Division of Agricultural and Food Chemistry of the ACS Fall 2020

CORNUCOPIA

including the AGFD program and abstracts for the

260th American Chemical Society (Virtual) National Meeting on

August 16 - 20, 2020

YOUNGMOK KIM & LIANGLI (LUCY) YU
Program Chairs

VIRTUAL PROGRAMMING HOW DOES IT WORK ?

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INSTRUCTIONS TO VIRTUAL PROGRAM PRESENTERS

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Visit our website - www.agfoodchem.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

2020 is definite a special year for everyone on the earth. The pandemic has affected our research, education and many aspects of everyone's daily life. Recent surging in newly confirmed corona virus infection cases in the Unites States suggests a long way ahead for us to fight against this unique virus. I hope all our community members and relatives/friends have been and continue to be safe and healthy.

The COVID-19 pandemic forced ACS to cancel our spring national meeting in Philadelphia, and to convert the San Francisco national meeting to a virtual conference. This will be the first virtual professional conference for many of us, which may be challenging. I would like to thank the leading program Chair (Dr. Youngmok Kim), all symposium organizers, presiders and presenters for your participation and contribution to AGFD technical program at the 260th ACS Virtual Meeting & Expo on August 17-20, 2020. AGFD had 306 abstracts accepted for poster and oral presentations. Several symposiums are organized to recognize the distinguished members who have enhanced the quality of life through advocating for safe, nutritious and sustainable food and agricultural systems. The AGFD Award Symposium is organized to honor Dr. Gary List for his outstanding contribution in lipid research. The JAFC Research Article of the Year Award Symposium and the AGFD Young Scientist Award symposium are traditional components for AGFD program at the fall ACS National Meeting. This year, the Withycombe-Charalambous Graduate Student Symposium has been moved to the fall meeting due to the pandemic, and the Spencer Award Symposium is organized by AGFD to honor of Dr. Jerry King. In addition, Drs. Brian Guthrie, Veronika Somoza and Yu Wang have been elected the 2020 AGFD fellows. Details of all AGFD awards can be found in this Cornucopia. Congratulations to all award winners!

AGFD has been an inclusive and multicultural professional community. As the United States and many other countries continue to grieve black lives lost, AGFD colleagues must confront systemic racism, and continuously try our best to advance racial equity and social justice.

I thank Dr. LinShu Liu for his initiative, as well as his time and efforts leading to the establishment of the new "Diet and Gut Microbiome" Subdivision within AGFD. Mr. Jason Soares serves as the first Chair for the new subdivision, and Dr. Guodong Zhang serves the Chair-elect, and Ms. Laurel Doherty and Dr. Karley Mahalak are the Secretaries. This new subdivision will bring together researchers in the diet, gut microbiota, food science, human health and nutrition areas together to enhance AGFD impact in this new active research area.

I look forward to your participation at the 260th ACS Virtual Meeting & Expo on August 17-20, 2020.

Liangli (Lucy) Yu

AGFD Chair 2020

CORNUCOPIA EDITORIAL STAFF & CONTACT INFORMATION	
Editor-in-Chief	C. Frey cfreyenterprise@gmail.com
General Manager	P. White
Staff	C. Kent, L. Lane, J. Olsen

FUTURE PROGRAMS

SAN ANTONIO March 21-25, 2021 ACS Meeting Theme: Bonding Through Chemistry

3rd Global Symposium on Chemistry and Biological Effects of Maple Food Products Hang Ma hang_ma@uri.edu Navindra Seeram nseeram@uri.edu

Food Complex Matrices Sourav Chakraborty schakraborty@ccsu.edu

Chemistry of Alcoholic Beverages Nick Flynn nflynn@wtamu.edu

Chemistry of Fermented Hispanic Foods Michael Tunick mht39@drexel.edu Elvira deMejía edemejia@uiuc.edu

Impact of Global Disasters on Food Quality, Safety and Security Alyson, Mitchell aemitchell@ucdavis.edu Michael Morello mjmorello226@gmail.com Liangli (Lucy) Yu lyu5@umd.edu

Alternative Protein Sources for Human Nutrition (Beef vs. Plant-based Protein) Brian Guthrie Brian_Guthrie@cargill.com Michael Morello mjmorello226@gmail.com John Finley jfinle5@lsu.edu

Chemistry of Meat Guoyao Wu g-wu@exchange.tamu.edu Nick Flynn nflynn@wtamu.edu

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

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

Chemistry Behind Consumer Acceptance of Flavor and Health Benefits Bhimu Patil b-patil@tamu.edu

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

Sustainability John Finley jfinle5@lsu.edu Michael Appell michael.appell@usda.gov H.N. Cheng hn.cheng@usda.gov

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

Food Packaging: Materials, 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

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

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

Food-Flavor Dynamics Assessments Via Real-Time Mass Spectrometry Jonathan Beauchamp jonathan.beauchamp@ivv.fraunhofer.de

Withycombe-Charalambous Graduate Student Symposium Kathryn Deibler kdd3@cornell.edu

Micro/Nanomaterials in Cereal Chemistry Min-Jung Kim min-jung.kim@usda.gov Amie Norton Amie.Norton@usda.gov Haijing Lin Haijing.Lin@usda.gov

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Oat Bioactives and Their Health Effects Shengmin Sang ssang@ncat.edu YiFang Chu yifang.chu@pepsico.com

Breath Monitoring for Food Consumption, Drug Intake, Health and Wellbeing Jonathan Beauchamp jonathan.beauchamp@ivv.fraunhofer.de Christina Davis cedavis@ucdavis.edu

General Papers & **General Posters** Youngmok Kim Youngmok.Kim@finlays.net

Undergrad Poster Competition Kathryn Deibler Kdd3@cornell.edu

ATLANTA August, 22-26, 2021

ACS Meeting Theme: Resilience of Chemistry

Chemistry of Aged Beer Nick Flynn nflynn@wtamu.edu;

Impact of Global Disasters on Food Quality, Safety and Security Alyson Mitchell aemitchell@ucdavis.edu Michael Morello mjmorello226@gmail.com Liangli (Lucy) Yu lyu5@umd.edu

Carbohydrate-Based Fat Replacers TBD

Advances in Nanomaterials for Food and Agricultural Applications Bosoon Park Bosoon.Park@USDA.gov Sechin Chang Sechin.Chang@USDA.gov

Nutraceutical Lipids Fereidoon Shahidi fshahidi@gmail.com and fshahidi@mun.ca

New Insights in Gut Microbiota Health-Benefits Coralia Osorio Roa cosorior@unal.edu.co

Feeding the Gut: What Drives a Healthy Gut Guodong Zhang Wei Chen LinShu Liu linshu.liu@ars.usda.gov

Green Polymers & Active Polymers LinShu Liu linshu.liu@ars.usda.gov Riasha Gorshkova Jinwen

Modification of Agricultural Biomass Into Value-Added Products Majher Sarker majher.sarker@usda.gov Helen Ngo helen.ngo@usda.gov Madhav Yadav madhav.yadav@usda.gov

Improving Food for a Changing World Alyson Mitchell aemitchell@ucdavis.edu Akira Murakami, akira@shse.u-hyogo.ac.jp

Advancements in Food and Metabolomics Jessica Cooperstone cooperstone.1@osu.edu Devin Peterson, Peterson.892@osu.edu

General Papers & General Posters Linshu Liu linshu.liu@ars.usda.gov

SAN DIEGO March, 20-24, 2022

ACS Meeting Theme: Evolving Biomolecular Sciences

Advances in the in Development of In-Silico Taste and Extra-Oral Nutrition Receptors Brian Guthrie Brian_Guthrie@cargill.com Antonella Di Pizio a.dipizio.leibniz-lsb@tum.de Soo-Kyung Kim skkim@wag.caltech.edu

