers for MP charcoal rot**

Chathuri Gamlath Mohottige1, cug3@msstate.edu, Todd Milsan1, Richard Baird2. (1) chemistry, Mississippi State Univ., Starkville (2) Biochemistry, molecular biology, entomology and plant pathology, Mississippi State Univ., Starkville Macrophomina phaseolina (MP) (Tassi) Goid is an agronomically important, soil born, ascomycete fungal pathogen that has a host range over hundreds of plant species including many important economic crops. This fungus has a historical presence in the Southern soil, hence, the potential damage from MP is one of the biggest risks facing the sweet potato industry in the US. Visual identification of this fungal infection, using their black melanized microsclerotia, is not enough to prevent spreading of the fungus which leads to the need for a rapid diagnostic mechanism for early-stage identification of the fungal infection. Rhizopus soft tissue is another major fungal threat in large-scale sweet potato storage warehouses. Volatile biomarkers for early detection were identified for both these fungi. Here we present an untargeted metabolomics approach to investigate the pathogenicity of Macrophomina phaseolina and Rhizopus stolonifer. Tissues from 3 different varieties of sweet potatoes namely, Beauregard-14, Beauregard-63, and Orleans were used to investigate the fungal infection. Headspace solid phase microextraction method coupled with GC/MS was used to collect the microbial volatile organic compounds (MVOCs) produced by the fungal inoculated sweet potatoes. Results analyzed using chemometric and PLS-DA analysis clearly demonstrate the differentiation of fungi infected sweet potato tissues from the healthy tissues and have identified key metabolites involved in the infection. More importantly, we have identified significantly important metabolites including groups of alcohols, alkanes, aromatic hydrocarbons, esters, furans, ketones, organic acids, and sesquiterpenes. The metabolites are linked to cellular stress and energy metabolism pathways. Combinations of more than one chemical group improve fungal infection diagnosis. We hope these findings will lead to a sensory machine such as electronic noses for large-scale agricultural storage warehouses to identify early-stage fungal infection.

**AGFD 355 Microencapsulation of antibiotic alternatives to modulate microflora at target intestinal location**

Ying Wu, ywu@tnstate.edu. Agricultural and Environmental Sciences, Tennessee State Univ., Nashville Essential oils and polyphenols are natural compounds that can be used as antibiotic alternatives, but their use is limited due to their sensitivity to heat and light, and harsh flavor and taste. Microencapsulation is a promising approach to protect bioactive components and to deliver them to the target location. The objectives of the present study are: 1) prioritize the best combination ratio of essential oils and polyphenols; 2) formulate and optimize microencapsulation for antibiotic alternatives; 3) Investigate the delivery efficiency, releasing profile and effects on bacteria of the microparticle using in vitro methods. Our result has indicated that synergistic effect between essential oils (EO) and polyphenols (PP) were observed inhibiting the growth of pathogenic bacteria and promoting the growth of beneficial bacteria after comparing their minimum inhibition concentrations. The EO/PP ratio of 5/5 exhibited the best synergistic interaction by inhibiting the pathogenic bacteria, E coli 015:H7, Salmonella typhi, and promoting the growth of Lactobacillus plantarum. The encapsulation formula contained 8% wall ingredients, and 1.6% core material (EO/PP mixture) in the format of emulsions prepared with the aid of a microfluidizer. Encapsulated compounds (EO/PP at the combination ratio of 5/5) were obtained using spray drying and freeze drying with the recovery rate of 65% and 92%, respectively. The results from the in vitro digestion model indicated that both drying techniques released EO and PP in a controlled manner. However, the freeze-dried particles gave a higher releasing content of the active compounds (EO and PP) compared to the spray dried particles. The addition of the novel ingredient, yellow mustard mucilage, could protect the core compounds from burst release before reaching the target location. The resultant microencapsulation products will be applied into the poultry diet for further validation of its modulation effects on microflora in poultry intestinal tracts.

**AGFD 356 Efforts to improve the long-term precision of fumonisin quantitation by LC/MS using a 13C labeled internal standard and a well characterized trending sample**

Benjamin Strong, strongben86@gmail.com, Ron Sarver, Eric Bergeron. Neogen Corporation, Lansing, Michigan Mycotoxins are a family of molecules produced by molds which can contaminate a wide range of food products. Many of these toxins are regulated by the FDA because of the dangers they pose to human health. Fumonisins, produced by Fusasrium molds, are a major source of contamination in corn and other food products. While there are many fumonisins found in nature, the most abundant are fumonisin B1, fumonisin B2, and fumonisin B3. The FDA has provided guidance that the sum of these three fumonisins not exceed 4 ppm for any food consumed by humans. To test for contamination, fumonisins are commonly
detected spectroscopically with derivatization or by using mass spectrometry. Mass spectrometry is a very powerful tool and is well suited for the detection of fumonisin. To achieve high precision with mass spectrometry, internal standards are often used. Due to their complex natural product structures, internal standards for mycotoxins are very expensive and must be used prudently. This research uses a fully labeled 13C34 fumonisin B1 internal standard with a strong ion exchange (SAX) solid phase extraction cleanup and LC/MS detection. Long term precision is also monitored by parallel data collection of a well characterized trending sample. Before the implementation of the internal standard, fourteen sets of data were analyzed over a six-month-time period and produced an average coefficient of variation of 15.6%. Fifteen sets of data have been analyzed after moving to the internal standard method, over a 14-month period, and have an average coefficient of variation of 2.7%.