Tree Nuts Alyson Mitchell aemitchell@ucdavis.edu

Water Alyson Mitchell, aemitchell@ucdavis.edu Mike Qian Michael.qian@oregonstate.edu

Food Macromolecules: Functionality, Health Benefits, Delivery Systems Wallace Yokoyama wally.yokoyama@ars.usda.gov Fang Zhong fzhong@jiangnan.edu.cn Nitin Nitin nnnitin@ucdavis.edu

Chemistry of Traditional Chinese Medicine Wallace Yokoyama wally.yokoyama@ars.usda.gov Jinlin Guo guo596@163.com Yue Zhang, yue.zhang@unl.edu

The International Chemical Congress of Pacific Basin Societies 2021 – A Creative Vision for the Future
Honolulu Dec 16-21, 2021

https://pacifichem.org
Call for submissions (closes April 11, 2021)

Flavor and Bioactive Compounds in Fermented Foods and Beverages (#156)

1) Flavor/off-flavor characterization and identification, flavor generation during fermentation and storage.
2) Chemistry/biochemistry of bio-active compounds, including identification of bioactive compounds in fermented foods, metabolism of bioactive compounds, and mechanism of fermented foods in preventing disease and improving human health.
3) Analytical methodologies including new developments in sample prep, chromatography, identification, structural elucidation.

Also symposia on -

New Developments in Food Processing (#118)
Food Bioactives, Inflammation and Gut Health (#176)

Symposium co-organizers: Michael C. Qian (michael.qian@oregonstate.edu), Philip Marriott, Zhen-Yu Chen, Chi-kun Wang, Hirotoshi Tamura, Yanping L.Qian, Young-Suk Kim, Mingwei Zhang

Executive Committee Meeting Minutes

Monday, March 23, 2020
via on-line teleconference
Takes place at each ACS National Meeting

Attendance: Alyson Mitchell, Lucy Yu, Xuetong Fan, Hang Ma, Kathleen Luo, Linshu Liu, Keith Cadwallader, Michael Tunick, Michael Morello, Brian Guthrie, Steve Toth, Michael Appell, Kathryn Deibler, Zhichao Zhang, Lauren Jackson, Michael Qian, Youngmok Kim, Xian Wu, Michael Tunick, John Finley, Michael Granvogl, Xiaohua He, Lauren Jackson? Jane Leland?

AGFD Chair Lucy Yu called the meeting to order at 5:14 PM EST

The **minutes** of the previous Executive Committee meeting were approved with no changes and are published in the Spring 2020 Cornucopia.

Lucy Yu summarized the **Special Topics Meeting**. Lucy requested that we change the minimum number of speakers for each half-day session to nine at the San Francisco ACS National Meeting and for future meetings. Each session receives $1,000 ACS allotment. Lucy explained that beginning Fall 2021, ACS will require nine papers per half-day symposium. The spring meeting was cancelled due to the Corona virus pandemic, and many of these papers are being moved to the Fall 2020 meeting so this meeting will be very packed. AGFD has been allocated only four rooms for this meeting. Increasing the number of papers per session will help with programming the fall meeting. Lucy explained that with breaks, symposia organizers will be able to schedule ten 20-minute presentations or nine with a longer keynote address. Michael Appell indicated that the program Chair has the final word on the number of speakers per half-day session. There was a discussion of prorating the $1,000 per session ACS allotment based upon the number of presentations given per session (this was discussed during the Special Topics meeting), however all agreed that from a financial housekeeping perspective this would be difficult to manage. A vote was taken and all agreed to have a

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minimum of nine speakers per half-day session, understanding that there may be circumstances when this is not possible. The Program Chair will communicate directly with the organizers if they have fewer speakers. Youngmok and Lucy will manage this for the fall meeting and session will not be prorated for fewer than nine presentation during the fall meeting.

Lucy Yu gave an update Linshu Liu's proposal to create a new ***Diet and Microbiome Chemistry*** subdivision within AGFD. All agreed that this is a popular topic and that a subdivision would benefit the AGFD. A vote was taken and received a unanimous yes vote. Linshu Liu will move ahead with creating this subdivision.

Xuetong Fan and Mike Morello gave an overview of the new document that was created in a subcommittee titled ***Guidelines for Subdivision Officers of Agricultural and Food Chemistry Division***. This document was created to help new Division Officers understand their role in Division leadership. This document will be added to the AGFD **Procedures Manual** by Michael Tunick and mailed out to the Executive Committee. A second one-page summary of this document will be created by Michael Morello and added to the Division website. This document will focus more on the recruitment of new subdivision members.

Stephen Toth gave the **Treasurer's Report**. Steve indicated that the Division had $33,546 in income (dues and ACS allotment) for the year. Expenses included awards and travel. The Division went from having $620,000 last year to 549,784 this year. Steve indicates that the San Francisco meeting will be a very expensive meeting based upon past meetings expenditures in San Francisco. Steve indicated that San Diego cost $51,269 and was the most expensive meeting to date for the Division. This may have been due to a light turn out at the Orlando Florida meeting. Steve estimates that the San Francisco meeting is estimated to cost ~$50,000. Mike Appell indicated that the Division receives an allotment of $50.00/poster and for us to encourage all meeting attendees to present a poster at the meeting. Kathryn Deibler asked for organizers to remind everyone that posters need to be substantially different than the oral presentations. A budget of $55,000 was set and passed for the San Francisco meeting.

Lucy Yu gave the **Program Report.** The Division had eight symposia and 300 abstracts submitted and accepted for the Philadelphia meeting; which was cancelled due to Covid-19. Most papers will be resubmitted for the San Francisco, Pacifichem or ACS Spring 2021 meetings. Steven Toth indicated that there was very little financial impact to AGFD due to the Spring 2020 meeting cancellation as the Division was able to get a refund on the banquet deposit. The possibility of a cancellation of the fall meeting was discussed in light of the pandemic, and the Division agreed that a contingency plan needed to be developed for this possibility. All agreed that a contingency plan did not need to be developed until May. Alyson Mitchell agreed to start looking into refundable venues early for the San Francisco meeting.

Youngmok Kim gave the **Future Programs Report**. Youngmok indicated that we will have 28 symposia for the Fall San Francisco meeting. Youngmok and Lucy will lead the program. There are currently 21 symposia scheduled for the San Antonio, TX meeting (March 21-25 2021), 12 symposia for the Atlanta, GA meeting (August, 22-26, 2021), and 3 symposia for the San Diego, CA National Meeting (March, 20-24, 2022). Michael Qian reminded everyone that the deadline for submission of abstracts to Pacifichem2020 is April 15, 2020. The Division will have three symposia at this meeting which include: Flavor and Bioactive Compounds in Fermented Foods and Beverages (#156), New Developments in Food Processing (#118), and Food Bioactives, Inflammation and Gut Health (#176).

Lucy Yu gave the **Favor Subdivision Report** for Tony Shao. Gal Kreitman from E. & J. Gallo will be the next secretary. The subdivision is hosting symposium "Chemistry of Wine: Flavor, Quality and Analysis" at the San Francisco Meeting. Tony noted that the subdivision is having to confirm speakers due to travel restriction or travel pre-approval that is required.

Hang Ma gave the **Functional Foods & Natural Products Subdivision Report**. Dr. Xian Wu, Assistant Professor at Miami University, joined the subdivision leadership. The subdivision proposed a symposium "The Third Global Symposium on Chemistry and Biological Effects of Maple Food Products" for the 2021 Spring Meeting in San

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Antonio, TX. Hang Ma and Navindra Seeram will organize. Hang Ma also indicated that he has been in communication with leaders from other ACS divisions including ACS Cannabis Chemistry Subdivision (ACS CANN) to co-organize 'hemp-themed' symposia in the future ACS meetings. They are currently brainstorming ideas and please let him know if you are interested. A symposium on Hemp is still being organized and targeted for 2021 or 2022.

John Finley gave the **Biotechnology/Bioengineering Subdivision Report**. John indicated that the subdivision needs to be rebuilt from the ground up as the current officers are unresponsive. He will have a new slate by the San Francisco Meeting.

Youngmok Kim gave the **Nutrition Subdivision Report**. Dr. Hye-Seon Kim at USDA-ARS has joined the nutritional subdivision as the incoming secretary. The division was going to host "Chemistry and Health Benefits of Fermented Foods and Beverages" this spring but due to the cancellation, it has been moved to Spring 2021. The subdivision will organize a symposium on "Omic Based Natural Product Discovery" fall 2020. Youngmok Kim was originally a co-organizer but due to the role as a program chair, he has removed his name from the symposium. He is still helping the co-organizers.

Xiaohua He gave the **Food Safety Subdivision Report**. The subdivision has a full slate of officers, which include Xiaohua He-USDA-ARS (Chair); Juhong Chen-Cornell University (Chair-Elect); Tony Jin-USDA-ARS (Vice Chair); Reuven Rasooly-USDA-ARS (Secretary); Xiaonan Lu-UBC, Canada (Secretary 2021). One symposium is planned for the San Francisco meeting "Alternatives to Antibiotic Use". There are currently seven confirmed speakers for this symposium. Xiaohua asked if she could give each speaker a registration fee waiver. Lucy indicated that she will receive $1,000 to spend at her discretion. She asked if there is a discount if Chair registers a speaker. Michael Appell indicated that there are no ACS waivers. The one-day registration is paid for by the Division out of the symposiums allocation. Kathryn Deibler indicated that this is supposed to be used for non-chemists only.

John Finley and Michael Appell gave the **Councilors Report**. John indicated that council committees are meeting after this meeting so there was no council meeting to report. Mike Morello indicated that the Committee on Science (ComSci) would like to co-sponsor more cutting edge symposia. Members of ComSci will try and identify the symposia co-sponsor. Mike Morello indicated that if we have any symposium that would qualify he will bring it up at the next ComSci meeting. Lucy Yu indicated that several Agro startups businesses have approached her for potential joint programming and that MPPG is looking for active co-sponsorships. Mike Appell indicated that Spencer award would qualify. Commercialization of pesticides, falls under the theme for San Francisco meeting. Mike Appell and John Finley agreed to get this information into the MPPG organizers.

Mike Appell reported that the **Nominations and Elections Committee** will hold electronic voting for president. John Finley indicated that MPPG voted on a theme of Chemistry of Flavors for the 2024 meeting in NOLA. They are looking for someone to be the thematic Chair. Mike Morello suggested Thomas Hoffman as a candidate. If anyone has any ideas for a candidate please contact John Finley to get more information.

Xeutong Fan gave the **Nominations Report** and indicated that the next Division Chair needs to come from academia. Michael Granvogl was approached. He indicated that he was interested and requests $1500 in travel to each meeting for two years. Alyson Mitchell and John Finley expressed concern that this would set a precedence. Michael Morello indicated that an amount of funding for travel may have been offered in the past and was previous discussed in an AGFD Executive Committee meeting. Michael Appell indicated that ACS offers travel support to members if they serve on ACS committees. Michael Morello indicated that non-councilor support to attend council meetings is $780/meeting. He indicated that the AGFD passed a vote to support non-councilors, who are part of governance, that attend ACS committee meetings at a level of $750 to help off-set travel. Alyson asked to have the minutes from previous AGFD meetings reviewed and the Executive Committee consulted so that a decision would be made regarding travel support for a Division Chair. All agreed.

The division will need to **vote for one councilor and one alternative councilor** as Michael Appell as the Division has

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only three positions in each category. The Division bylaws allow electronic balloting. The deadline for the voting is Michael Morello indicated that the alternative councilor should be willing to go to both meetings a year to attend the November. There was a discussion of the need for alternative councilors to attend both ACS meetings (Spring and Fall) as well as join ACS standing committees to help improve AGFD engagement and representation. Alyson asked that we create a document that outlines the general Division expectations of councilors and alternative councilors. ACS committee meetings. Mike Appell, Mike Morello, and Xuetong Fan and four at large Division members will form a subcommittee to identify nominations for councilors by July 1, 2020.

The **Award Committee Report is** already published the Cornucopia.

Michael Granvogl gave the **Young Scientist Award Report** and indicated that he had four excellent applications. The award was given to Bruno Fedrizzi, Associate Professor, School of Chemical Sciences, University of Auckland, New Zealand. The judges asked that the remaining participants resubmit for next year as they were very qualified.

Kathleen Luo gave the **Student Committee Report**. Kathleen introduced the new student representative Zhichao Zhang. She also indicated that ACS had a Program-in-the-Box and out Division was actually hosting the event. Kathleen and Zhichao organized a student event around the Program-in-a-box and worked on the C-4 advertisement, although it didn't work out due to the Corona virus. Mike Appell suggested putting the Program-in-a-Box information on our Division website.

Lucy gave the **Cornucopia Report** for Carl Frey. In anticipation of a light turnout at the Philadelphia meeting he only had 200 copies of the Spring Cornucopia printed. With the meeting cancelled, Carl will hold on to 150 copies for distribution at the fall meeting. Fifty copies will go to the 2020 CERM/Columbus Section Regional Meeting to serve as advertising for AGFD. Carl thanks everyone that provided content for the spring issue.

The **Hospitality/Public Relations Report** was given by Alyson Mitchell who indicated that the deposit for the Chair's Reception was returned and that there is nothing further to report.

Michael Qian gave the **Membership Report** and indicated that as of Jan. 31, 2020, our total membership has reached to 3,103, close to our February record high. We have 2,065 regular members and ~1,000 Division affiliates. Mike Morello indicated that Division affiliates are important but only regular members count for council membership and that we should consider focusing on growing this section of our membership. Mike Appell suggested giving a complimentary membership with award for Award for the Advancement of Application of Agricultural and Food Chemistry. A student should be a member of AGFD for eligibility of any student award. Eligibility for the Young Scientist award requires membership in the division for 5 years. Mike Appell suggested adding membership questions to the application. Kathryn indicated that ACS membership is a criteria for the student competitions but many apply anyway and she lets them know they need to join.