AGFD 357 Detection of beef quality by using impedance characteristics  Zongbao Sun, tly@ujs.edu.cn, Liming Liang, Tianzhen Wang, Xiaobo Zou, Xiaojing Yan, Junkui Li, Xiaoyu Liu. School of Food and Biological Eng., Jiangsu Univ., Zhenjiang, Jiangsu, China  In order to establish a fast, convenient and low-cost method to detect the quality of beef, we compared and analyzed the changes of the impedance characteristics of the beef with different storage days and different storage methods (fresh/frozen-thawed) in the frequency range of 101-105Hz. And some rules of the change were explained in this paper. To verify the feasibility of detecting beef quality by using impedance characteristics, we established the discriminant model by combining back propagation algorithm artificial neural network (BPANN) with impedance characteristics of different quality beef. Results showed that combining BPANN with impedance characteristics could classify the samples (fresh/frozen-thawed) into two groups according to the mode of storage and classify the samples into three groups according to different storage days (0d, 15d, 30d). The accuracy of the model established by using BPANN to distinguish fresh beef from frozen-thawed beef could reach 99%, and the accuracy of the distinguish of different storage days could reach 98%. A PLS was applied to establish a quantitative prediction model of impedance spectroscopy and TVB-N, and the correlation coefficients of training set and test set were 0.9312 and 0.9277, respectively, showing good performances for predicting TVB-N. Since TVB-N was one of the most important parameters to determine meat freshness, the impedance characteristics could be used to predict the freshness of beef. In summary, the combination of impedance properties and chemometrics was a simple, effective and promising application for the detection of beef quality.

AGFD 358 The discrimination of production process and age of Zhenjiang aromatic vinegar based on SPME-MS  Zongbao Sun, tly@ujs.edu.cn, Xiaojing Yan, Tianzhen Wang, Xiaobo Zou, School of Food and Biological Eng., Jiangsu Univ., Zhenjiang, Jiangsu, China  Zhenjiang vinegar is one of the most representative types of vinegar in China. It is famous for certain Zhenjiang aromatic vinegar based on SPME. In this paper, SPME-MS Tech. was used to obtain the ion abundance of Zhenjiang vinegar using different production processes with five vinegar ages (fresh, six-month-aged, two-year-aged, three-year-aged, and four-year-aged). Three chemometric methods, linear discriminant analysis (LDA), support vector machine (SVM) and back-propagation neural network (BPANN), were used to establish a discriminant model. The results showed the recognition rate of train group and test group in the BPANN model reached 100% and 99%, respectively, when it comed to identifying the different production processes or five vinegar ages of Zhenjiang aromatic vinegar. To identifying two different production processes and five vinegar ages of Zhenjiang aromatic vinegar simultaneously, the performance of the LDA model was 100%. Therefore, the rapid identification of Zhenjiang vinegar with different production processes and vinegar ages can be achieved by SPME-MS combined with chemometric.

AGFD 359 WITHDRAWN

AGFD 360 Visible colorimetric oxygen indicator for quick response and real-time monitoring of the integrity of modified atmosphere packaging  Xinghai Liu, liuxh@whu.edu.cn. School of Printing and Packaging Eng., Wuhan Univ., Wuhan, China  Oxygen indicator is a new technique for nondestructive testing (NDT) of modified atmosphere packaging (MAP). During transportation and storage, destruction may happen at any time, which can result in an increase of oxygen concentration. It might lead to food quality decline and even food spoilage. However, without professional equipment, it is difficult to judge whether the package is intact. Herein we reported a visible colorimetric oxygen indicator, which can accurately detect intact packaging system to ensure food safety. This indicator consists of titanium dioxide, glycerol, methylene blue (MB) and hydroxyethyl cellulose (HEC). The oxygen indicator demonstrated excellent photocatalytic performance and effectively avoided excitation by visible light. Additionally, the reaction time of indicator in recovery stage can be controlled by changing the concentration of MB because of pseudo first order kinetics. Simultaneously, we studied the rheological properties, thixotropic properties, and wettability of the indicator. The results demonstrated the printability of the indicator solution, which was then printed in the polyethylene terephthalate (PET) film by screen printing and applied to MAP. The application results showed that the prepared oxygen indicator was able to provide visual support to judge whether the packaging was intact and the food was safe.