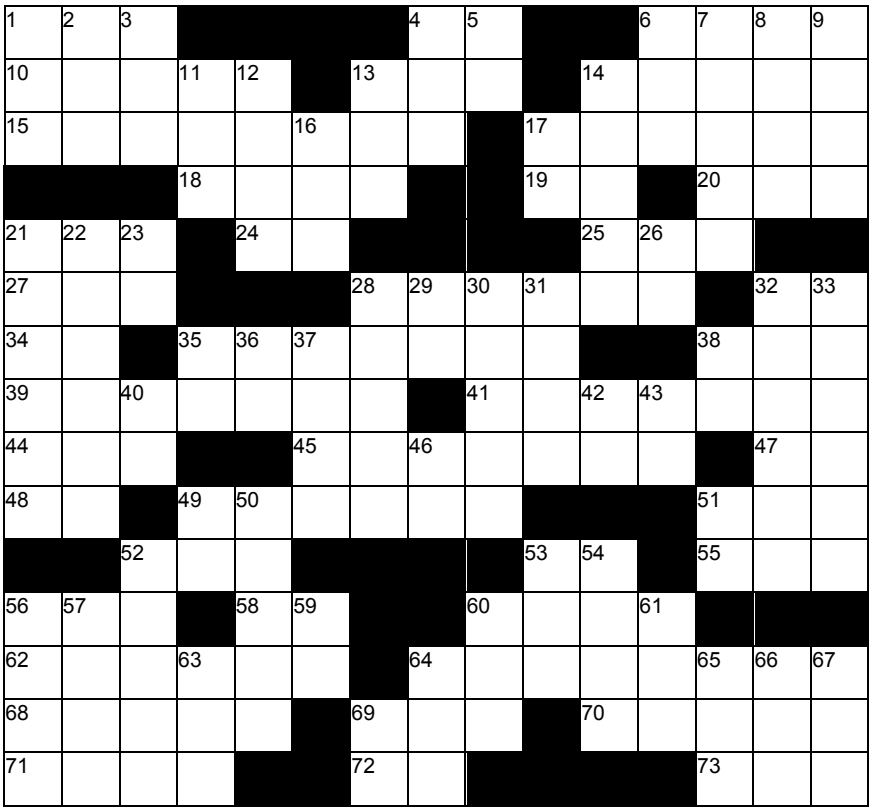
Lucy Yu gave the **Journal Report**. There was a special issue dedicated to Highlights of the San Diego meeting. She indicated that only one Highlights issue of a meeting can be accomplished a year due to the time it takes to publish. She suggested that the Division continue to have one Highlights issue for the fall meeting. Kathryn Deibler suggested publishing books to help generate revenue. Lucy suggested using papers that are rejected from the Fall Highlights issue and use these and other papers from the spring meeting to create symposium series books.

Mike Appell gave the **Communications Report** and indicated that the website was recently updated. There are now a few files on the website that contain lots of great information. Alyson Mitchell asked that everyone send her updates for the newsletter at least one week in advance to the end of the month.

Under **New Business**, Michael Qian gave an update on the Third International Flavor Conference. It was well attended by over 350 people. There were over 100 abstracts (posters and symposium) and a 2-day workshop. The total cost to the division was $11,000. Most sponsorship ranged around $3,000.

The meeting adjourned at 8:25 PM (EST). *Minutes submitted by Alyson Mitchell*

CITY ON THE BAY PLAY



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

ACROSS

1 Six-pack muscles
4 -- & Food Division
6 Newborn horse
10 Shake your -----!
13 Sass
14 SFPD's *Dirty* -----
15 SF bell ringing transport
17 SF's Oracle Park team
18 Headwear for 17 Across
19 Hrs. beyond 40/wk.
20 Santana's --- *Como Va*
21 Printer quality spec.
24 Egyptian sun god
25 Three strikes & you're ---
27 Monopoly foursome
28 Synthetic polymers derived from cellulose
32 *Law & Order* role (abbr)
34 Abuser recovery org.
35 Ripens or ages
38 Uno y uno
39 SF's Transamerica -------
41 Alcatraz
44 Slithery sea creature
45 Arbitrate
47 Fa, sol, la, --
48 Jr's dad
49 ------ *Waldo?*
51 Resident of 41 Across
52 Mulish remark: --- Haw!
53 Light meter element
55 URL suffix: dot ---
56 sports drink: Gator ---
58 H_2O purification method
60 Rice a ---- (The SF treat)
62 SF's ------ State Warriors
64 California mania of 1849
68 Parts in plays & films
69 Peppy beverage: Mtn. ----
70 Brown tone of old photos
71 Element at center of heme
72 Approximately 0.39 in.
73 Secret agent

DOWN

1 As easy as ---
2 It can be a constrictor
3 Weep
4 78% N_2+21% O_2+1% Ar
5 Family Dr.
6 Civilian airspace overseer
7 Here I come, ready ------!
8 Displaying a flamoyant air
9 To undergo cell breakdown
11 Separation on a glass plate
12 365 (or 366) days
13 --- Vegas
14 Make advances towards
16 Tax return expert
17 Monopoly corner square
21 Curtains
22 Bon Jovi: *Livin' on a* ------
23 Exists
26 You and me
28 More impolite
29 Inert gas that fills lightbulbs
30 Abominable snowmen
31 MSDS prescriber
32 Title of many lab heads
33 Requesting
35 A post-bachelor degree
36 Before noon
37 What 55 Across does
38 Hairstyle
40 *Goosebumps* author Stine
42 --, go home!
43 Do, --, mi
46 -- facto or – jure
49 You and me
50 ----- mud in your eye!
51 Head of a military unit (abbr)
52 "You had me at -----."
53 The sun
54 A bread loaf has two
56 ---- culture or ---- business
57 Entryway
59 Switch option
60 Propel a boat with an oar
61 Anger, wrath
63 Scout --- or lion's ---
64 Ruby, emerald, or diamond
65 Delivery via a brown truck
66 Tiny taste
67 Make --- while the sun shines
69 Australian rock band: AC/--

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

At ACS National Meetings you can discuss division activities at the AGFD information table located near the AGFD technical session rooms. Join >3000 AGFD members via the application form (below) or on-line at www.agfoodchem.org or www.acs.org (click on Communities, Technical Divisions, Technical Division List) 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

	APPLICATION FOR AGFD DIVISION MEMBERSHIP (7623P)
Title	
Name	
1st address line	
2nd address line	
City	
State	
Zip code	
Country	
e-mail address	
Phone	
check one	**MEMBERSHIP FEE**
[ ]	I am an ACS member and wish to join AGFD ($10.00)
[ ]	I am not an ACS member and wish to join AGFD ($15.00)
[ ]	I am a full time student and wish to join AGFD ($10.00)
Be cool J O I N A G F D	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

ROSTER OF AGFD OFFICERS & COMMITTEE LEADERSHIP

Chair - Serves 1 year. Preside over Division meetings & appoint committees
Liangli (Lucy) Yu
University of Maryland
College Park MD
301-405-0761 lyu5@umd.edu

Chair-Elect - Serves 1 year. Substitute for the chair as needed
Youngmok Kim, Finlays
North Kingstown RI
youngmok.kim@finlays.net

Vice-Chair - Serves 1 year. Assist Chair-elect. Develop future technical programs.
Linshu Liu USDA-ARS-ERRC
linshu.liu@ars.usda.gov

Secretary - Responsible for Division correspondence and meeting minutes.
Alyson Mitchell
University of California, Davis
aemitchell@ucdavis.edu

Treasurer - Responsible for Division finances.
Stephen Toth
International Flavors & Fragrances R&D
Union Beach NJ stephen.toth@iff.com

Cornucopia Editor - Edit newsletter.
Carl Frey cfreyenterprise@gmail.com

Councilors - Represent Division for 3 years on ACS council.
John Finley (thru '20) jfinle5@lsu.edu
Lauren Jackson (thru '20)
lauren.jackson@fda.hhs.gov
Michael Tunick (thru '21)
mht39@drexel.edu

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

Student Activities - Attract and retain graduate/undergraduate student members.
Kathleen Luo kkluo@ucdavis.edu
Zhichao Zhang yntzhang@ucdavis.edu

Nominations - Develop officer slate. Served by Immediate Past Chair.
Xuetong Fan xuetong.fan@ars.usda.gov

Public Relations - Publicize Division.
Alyson Mitchell aemitchell@ucdavis.edu

Alternate Councilors - Substitute for Councilors. Serves 3 years.
Keith Cadwallader (thru '20)
cadwlldr@uiuc.edu
Kathryn Deibler (thru '21)
kdd3@cornell.edu
Michael Qian (thru '21)
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@gmailcom

Awards - Solicit nominations, oversee awards process.
Chair Michael Morello
mjmorello226@gmail.com
Student Awards Liangli (Lucy) Yu
lyu5@umd.edu
Fellow Awards Fereidoon Shahidi
fshahidi@mun.ca
Student Presentations Kathryn Deibler kdd3@cornell.edu
Young Scientist Awards
Michael Granvogl
Michael.Granvogl@uni.hohenheim.de
Canvassing Stephen Toth
stephen.toth@iff.com

Finance - Monitor Division's finances for 1 year. Led by Immediate Past Chair
Xuetong Fan
xuetong.fan@ars.usda.gov

Hospitality - Organize receptions and banquets. Alyson Mitchell
aemitchell@ucdavis.edu

Membership - Recruit and retain Division members. Michael Qian
michael.qian@oregonstate.edu

Multidisciplinary Program Planning
Help coordinate nat'l mtg programming
John Finley jfinle5@lsu.edu

Sub-divisions Develop symposia.