AGFD 361 Fabrication of chitin nanofiber/calcium alginate sponges and their application as wound healing  Yumin Du, duayumin@whu.edu.cn, Zhiyi Peng. Center of Research on Biomass Resource, Wuhan Univ., Wuhan, Hubei, China  Chitin nanofibers (ChNFs) with mean diameter of ~40 μm and lengths of thousands of nanometers were prepared by TEMPO (2, 2, 6, 6-tetramethylpyperidine-1-oxyl)-mediated oxidation of β-chitin. ChNFs retained the intrinsic bioactivities of chitin, including excellent biocompatibility and high aspect ratios. By using the internal gelation with CaCO3-GDL complex and the incorporation of ChNFs as the reinforcing component into alginate matrix, novel and homogeneous ChNFs/calcium alginate sponges (ChNFs/ALG) were prepared. The experimental results showed that ChNFs/ALG sponges exhibited good three-dimensional (3D) structure as well as lamellar and porous morphologies. Animal tests demonstrated that the healing time of wound could be shortened by 2 days and no obvious scar was observed, compared to the commercial gauze. The inflammatory factors produced by the body had no significant change, indicating that the sponges possessed good biocompatibility. In the wound treated by the sponge, the number of inflammatory cells was few, the granulation tissue was more uniform and the collagen deposition was increased, showing that the ChNFs/ALG sponges have good potential in the biomedical material field.

AGFD 362 Protein unfolding and aggregation of PSE-like chicken meat protein at an extreme alkaline pH: Influence on edible film-forming properties  Xue Zhao, 2017208024@njau.edu.cn, Tong
Xing, Xinglian Xu. Food Sci. & Tech., Nanjing Agricultural Univ., Jiangsu, China. The mechanisms of the unfolding and aggregation of PSE-like chicken meat protein at extreme alkaline pHs (pH 11.0, 11.5 and 12.0) were studied and related to the physical properties of edible films. Results of asymmetrical flow field-flow fractionation coupled with various detectors showed that pH 12.0 leads to a certain degree of protein aggregation, which could also be observed in atomic force microscopy (AFM) images. Higher levels of protein denaturation and unfolding, as proved by the circular dichroism spectrum, could induce this aggregation, whereas all pH-adjusted groups exhibited similar flow behavior. The pH 11.0 sample exhibited films with higher water resistance compared to others. Comparatively, solubilizing PSE-like meat protein at pH 11.5 could result in better edible films with greater chemical properties, water resistance and transparency. Our results elucidated the effects of the PSE-like chicken meat protein unfolding and aggregation on edible film properties under various extreme alkaline pH conditions.

AGFD 363 RFID-enabled wireless humidity sensor for food packaging Shuangli Ye, slye@whu.edu.cn. School of Printing and Packaging, Wuhan Univ., Hubei Province, China, Wuhan, China. This work presents the fabrication and design of a flexible chipless RFID humidity sensor, which can be used for the low cost humidity monitoring of the intelligent food packaging. With inkjet-printed ink and ion-exchange technique, silver antenna operating at ultra-high frequency with high gain is fabricated on the flexible polyimide (PI). The proposed antenna structure is designed by finite element method (FEM) based Ansys high frequency structure simulator (HFSS). The physical properties of the silver nanoclusters are characterized by the SEM, XRD and AFM techniques. With the integration of the designed silver antenna and the linear dielectric behavior of PI film to humidity, a chipless RFID humidity sensor is developed. The resonance frequency of the chipless RFID sensor is shifted with the environmental humidity, resulting in the variation of the backscattered power level. The sensitivity have been optimized by the antenna design and the fabricated process, leading to the signals can be easily detected by the RFID reader. The developed low cost passive chipless RFID sensor has potential applications for the intelligent food packaging.

AGFD 364 Improved thermal stability of W1/O/W2 double emulsions with bioactive peptide/poly saccharides complexes prepared by self-assembled electrostatic interaction Yeonji Jo1, jo.yeonji.1986@gmail.com, Ulrike Sabine van der Schaaf2, Sang-Gi Min3. (1) Univ. of Alberta, Edmonton, Canada (2) Inst. of Process Eng. in Life Science, Karlsruhe Inst. of Tech., Germany (3) Konkuk Univ., Seoul, Korea (Democratic People’s Republic of). Water in oil in water (W1/O/W2) double emulsion, promising encapsulation systems for hydrophilic substances, is a part of multi-compartment liquid dispersions in which the disperse phase itself is an emulsion. Double emulsions can also protect functional water-soluble ingredients included in the inner-water (W1) phase from chemical degradations (e.g., various process operations experienced by food products during their manufacture, especially temperature). In this study, bioactive peptides (BP)/polysaccharides (P) complexes were designed by using self-assembled electrostatic interaction to control release behavior of BP in double emulsion system. Therefore, the objective of our study proposed to develop food-grade W1/O/W2 double emulsions containing a BP/P complexes and to investigate their thermal stabilities under a temperature evaluation (25, 45, 65, and 85°C). The effect of pH, NaCl (osmolyte) addition and biopolymer type (chitosan and pectin) were investigated and optimized to obtain the highest yield of complexation behavior underpinned by measuring of zeta-potential. Afterwards, BP/chitosan and BP/pectin complexes were produced. For influence of osmolyte in double emulsions, the encapsulation efficiency of BP was decreased in presence of NaCl, which can be attributed to competitive action between BP and NaCl in W1-phase. Whereas, the double emulsions containing BP/P complexes showed a high thermal stability and low release of encapsulated BP over time. After storage at 65°C for 4 h, the release amount of BP was 42% at pH 8 and 52% at pH 2, and decreased down to 32% and 38% in BP/chitosan and BP/pectin complexes, respectively. From the results, it was suggested that BP-loaded W1/O/W2 double emulsions could be controlled by different charged polysaccharides, and it will be able to utilize as functional food ingredients in development for heat sensitive food and pharmaceutical products.