Flavor
Chair, Tony Shao tony.shao@pepsico.com
Chair-Elect, GK Jayaprakasha
gkjp@tamu.edu
Vice-Chair, Yu Wang yu.wang@ufl.edu
Secretary, Michael Granvogl
michael.granvogl@tum.de

Functional Foods & Nat. Products
Chair, Hang Ma hang_ma@uri.edu
Chair-Elect, Yu Wang yu.wang@ufl.edu
Vice-Chair, Xian Wu
Wux57@miamioh.edu
Secretary, (open)

Food Bioengineering
Chair, John Finley jfinle5@lsu.edu
Chair-Elect, Sam Alcaine
sda23@cornell.edu
Vice-Chair, Christopher Simmons
cwsimmons@ucdavis.edu
Secretary, Tianxi Yang
Tianxi.Yang@fda.hhs.gov

Nutrition
Chair, Youngmok Kim
yongmok.kim@finlays.net
Chair-Elect, Mina Kim
minakim@jbnu.ac.kr
Vice-Chair, Mathias Sucan
Mathias.sucan@gmailcom
Secretary, Hye-Seon Kim,
hyeseon.kim@usda.gov

Food Safety
Chair, Xiaohua He
xiaohua.he@ars.usda.gov
Chair-Elect, Juhong Chen
juhong@cornell.edu
Vice-Chair, Tony Jin Tony.Jin@usda.gov
Secretary (2020), Reuven Rasooly
Reuven.rasooly@usda.gov
Secretary (2021), Xiaonan Lu
Xiaonan.lu@ubc.ca

Diet & Gut Microbiome
Chair, Jason Soares
jason.w.soares.civ@mail.mil
Chair-elect, Guodong Zhang
guodongzhang@umass.edu
Secretaries, Laurel Doherty
Laurel.a.doherty.civ@mail.mil &
Karley Mahalak
Karley.mahalak@usda.gov

AWARD NEWS

Gary R. List, University of Illinois, won the 2020 **Award for the Advancement of Application of Agricultural and Food Chemistry**. This award recognizes his outstanding contributions to pure and applied agricultural and food chemistry, much of it performed while at the USDA-ARS-NCAUR in Peoria, Illinois. The award celebrates his career researching the chemistry and technology of edible fats and oils and oil seed processing. His research served as the basis for the AOCS anisidine method to assess secondary oxidation. Dr. List authored 113 peer reviewed journal articles, 41 book chapters, 8 books and contributed to 175 other articles/proceedings. He serves on the editorial board for J. Am. Oil Chem. Soc., Inform, and the lipid library.

Bruno Fedrizzi, Associate Professor, School of Chemical Sciences, The University of Auckland, New Zealand, received the 2020 AGFD **Young Scientist Award.** This honor recognizes scientists early in their careers for their outstanding scientific contributions to agricultural and food chemistry. His research used novel analytical methods to study wine aroma and unravel yeast metabolism. He mentors 13 PhD students. Eleven PhD and 16 MSc students have matriculated through his program. Dr. Fedrizzi serves as associate editor for both *Food Chemistry* and the *Journal of the Science of Food and Agriculture.*

Brian Guthrie of Cargill Food System Design, Wayzata, Minnesota, **Veronika Somoza** of Leibniz Institute for Food System Biology, Technical University of Munich, Germany and **Yu Wang** of Citrus Research and Education Center, University of Florida, Lake Alfred Island received a 2020 **AGFD Fellow Award**. The AGFD Fellow Award recognizes outstanding scientific contributions to the field of agricultural and food chemistry.

Yunxuan Chen, University of British Columbia won the AGFD **Undergraduate Poster Presentation Award** at the virtual Spring 2020 ACS National Meeting for work on detection and speciation of arcobacter bacteria using raman spectroscopy. **Andrew Reagan**, University California, Davis came in second place for work on HS-SPME-GC/MS method development and validation for volatiles in California blue elderberries and **Ye Chen**, University California Davis received the third place award for work on carbohydrate characterization in traditional Chinese medicine.

Brian Guthrie of Cargill Food System Design, Wayzata, Minnesota, received the 2020 **Award for Distinguished Service to the Division of Agricultural and Food Chemistry**, recognizing their frequent presentations at AGFD symposia. Brain is a former Chair of AGFD.

Xinhe (Michael) Huang at the University of Illinois at Urbana-Champaign received the 2020 **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. He is conducting his dissertation research in the flavor science laboratory of Keith Cadwallader at the University of Illinois.

For the following loyal members of AGFD 2020 marked **50 Years of Membership in AGFD**: **Terry Acree, Pio Angelini, Ronald G Buttery, Ardath Beale Canon, Robert A Flath, Mamoun Mahmoud Hussein, John C Leffingwell, John Hyland Litchfield, Cynthia J Mussinan, Harold Pattee.**

Michael Appell, Research Chemist in Mycotoxin Prevention and Applied Microbiology Research at the USDA Agricultural Research Service received an **ACS Outreach Volunteer of the Year Award** for his outreach work with the Illinois Heartland Section. The outreach efforts included public demonstrations of lab safety and showcased the contributions of senior chemists to communities and the chemistry profession. He has served in leadership positions in the Illinois Heartland Section and for several years has served as AGFD Web-master. In 2103 he received the AGFD Distinguished Service Award and in 2015 he became an AGFD Fellow.

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More AWARD NEWS

The following loyal members of AGFD received their **25 Year AGFD Service Award** in 2020: **Ronald Belanger, Mark Berhow, Bela Buslig, Christoph Cerny, Paul Cook, Laurence Davin, Jean Delfiner, Glenn Dria, Gillian Eggleston, Paul Ford, Tong-Jen Fu, Hylsa Garcia, Thomas Hartman, John Hsu, Chris Johnson, James Kennedy, Susan Kraft, Jawad Malik, John Manthey, Terrence Miesle, Steven Paeschke, Lee Raley, Peter Schieberle, Mathias Sucan, Chris Vlahakis, Mark Walsh, Jolynne Wightman, Peter Winterhalter**

Thomas C. Sparks of Agrilucent LLC and recently retired from Corteva Agriscience, Indianapolis, Indiana, received the 2020 **Sterling B. Hendricks Memorial Lectureship Award** for Outstanding Achievement in Agricultural and Food Chemistry. His research, documented in over 160 publications, spans entomology, insecticide toxicology, discovery research for new insect control agents, insecticide resistance and crop protection. The award is co-sponsored by the AGFD and AGRO divisions.

Jerry King, University of Arkansas, received the 2020 **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, honors his work on 'green' sub- and supercritical fluid chemical separations and processing of natural agricultural products. Dr. King is currently CEO of Genesis Engineering.

The team of **Yusuke Kojima, Chihiro Honda, Izumi Kobayashi, Ryo Katsuta, Satomi Matsumura, Izumi Wagatsuma, Maya Takehisa, Hitoshi Shindo, Masaru Hosaka, Tomoo Nukada, and Masafumi Tokuoka** won the 2020 **Journal of Agricultural and Food Chemistry Research Article of the Year Award** for their publication *Transglycosylation Forms Novel Glycoside Ethyl α-Maltoside and Ethyl α-Isomaltoside in Sake during the Brewing Process by α-Glucosidase A of Aspergillus oryzae* (JAFC 2020, 68, 5, 1419–1426).

Liangli (Lucy) Yu professor at the University of Maryland (College Park) College of Agriculture and Natural Resources received the **IFT 2020 Stephen S. Chang Award for Lipid or Flavor Science** recognizing her research in 3-MCPD ester toxicology and formation mechanisms. Her other research has focused on development and production of specialty edible oils and the by-products of fruit and vegetable seeds, leading to healthy products with nutraceutical benefits. She served for over 15 years as the AGFD Membership Chair and currently Chairs the AGFD Division. She is no newcomer to the AGFD Awards page. In 2006 she received the AGFD Young Scientist Research Award and in 2011 she became an AGFD Fellow.

Keith Cadwallader, Professor at the Department of Food Science and Human Nutrition, University of Illinois, Urbana-Champaign was awarded **2020 IFT Fellow**. He became an AGFD Fellow in 2010. He has served as AGFD Chair and currently serves as an AGFD Alternate Councilor**.**

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

Find information about all AGFD awards at www.agfoodchem.org Scroll down to and click on *AGFD Award Details* to load a PowerPoint file detailing award eligibility and nomination deadlines as well as lists of past awardees**.**

2020 AGFD Awards Committee : AAAFC IFF/AGFD Awards (Mike Morello), AGFD Fellow Awards (Fereidoon Shahidi), AGFD Distinguished Service Awards (Mike Morello), Student Awards – Teranishi Fellowships (Liangli [Lucy] Yu), Graduate & Undergraduate Student Symposia (Kathryn Deibler), Young Scientist Awards (Michael Granvogl), Sterling B. Hendricks Memorial Lectureship (Michael Appell), Spencer Awards (Sarah Leibowitz)

VIRTUAL PROGRAMMING – HOW DOES IT WORK ?

Welcome to the first ACS Virtual National Meeting. Before you can attend the meeting to learn something you first need to learn how to participate in a virtual meeting. ACS has a page titled "**Questions and Answers**" tab on the website (link below) for the upcoming virtual meeting. Read through this information as it will answer most questions that you might have.
https://www.acs.org/content/acs/en/meetings/national-meeting/registration/attendees/2020-virtual-meeting-and-expo-questions-and-answers.html

Presenters can find instructions on how to **record your presentations**. This information is found on the ACS website under the "**Presenters Resources"** tab (link below)
https://www.acs.org/content/acs/en/meetings/national-meeting/registration/presenters.html.

AGFD Technical Program

AGFD - A
General Papers Analytical Chemistry in Food Science
Y. Kim, H. Jang Organizer, H. Jang, Presiding
AGFD 1 . Determination of direct available phosphate and soluble potash in fertilizers by ICP-OES. C. Tu, D. Chand, S. Aylesworth, M. Khosravifard
AGFD 2 . Vitamins and minerals analysis of crinum jagus bulb as a measure of its anti- neurocardiogenic syncope potential. D.L. Abiona, O.O. Onawumi, S.O. Oladoye
AGFD 3 . Simultaneous measurement of saccharin and resveratrol in urine using UHPLC(ESI)-MS/MS. V. Weinborn, A. Lehmkuhler, S. Zyba, M. Haskell, A.E. Mitchell
AGFD 4 . Characterizing headspace volatile profiles of native, drought-tolerant California blue elderberry (Sambucus nigra ssp. cerulea). K. Uhl, A.E. Mitchell
AGFD 5. Simultaneous determination of nitrate and nitrite in spinach and meat by ion chromatography. M. Aggrawal, J. Rohrer
AGFD 6 . Changes in Tennesse whiskey odorants by the Lincoln County process. T. Kerley, J.P. Munafo
AGFD 7 . Investigation of chemicals extracted from smoke and leaves vegetation: Non-targeted characterization comparison using 2D GCxGC TOFMS of solvent extractions.. R.K. Moore, D. Mann
AGFD 8 . Advanced and innovative biosensing technologies for food safety. J. Chen
AGFD 9 . Centrifugal partition chromatography (CPC): Purifications from benchtop to industrial scale. V. Glinski, B. Silverman

AGFD - B
Chemistry, Safety & Sustainability of Nuts & Nut Products
A. E. Mitchell, Organizer, Presiding L. A. Lerno, Presiding
AGFD 10 . Nut polyphenols: from bioaccessability to bioactivity. B.W. Bolling
AGFD 11 . Almond milk protein digestion under normal and elevated gastric pH conditions to mimic acid suppression therapy. G. Bornhorst, K. Rios-Villa, T. Estevez, A. Afsarifad
AGFD 12 . Influence of almond pasteurization on rancidity in almonds. K. Luo, A.E. Mitchell
AGFD 13 . Analysis of almonds from an underwater archaeological site: Non-destructive characterization by headspace GC-MS. L.A. Lerno, E. Jaszczak, K. Lapsley, A.E. Mitchell
AGFD 14 . Utilization of almond processing residual biomass for soil biosolarization. J. Fernandez-Bayo, E. Shea, E. Lopez, A. Parr, J. Milkereit, Y. Achmon, J. Toniato, S. Chen, R. Crowley, J. VanderGheynst, J. Stapleton, A. Hodson, C. Simmons
AGFD 15 . Development of advanced harvest strategies to enhance sustainability of almond Production. P. Brown
AGFD 16 . Tailoring almond protein extraction for improved extractability, functionality, and biological properties. J. Moura Bell
AGFD 17 . Characteristics and chemical composition of monkey cola (Cola millenii K.Schum) seeds, mesocarp and oils: Nutrient and industrial potentials. M.O. Bello, A.O. Ibrahim, T. Edewor, A.F. Ogundola, H. Adedosu, A.O. Akintola, A. Alade
AGFD 18 . Measuring aflatoxins in macadamia nuts: Evaluation of current analytical methods. R. Johnson

AGFD - C
Chemistry of Wine: Flavor, Quality, & Analysis
G. K. Jayaprakasha, Y. Wang, A. L. Waterhouse, Organizers M. Granvogl, C. Shao, Organizers, Presiding
AGFD 19 . Effect of regionality on the sensorial and chemical aging characteristics of Pinot noir grown on the U.S. West Coast. A. Cantu, S. Lafontaine, I. Frias de Locio e Silva, M. Sokolowsky, A. Yeh, P. Lestringant, S. Byer, H. Heymann, R. Runnebaum
AGFD 20 . Rapid quantification of Brettanomyces derived volatiles in wines by parallel extraction onto sorbent sheets coupled to high resolution mass spectrometry. J. Rafson, M. DiGregorio, G.L. Sacks
AGFD 21 . Odorants from aged riesling (Joh. Jos. Prüm). M. Dein, T. Kerley, J.P. Munafo
AGFD 22 . Impact of different amelioration techniques on the chemical composition and sensory characteristics of smoke impacted wines. A. Oberholster, Y. Wen, S. Hay, S. Dominquez Suarez, C. Brenneman, H. Heymann, S. Lafontaine, R. Cauduro Girardello, A. Rumbaugh
AGFD 23 . WITHDRAWN