AGFD 365 Impact of gut microbiota on the metabolism and bioactivity of [6]-shogaol in ginger Shengmin Sang, ssang@ncat.edu. Center for Excellence in Post-Harvest Technol, North Carolina AT State Univ., Kannapolis [6]-Shogaol (6S), one of the major bioactive components in dry ginger, is attracting considerable attention because of its wide spectrum of biological activities, but its metabolic fate especially the metabolism of 6S by gut microbiota is still not fully understood. This talk will present our recent findings on the impact of gut microbiota on the metabolism and bioactivity of 6S. The microbial metabolism of 6S was examined for the first time in germ-free (GF) and specific pathogen free mice and in in vitro batch human fecal fermentation system. The major microbial metabolites of 6S were detected and identified by LCMS analysis and in comparison with authentic standards. We also demonstrated that the inactive glucuronidated 6S and its phase I and thiol conjugated metabolites could be rapidly de-conjugated by human gut microbiota and in mice to the active free forms in the GI track. In addition, we also observed the interindividual variability on the formation of microbial-derived metabolites of 6S by human gut microbiota.

AGFD 366 Dietary flavonoid and gut microbiota interaction: Critical in anti-inflammation and anti-cancer in the colon Hang Xiao, hangxiao@gmail.com. Food Sci., Univ. of Massachusetts, Amherst Dietary flavonoids and microbiota in the colon interact in a reciprocal manner as bacteria can metabolize flavonoids to various metabolites, and flavonoids can modulate microbiota composition and associated biofunctions. This interaction, which remains to be elucidated, is anticipated to have a significant impact on the risk of several diseases such as colitis and colon cancer. A detailed understanding of this interaction will facilitate the development of dietary flavonoid-based strategies for preventing these diseases. In this talk, the recent findings from our lab in terms of the interplay between gut microbiota and flavonoids such as polymethoxyflavones (PMFs), curcumin, resveratrol and pterostilbene will be summarized. The implication of the interplay in inhibiting colon inflammation and colon cancer will be described. For example, PMFs, a unique class of citrus flavonoids, displayed potent anti-inflammatory anti-cancer properties in the colon in our animal studies. We found that gut microbiota mediated the production of an array of colonic metabolites of PMFs after their oral administration in mice, and these metabolites possessed much stronger anti-inflammatory and anti-cancer effects than their parental PMFs. Furthermore, PMFs modulated the composition of gut microbiota to alleviate microbial dysbiosis, which in turn might contribute to the anti-inflammatory and anti-cancer effects in the colon. Overall, our results provided a basis to utilize flavonoid-microbiota interactions in the inhibition of colonic inflammation, colon cancer, and other related diseases.

AGFD 367 Vitamin E forms: Protective effects on gut health and modulation of gut microbiome Qing Jiang, qjiang@purdue.edu. Nutrition Science, Purdue Univ., West Lafayette, Indiana My lab has been investigating the functions and metabolism of traditionally
AGFD 368 Mildly oxidized vegetable oil exaggerates colitis and colitis-associated colon tumorigenesis  Guodong Zhang, guodongzhang@umass.edu. 245 Chenoweth Laboratory, Univ. of Massachusetts Amherst  Vegetable oils, such as corn, soybean, safflower, and canola oils, consist a substantial part of our diet. Rich in polyunsaturated fats, the vegetable oils are prone to oxidation and these oxidation products are commonly found in the diet. However, the effects of oxidized oils on human health are not well understood. Here we show that dietary administration of oxidized vegetable oils, even with low oxidative status (within the recommended industrial limit of oxidative status of fresh vegetable oil), exaggerates colitis and exacerbates colitis-associated colon tumorigenesis in mice. Oxidized oil reduces the diversity and alters the composition of gut microbiome, and fails to promote colitis in antibiotic cocktail-treated mice. In addition, oxidized oil impairs intestinal barrier function, increases bacteria translocation from the gut into systemic circulation, enhances activation of Toll-like receptor 4 (TLR4) signaling, and fails to exaggerate colitis in Tlr4-/- mice. Together, these results support that oxidized vegetable oil could be a risk factor of colitis and colitis-associated colon cancer, via altering gut microbiome and activating TLR4 signaling.