AGFD 24 . Rational approach to identifying novel wine grape odorant targets in grape germplasm based on expected stability during fermentation and storage. T. Bates, X. Kuang, G.L. Sacks
AGFD 25 . Identification of monoterpene glycoside aglycones and changes in free and bound monoterpene content in Vitis vinifera cv. Riesling juice fermentations across four commercial yeast strains. A. Caffrey, L.A. Lerno, J. Zweigenbaum, S.E. Ebeler

AGFD - D
Advancement in the Detection of Food Chemical & Microbiological Hazards
J. Chen, L. He, X. Lu, A. E. Mitchell, Organizers, presiding
AGFD 26 . Encapsulation of food supplements including curcumin, in sporopollenin microcapsule obtained date palms and released in large intestine. A. Aldalbahi
AGFD 27 . Rapid quantitation of 14 mycotoxins by liquid chromatography-tandem mass spectroscopy. B. Nakhjavan, N. Ahmed, M. Khosravifard
AGFD 28 . Non-targeted screening study of chemical hazard factors in rice based on metabolomics strategy. W. Zheng, M. JIn, B. Gao, L. Yu
AGFD 29 . Geographical origin discrimination of Chinese wheat using ultra-high-performance-liquid-chromatography tandem mass spectrometry (UPLC-MS) coupled with multivariate data analysis. M. JIn, W. Zheng, B. Gao, L. Yu
AGFD 30 . Alternative testing methods for safety assessment associated with liver injury. J. Oh
AGFD 31 . WITHDRAWN
AGFD 32 . Using mass spectrometry to quantify prion polymorphisms and phenotypes in heterozygous sheep and deer.. C.J. Silva, M.L. Erickson-Beltran, C. Duque Velásquez, J.M. Aiken, D. McKenzie, I. Martín-Burriel, J.J. Badiola, J.R. Requena, B. Marín, R. Bolea
AGFD 33 . Rapid, portable detection of amatoxins (amanitins) by lateral flow immunoassay: Applications using mushrooms and urine samples. C. Bever, C. Adams, R. Hnasko, J. Kae, R. Poppenga, M. Filigenzi, K.D. Swanson, E. Hamelin, L. Cheng, L. Stanker

AGFD - E
General Papers Chemistry for Humans
Y. Kim, H, Kim Organizer H. Kim, Presiding
AGFD 34 . Bioactive compounds from porphyra tenera, a popular edible seaweed, with potential anti-inflammatory and anti-colon cancer activities. L. Yi, Y. Han, Q. Wang, H. Xiao
AGFD 35 . Cottonseed-derived compounds regulate anti- and proinflammatory gene expression in mouse cells. H. Cao, K. Sethumadhavan
AGFD 36 . Retinoic acid signaling pathways in development and diseases. H. Laxminarayan
AGFD 37 . MiR-27a-5p regulates mitochondrial dysfunction and intrinsic apoptosis induced by acrylamide via targeting Btf3. L. Zhang, L. Yang, L. Dong, F. Chen
AGFD 38 . Sustainability indicators for selected greenhouse production facilities in North America. J. Thissen, P. Davidson
AGFD 39 . Changes in dietary patterns and associated human behaviors in southwestern US municipal wastewater during the COVID-19 global pandemic. D.A. Bowes, E.M. Driver, R.U. Halden
AGFD 40 . Human bitter taste sensing receptor T2R50 mediates the anti-inflammatory effect of trans-resveratrol in human gingival cells in culture. J. Tiroch, S. Sterneder, B. Lieder, A. Holik, J.P. Ley, V. Somoza
AGFD 41 . Viability of Lactobacillus rhamnosus GG microencapsulated in alginate/chitosan hydrogel particles during storage and simulated gastrointestinal digestion: Role of chitosan molecular weight. X. Qi, J. Rao

AGFD - F
Spencer Award: Symposium in honor of Dr. Jerry King
G. E. Clapp, S. J. Leibowitz, Organizers, Presiding
AGFD 42 . Spencer Award Address: A multidisciplinary journey through agricultural and food chemistry. J.W. King
AGFD 43 . Government/Industry teamwork to expand the uses of supercritical fluids. R. Schlake
AGFD 44 . Do berry volatiles play a role in health promotion?. L. Howard, S. Lee, C. Brownmiller
AGFD 45 . Extraction of oilseeds with supercritical carbon dioxide. Effects on oil and meal properties. G.R. List
AGFD 46 . Application of solubility concept in bioprocessingiIndustries. K. Srinivas
AGFD 47 . CBD extraction and capstone design. M.V. Jamieson
AGFD 48 . Study of operating conditions for supercritical fluid extraction equipment at industrial scale to obtain an enriched-CBD extract from Colombian cannabis. A.C. Gallo Molina, A. García
AGFD 49 . Topological effects on separation of alkane isomers in metal-organic frameworks. S. Bobbitt, A.S. Rosen, R. Snurr

AGFD - G
Chemistry of Wine: Flavor, Quality, & Analysis
M. Granvogl, G. K. Jayaprakasha, Y. Wang, Organizers
C. Shao, A. L. Waterhouse, Organizers, Presiding
AGFD 50 . Quantification of active compounds in wine and deciphering their biosynthesis: Contribution of organic chemistry to the field. F. Cavelier, A. Roland, R. Schneider
AGFD 51 . Can wine oxidizability be measured?. A.L. Waterhouse, T. Nguyen, Y. Miao
AGFD 52 . Characterizing red wine astringency by chemistry, sensory and tribology.. A.A. Watrelot, T. Kuhl, G. Sivakumar, D. White, S. Sundararajan
AGFD 53 . Redox cycling of iron: Effects of chemical composition on reaction rates with phenols and oxygen in model wine. T. Nguyen, A.L. Waterhouse
AGFD 54 . Wine tanins : Analysis and implications on quality and biological aspects. C. Miramont, A. Vignault, A. Jouin, Z. Rasines Perea, K. Chira, M. Jourdes, P. Teissedre
AGFD 55 . Impact of anthocyanins on grape skin tannin during maceration. J.R. Campbell, F. Grosnickel, J.A. Kennedy, A.L. Waterhouse
AGFD 56 . WITHDRAWN

AGFD - H
Withycombe-Charalambous Graduate Student Symposium
K. Deibler, Organizer, presiding
AGFD 57 . Alkynyl silver modified chitosan as a novel antimicrobial coating material for food packages. L. Mei, Q. Wang
AGFD 58 . Effects of phytochemical composition on anti-inflammatory and antioxidant activities in cranberry fruit (Vaccinium macrocarpon) from different regions of the United States. L. Xue, C. Liu, H. Ma, N.P. Seeram, C.C. Neto
AGFD 59. Chemical compositions of selected cold-pressed seed flour extracts and their health beneficial properties. U.E. Choe, Y. Li, L. Yu, B. Gao, T.T. Wang, J. Sun, P. Chen, L. Yu
AGFD 60 . Mechanistic study of anti-obesity effect of polymethoxyflavones through their bioavailability,

biotransformation and interaction with gut microbiota in vivo. M. ZHANG, C. Ho, Q. Huang
AGFD 61 . Development of microfluidic “lab-on-a-chip” device and internet-of-things technique to rapidly detect antimicrobial-resistant pathogens in foods. L. Ma, X. Lu, K. Chou
AGFD 62 . Fatty acid ester of cellulose nanocrystals attached with polyethylene glycol for stabilization and targeted delivery of beta-carotene oil-in-water emulsion.. A.S. Patel
Contemporary Use of Fumigants
Sponsored by AGRO, Cosponsored by AGFD
Latest Technology for Agriculture and Agrochemistry
Sponsored by AGRO, Cosponsored by AGFD and ANYL