AGFD 369 An in vitro small intestine model with simulated resident microbiome  Laurel A. Doherty, laurel.a.doherty.civ@mail.mil, Jordan Whitman, Steven Arcidiacono, Karen Conca, Jason W. Soares. U.S. Army CCDC - Soldier Center, Natick, Massachusetts, US  Detailed characterization of the small intestine with regard to nutrient digestion, bioavailability, and impact of the resident microbiome is limited due to the relative inaccessibility of the organ. Design of a small intestine model can provide more detailed knowledge of these processes; numerous in vitro models have been developed to simulate small intestine enzymatic digestion of dietary inputs, but few emulate nutrient absorption and none to date incorporate the resident microbiota. Here, we present an in vitro fermentation model of the small intestine including microbiota and nutrient absorption to enhance physiological relevance. A stepwise biofidelic model design approach was implemented with initial stages consisting of simulating ileum conditions, including pH, residence time, and media formulations representing “fasted” and “fed” conditions, utilizing an automated bioreactor system for real-time monitoring and control of fermentation parameters, and with incorporation of digestive enzymes and bile acids for breakdown of food inputs. Passive nutrient absorption was simulated using hollow-fiber columns and initially optimized using small molecules to mimic dietary digestion byproducts. To simulate the resident microbiome, a consortium of organisms were selected to represent major phyla and functions and competitive growth dynamics characterized in fermentations representing “fed-state” ileum conditions. A consortium of five organisms was grown under both anaerobic and microaerophilic conditions; preliminary results indicate synergistic growth compared to monoculture. Validation of the model with simplified food components, with and without incorporated microbiota, will be presented. This effort compliments our current large intestine fermentation model and will establish a complete microbial model of the lower GI tract. Insight gleaned from this model, alone or in concert with in vivo studies, can elucidate the role of the small intestine microbiome in nutrient digestion and host bioavailability and inform nutritional strategies to restore and maintain microbiome homeostasis.

AGFD 370 Targeted metabolomics identifies epoxygenated linoleic acid-derived epoxygenated linoleic acid as an important modulator of colon tumorigenesis  Guodong Zhang, guodongzhang@umass.edu. 245 Chenoweth Laboratory, Univ. of Massachusetts Amherst  Colon cancer is the third most common cancer and the second leading cause of cancer-related death in the US, emphasizing the need for discovery of new cellular targets. Using a metabolomics approach, we report here that epoxygenated fatty acids (EpFA), which are eicosanoids metabolites produced by cytochrome P450 (CYP) monooxygenases, were increased in both the plasma and colon of azoxymethane (AOM)/dextran sodium sulfate (DSS)-induced colon cancer mice. CYP monooxygenases were overexpressed in colon tumor tissues and colon cancer cells. Pharmacological inhibition or genetic ablation of CYP monooxygenases suppressed AOM/DSS-induced colon tumorigenesis in vivo. In addition, treatment with 12,13-epoxyoctadecenoic acid (EpOME), which is a metabolite of CYP monooxygenase produced from linoleic acid, increased eicosanoid production and JNK phosphorylation in vitro and exacerbated AOM/DSS-induced colon tumorigenesis in vivo. Together these results demonstrate that the previously unappreciated CYP monooxygenase pathway is upregulated in colon cancer, contributes to its pathogenesis, and could be therapeutically explored for preventing or treating colon cancer.

AGFD 371 Impact of different starter cultures on the quality of salami sausages  Yingli Liu, liuyingli@th.btbu.edu.cn, Junyan Wei, Jing Wang. School of Food and Chem. Eng., Beijing Tech. and Business Univ., China  Lactobacillus sakei H1, Lactobacillus lactis N102, Lactococcus lactis Natick, China, and Debaryomyces Hansenii Y4-1  Deharyomyces hansenii Y4-1 and Wickerhamomyces anomalus Y12-3 were evaluated to determine their roles in improving the quality of salami sausages. The physicochemical properties (pH, water activity (aw), malonaldehyde content, nitrite residue and color) were evaluated in the initial meat batter and at different ripening stages. The texture properties, sensory evaluation, and flavor substances of the sausage were determined after maturity. Bacterial diversity and dynamics were also examined using high-throughput sequencing at different ripening stages. A decrease in pH, aw and nitrite residue in all group was observed during ripening, while the pH and nitrite residues in the inoculated sausages were significantly lower than those in the non-inoculated control, especially with mixed strains. TBARS values of all groups showed an increasing trend during ripening and the inoculation of dry sausages with bacterial strains and yeast significantly decreased the values compared to the control group. The results of color showed that the L value and a value of the inoculant group were higher than those of the control group, and the b value was lower than the control group. The determination of the texture properties indicated that the hardness and chewiness of the mixed starter group of the four strains were superior to those of the other groups, and the sensory evaluation score of the group was the highest. The results of bacterial diversity indicated that there were mainly Firmicutes, proteobacteria, and Cyanobacteria at the phylum level at different ripening stages. Lactobacillus spp., Weissella spp., Pediococcus spp. are the main beneficial bacteria present, and some spoilage bacteria such as Photobacterium spp., Brochothrix spp. and Pseudomonas spp. are also detected. Lactococcus lactis spp were the main bacteria in all groups and its content in the group inoculated with the starter was significantly higher than that in the control group, while the content of spoilage bacteria was lower than that in the control group. The results of the determination of fungal diversity after the ripening of the sausage showed that the fungi of the group inoculated yeast were Debaryomyces hansenii or Wickerhamomyces anomalus, while other groups had more other fungal species. The results showed that the mixed starter cultures had a significant improvement in the quality of sausage.
AGFD 372 Studies on the effect of processing method on the loss of nutrients in some grains and legumes  Mark C. Azih, markazih@yahoo.com. Dept. of Chemistry, Ambrose Alli Univ., Ekpoma Edo State, Nigeria  The analysis of carbohydrates and protein losses through leaching was carried out in soaked cereal grains (wheat, corn, millet and sorghum) and legumes (brown beans, soyabeans, pigeon pea and bambara groundnut). One hundred grammes of each sample was soaked in 400ml of distilled water for 2, 4, 8, 16 and 24 hours at 15°C, 20°C and 25°C. The filtrates obtained over the different time durations and temperature treatments were analyzed for carbohydrate and protein content. The results showed an increase in leaching losses of these nutrients over time in all the samples. Greater leaching losses of nutrients were also observed at higher temperatures. The greatest percent carbohydrate loss occurred in wheat after 24 hours at 25°C while the least was in bambara groundnut after 2 hours at 15°C. For protein the greatest percentage loss occurred in corn after 24 hours at 25°C, while the least was in pigeon pea after 2 hours at 15°C. The results suggest that local Nigerian delicacies like pap and akara which are prepared from soaked corn and beans respectively, would benefit from reduced leaching losses if the soaking is carried at lower temperatures and shorter durations. Optimal soaking conditions are suggested for the different samples.

AGFD 373 Elucidating composition and structure of purified condensed tannins: Corroboration of thiolysis and spectroscopic data  Wayne Zeller1, wayne.zeller@ars.usda.gov, Laurie A. Reinhardt1, Emily E. Hardcastle1, Jamison T. Robe1, Irene Mueller-Harvey2, Aina Ramsay2, Honorata M. Ropiak2, Christos Fryganas2, Ronald H. Brown2, Chris Drake2, Rebecka Sepela3, Ann E. Hagerman3. (1) U.S. Dairy Forage Research Center, USDA-ARS, Madison, Wisconsin (2) Univ. of Reading, School of Agriculture, Policy and Development, Reading RG6 6AT, UK (3) Miami Univ, Oxford, Ohio Condensed tannins (CTs) consist of oligomers and polymers of flavan-3-ol subunits varying in hydroxylation patterns, cis- and trans-configuration of C-ring substituents, interflavan bond connections, mean degree of polymerization (mDP) and extent of depside linkage (esterification). Robust analytical methods to determine CT composition and structure are paramount to understanding the biological activity exerted by these secondary plant metabolites in human health, agriculture and environmental systems. Using wet chemistry (thiolysis degradation) and spectroscopic methods (two-dimensional nuclear magnetic resonance (2D NMR) spectroscopy) in concert, progress in the structural elucidation of purified CTs has been made. We have previously shown that integration of the 2D NMR cross-peaks signals for procyanidin/prodelphinidin (PC/PD) and cis/trans flavan-3-ol subunit provides relative ratios that corroborated thiolytic data. Recent progress of CT structure elucidation using these methods include the identification and content estimations of the terminal flavan-3-ol subunits, the extent of galloylation, ratios of A-type to B-type interflavan linkages and mDP of purified CT samples. In addition, a second set of 2D NMR cross-peaks signals (H/C-2) can provide reliable determination of flavan-3-ol cis/trans ratios. Corroboration of the data from these methods provides a confirmation of CT structure and will assist in the accurate formulation of CT structure-biological activity relationships.

AGFD 374 Water for coffee: Impact of solvated minerals on coffee flavor  Christopher H. Hendon, chendon@uoregon.edu. Chemistry and Biochemistry, Univ. of Oregon, Eugene  It is difficult to determine the absolute mineral composition of water from taste alone. However, the same water used to brew coffee paints a different picture - the perceived acidity in coffee is highly sensitive to the composition of the brew water. Examination of the pKa of operative compounds giving rise to flavors in the coffee flavor wheel figure shows that, in particular, the weak organic acids present in coffee are most susceptible to changes in bicarbonate concentrations in brew water. This lecture will discuss the composition of coffee, and opportunities in water chemistry to enable higher quality brews.

AGFD 375 Pru du 8: First member of a new food allergen family  Yuzhu Zhang1, yuzhu.zhang@usda.gov, Huilian Che2,1, Songsong Jiang2,1, Tengchuan Jin3, Shu-Chen Lyu4, Kari Nadeau4, Tara McHugh1. (1) USDA, Albany, California (2) China Agricultural Univ., Beijing (3) Univ. of Science & Tech. of China, Hefei (4) Stanford Univ., California  Almonds are high on the list of the most likely tree nut to trigger allergic reactions in the US. One of the allergenic proteins was believed to be the 2S albumin because two of its peptide sequences has high sequence identities with known 2S albumin in other species. However, a recent article debated that the allergen is likely to be the 7S vicilin of almond because the two peptide sequences matched 100% to those in the translation of a partial almond mRNA in the GenBank which is homologous to the N-terminal leader peptides of the 7S vicilin from some species. To uncover the identity of this allergen, we isolated its complete mRNA, expressed the protein deduced from the mRNA and confirmed that it is a food allergen. It is neither the 2S albumin nor the 2S vicilin. Rather, it belongs to a novel class of food allergens with antimicrobial activity and it has been officially designated as Pru du 8.

AGFD 376 Defining typicity of Pennsylvania-grown Grüner Veltliner wines using instrumental and human sensory methods  Stephanie Keller1, stk5117@psu.edu, Michela Centinari2, Helene Hopfer1, Ryan Elias1. (1) Food Sci., Pennsylvania State Univ., Univ. Park (2) Plant Science, Pennsylvania State Univ., Univ. Park  Grüner Veltliner (Vitis vinifera), an Austrian grape variety, is a relatively new grape to wine growers and producers in the northeast US including Pennsylvania, which is the focus of this present study. While climatic conditions are favorable to its growth, the Pennsylvania wine industry is still becoming familiar with the varietal characteristics of Grüner Veltliner grown and produced in this region. Defining typicity, described as the “perceived representativeness” of a wine produced from a designated area, has been of interest to the industry, as it helps identify environmental, viticultural, and sensory factors that can improve marketing strategies to wine consumers. The aim of this study was to characterize the chemical and sensory factors that drive typicity of Pennsylvania-grown Grüner Veltliner wines. Grüner Veltliner grapes were sourced from multiple regions across the state in 2018 and wines were made using a standardized vinification method. Wines were characterized by volatile aroma profiling with headspace solid phase microextraction gas chromatography, as well as phenolic profiling. In addition, the sensory fingerprints of the wines were evaluated by a trained descriptive analysis panel. Significant differences (p < 0.05) were found in numerous fruity and floral aroma compounds of wines vinified from grapes grown in the northwest, northeast, and southeast regions of Pennsylvania. Ongoing phenolic and descriptive analyses are providing further insight into how these wines differ. Results from this study will be useful in developing recommendations for wine producers to identify specific flavor compounds and attributes that contribute to perceived Grüner Veltliner quality.

AGFD 377 Effect of post-harvest moisture exposure on stored roasted almonds  Kathleen Luol, kkluo@ucdavis.edu, Dawn M. Chapman2, Alyson E. Mitchell3. (1) Food Sci. & Tech., UC Davis (2) Eurofins Food Integrity and Innovation, Livermore, California (3) Food Sci. Tech., UC Davis  Almond quality is affected by the exposure of moisture and temperature post-harvest through the
environment. Moisture exposure that causes moisture content ≥ 8% can result in a quality defect termed concealed damage, which is a brown discoloration of the nutmeat that occurs only after moderate to high heat treatments (roasting, bleaching, etc.). Current industrial practice for reducing moisture in almonds prior to processing, is to apply low heat to in-hull almonds until a moisture content of ~6% is achieved. Drying can reduce the visual discoloration of the nutmeat, however the quality of these roasted almonds over a typical storage lifetime is unknown. To address this, almonds exposed to moisture (ME, ≥8%), and subsequently dried to ≤ 6% moisture, were roasted to achieve a light roast (LR) and dark roast (DR) level. Roasted almonds were held under accelerated shelf-life conditions (39°C, 15% RH) to promote rancidity development and evaluated over 12 months; sampling once a month. Peroxide value, free fatty acid value, conjugated dienes, and headspace volatiles, were evaluated.

Descriptive and hedonic sensory analysis were performed at 0, 1, 3, 5, and 7 months of storage for the LR almonds. Descriptive analysis used trained panelists to rate specific sensory attributes and determined degree of differences (DOD). Hedonic analysis collected consumers’ likings on a 9-point scale. A significant difference in PV and FFAs were found between the ME and control almonds at both roasting level. Significant quality differences between ME and control almonds were detected in descriptive analysis. However, regular consumers did not notice any quality differences between the ME and control LR almonds.

AGFD 378 Identification of aroma compounds in four Chinese mango juices, and effects of thermal and high-pressure processing on the mango juice aroma profiles. Wentao Zhang, Fei Lao, fei.lao@cau.edu.cn, Jihong Wu. China Agricultural Univ., Beijing, China Volatile components, especially the aroma active components, impact the overall flavor profile of mango strongly. Identification of aroma active components and study the effect of processing on aroma compounds is significant for controlling the flavor quality of the mango products. The volatile compounds and aroma active components of four cultivars of mango juices, namely Tainong, Xiangya, Keitt, and Pingguo, which were harvested in Sichuan province, China, were studied. Compounds were identified by solid phase microextraction-gas chromatography-mass spectrum/olfactometry (SPME-GC-MS/O) and odor activity value (OAV). In addition, changes of Keitt mango juice aromas after pasteurization and ultra-high-pressure (UHP) processing were further investigated. The electronic nose and electric tongue was applied to discriminate the overall aroma of different cultivars and processing. Sixty-seven components were identified in four cultivars of mango juices, including monoterpenes, lactones, aldehydes (C6 and C9 aldehydes), alcohols, and acids. Twenty-two aroma compounds, such as β-myrcene, (E)-2-hexenal, (E)-2-nonenal, (Z)-3-hexenol, geraniol, (E)-β-Ionone, ethyl butyrate, and γ-lactone, were characterized as primary mango aroma contributors by odor activity value (OAV) and frequency detection analysis (FDA). Pasteurization diminished C9 key mango aroma compounds significantly (p<0.05), such as (E,Z)-2,6-nonadienal and (E)-2-nonenal. UHP had shown to have various effect on terpenoids. For example, compared to fresh juice, 3-carene, terpinolene and caryophyllene in the UHP juice increased significantly (p<0.05) while β-myrcene and D-limonene decreased significantly. Fresh juice, pasteurized juice and UHP juice could be distinguished efficiently by electronic nose and electronic tongue, suggesting that electronic nose and tongue have great potential could be served as options to distinguish juices undergone different processing. This current work is of great significance for identification of mango cultivars and processing methods by volatile components and aroma active components, as well as controlling of flavor quality in mango juice processing.

AGFD 379 Dietary intake of estrogen-mimicking endocrine disruptors and breast cancer. Devin A. Bowes, dbowes@asu.edu, Rolf U. Halden. Biodesign Center for Environmental Health Eng., The Biodesign Inst. and School of Biological and Health Systems Eng., Arizona State Univ., Tempe Hormone-responsive breast cancer (HR+), mainly influenced by endogenous estrogen fluctuations, accounts for the majority (80%) of all cases of breast cancer. Dietary factors are suggested to contribute to one-third of the incidence of breast cancer regardless of type. Estrogen-mimicking endocrine disruptors (EEDs), a specific class of endocrine disrupting chemicals (EDCs), have been shown to infiltrate the human diet and bind to estrogen receptors, with prior studies reporting associations between these exposures and breast cancer. Recent literature (n= 13 papers; 2013 - 2018) was reviewed to examine correlations amongst dietary intake of EEDs and breast cancer. Per capita dietary ingestion rates were identified for bisphenol A (BPA) (4.0 x 10^-4- 4.2 x 10^-3 mg/kg-day), phytoestrogens (sum of genistein and daidzein; 1-3 mg/kg-day), and pesticides, specifically dichlorodiphenyltrichloroethane (DDT) (3.0 x 10^-5mg/kg-day) and atrazine; (3.3 x 10^-5mg/kg-day). Additional EEDs showing positive links to breast cancer were examined, e.g., phthalates and parabens; however, evidence supports exposure routes were more dominated by inhalation and dermal absorption, rather than dietary ingestion. Further studies assessing linkages between chronic dietary exposure to humans, chemical distribution in human breast tissue, and estrogen receptor affinity of the compound should be more closely examined. New prospects for reducing unwanted dietary exposure to these estrogen-mimicking endocrine disruptors also were evaluated.
## Schedule of AGFD Technical, Business, Planning, and Social Activities

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>Sun 12:15-1:00pm</td>
<td>AGFD General Posters/Reception</td>
<td>Convention Center Room 33B</td>
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<tr>
<td>Sun 5:30-7:30pm</td>
<td>JAFCS Research Award Reception</td>
<td>Hilton Bayfront – Indigo Room 204A</td>
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<tr>
<td>Mon 12:15-1:00pm</td>
<td>Executive Committee Meeting</td>
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<tr>
<td>Mon 5:30-8:15pm</td>
<td>AGFD Awards Banquet</td>
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<td>Mon 8:00-10:00pm</td>
<td>Sci-Mix</td>
<td>Convention Center Room 33C</td>
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<tr>
<td>Tue 10:00-10:40am</td>
<td>Young Scientist Award</td>
<td>Hilton Bayfront – Indigo Room 204A</td>
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<tr>
<td>Tue 11:30-12:30pm</td>
<td>Future Programs/Reception</td>
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<td>Tue 1:20-2:10pm</td>
<td>Sterling Hendricks Award Reception</td>
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**AGFD Awards Banquet**

- Location: Convention Center Room 33B
- Time: 5:30-7:30pm

**Future Programs/Reception**

- Location: Convention Center Room 33B
- Time: 12:15-1:00pm

**Sci-Mix**

- Location: Convention Center Room 33B
- Time: 10:00-10:40am

**AGFD General Posters/Reception**

- Location: Convention Center Room 33B
- Time: 5:30-7:30pm

**JAFCS Research Award Reception**

- Location: Hilton Bayfront – Indigo Room 204A
- Time: 10:00-10:40am

**Executive Committee Meeting**

- Location: Convention Center Room 33B
- Time: 11:30-12:30pm

**Sterling Hendricks Award Reception**

- Location: Convention Center Room 33B
- Time: 1:20-2:10pm

**Young Scientist Award**

- Location: Hilton Bayfront – Indigo Room 204A
- Time: 6:00-9:00pm

**Convention Center Room 33B**

- Location: Convention Center Room 33B
- Time: 12:15-1:00pm

**Convention Center Room 33C**

- Location: Convention Center Room 33C
- Time: 8:00-10:00pm