AGFD - I
General Posters
Y. Kim, Organizer
AGFD 63 . Carbohydrate characterization in traditional Chinese medicine using rapid high-throughout mass spectrometry-based methods. Y. Chen, J.J. Castillo, E. Nandita, G. Couture, C.B. Lebrilla
AGFD 64 . Detection and speciation of arcobacter bacteria using Raman spectroscopy. Y. Chen
AGFD 65 . HS-SPME-GC/MS method development and validation for volatiles in California blue elderberries (Sambucus nigra ssp. cerulea). A. Reagan, A.E. Mitchell
AGFD 66 . WITHDRAWN
AGFD 67 . Viticultural performance of four Vitis vinifera L. cv. Petite Sirah clones, and determination of their respective wine characteristics. R. Cauduro Girardello, A. Walker, H. Heymann, L. Chacon Rodriguez, A. Oberholster
AGFD 68 . 13C-Labeled Brettanomyces (barley) feedstocks for chemical characterization of rangeland smoke effects on wine quality. D.C. Cerrato, M. Penner, E. Tomasino
AGFD 69 . Determination of phytic acid in beans and wild rice using tap water extraction and ion chromatography. T.T. Christison
AGFD 70 . Rheological study of emulsions ofsSome acacia gums. R.M. Daoub, M. Misran, E.A. Hassan, M.E. Osman
AGFD 71 . Identification of aroma-active compounds in pea proteins. Y. Liu, M. Drake
AGFD 72 . Efficient analytical methods to identify lipid oxidation in dairy products. C.M. Reusz, D.C. Cadwallader, M. Drake
AGFD 73 . Impact of plastic package and storage on off-flavors in fluid milk and cream. D.C. Cadwallader, C.M. Reusz, M. Drake
AGFD 74 . Sensory properties and consumer acceptance of mushroom-egg white blends. X. Du, A. Muniz, J. Sissons, M. Shanks
AGFD 75 . Huanglongbing (HLB) disease’s impact on pectin quality during grapefruit maturation. K. Ferguson, R.G. Cameron, R. Ferrarezi, J. Bai, M. Cruz
AGFD 76 . Comparative analysis of changes to the human gut microbiota community that occur in response to pectins with variable degrees of methoxylation. J. Firrman, L. Liu, R. Gadaingan
AGFD 77 . Effect of cold atmospheric plasma on nutraceutical content of broccoli sprouts and microgreens
. A. Gilbert, R.V. Tikekar
AGFD 78 . Mitigation effects of high methoxyl pectin on acrylamide formation in the Maillard model systems. S. Guoyu, Y. Liu, P. Wang, Y. Zhu, X. Hu, F. Chen
AGFD 79 . Phytochemical composition and bioactivity of clove (Syzygium aromaticum) oil and post-distillation biomass extract. I.M. Gutierrez, H. Hopfer, J. Lambert
AGFD 80 . Correlation between the intercellular antioxidant activities and chemical structure changes of decapeptide IVTNWDDMEK-Ribose Maillard reaction conjugates. J. Han, Q. Wang, H. Wu, B. Zhu, H. Xiao
AGFD 81 . Novel development of an amperometric biosensor for serum cholesterol level determination. Y. Lo, G. Ren, M. Hsiao, H. Honda
AGFD 82 . Residues and dietary risk assessments of 2,4-D isooctyl ester, metribuzin, acetochlor and 2-ethyl-6-methyl aniline in corn or soybean fields. x. Zheng, J. Hu
AGFD 83 . Novel sensor array for intelligent analysis and differentiation of pesticides based on the inhibition of multiple enzymes. H. Huang, J. Li, D. Song, S. Yan
AGFD 84 . Effect of metal ions on stability of vitamin C determined by HPLC. J. Huang, F. Chen
AGFD 85 . Relationship between functional group evolution and copper adsorption of lignocellulose and non-lignocellulose derived biochars under different temperature. X. Jian, Y. Feng, X. Chen, Q. Chen
AGFD 86 . Multi-analytical method of pesticides from meat using LC/MSMS. H. Jo, K. Hwang, K. Jeong, H. Kim, T. Lee, J. Sun, J. Moon
AGFD 87 . Investigating and comparing arabinoxylan structures in cool-season pasture grasses from central Kentucky. G. Joyce, H. Gaul, R. Schendel
AGFD 88 . Black raspberry phytochemicals and anti-inflammatory effect in vitro. L. Lavefve, L. Howard, C. Brownmiller, S. Lee
AGFD 89 . Dietary exposure assessment for volatile N-nitrosamines from processed meat products for the U.S. population. H.S. Lee
AGFD 90 . Analysis of α-dicarbonyl compounds and 4-methylimidazole in coffee with various roasting and brewing conditions. K.G. Lee, S. Hyung, S. Kim
AGFD 91 . Volatile compounds, antioxidant, anti-wrinkle and skin whitening effect of various beans extracts. K.G. Lee, E. Han, H. Kim, B. Yoo
AGFD 92 . WITHDRAWN
AGFD 93 . Methyl anthranilate: A novel quorum sensing inhibitor and anti-biofilm agent against Aeromonas sobria. T. Li, X. Sun, H. Chen, B. He, Y. Mei, D. Wang, J. Li
AGFD 94 . Improving pea protein functional properties through acylation and guar gum conjugation. Y. Shen, Y. Li
AGFD 95 . Transient colonization of exogenous Lactobacillus rhamnosus GG (LGG) in the human intestine and its effect on microbial ecosystem, an in vitro study. L. Liu, J. Firrman, K. Mahalak, C. Tanes, S. Daniel, K. Bittinger
AGFD 96 . Inkjet-printed colorimetric gradient indicators for monitoring fish freshness. X. Luo, L. Lim
AGFD 97 . Analysis of the ability of capsaicin to modulate the human gut microbiota in vitro.. K. Mahalak, J. Bobokalonov, J. Firrman, L. Liu
AGFD 98 . Comparison of sour and sweet whey for the biotechnological production of aroma compounds using Galactomyces geotrichum mold. M.A. Majcher, K. Szudera-Konczal, K. Myszka, P. Kubiak, H. Jelen
AGFD 99 . Efficiency of seeds' germination in pre-sowing irradiation by UV- light of different spectral composition. M. Marenych, T. Sakhno, A. Semenov, N. Barashkov
AGFD 100 . Identification of vitamin K binding protein by magnetic beads labeled derivative to search a novel activity. K. Masaharu, F. Ayako, M. Kamao, Y. Suhara, H. Yoshihisa
AGFD 101 . Cocoa mucilage as raw material for the production of cyclodextrins. M.F. Mercado, J.R. Pinzon
AGFD 102 . Quantitation of selected tastants from mushroom hydrolysates. A. Moore, J.P. Munafo

AGFD 103. Anti-inflammatory properties of blackberry phenolic and volatile compounds. P. Morin, J.R. Tipton, L. Howard, C. Brownmiller, S. Lee
AGFD 104 . Effect of steam roasting on bioactive compounds in cocoa beans. S. Navare, J. Lambert, R. Anantheswaran
AGFD 105 . Evaluation of the antioxidant activities of Celosia trigyna (LINN) extracts. O. Ogunjinmi
AGFD 106 . Mechanism-based toxicity screening of natural compounds based on high-throughput approaches. S. Park, M. Choi, S. Kim, H. Han, J. Ahn, J. Ahn, J. Oh
AGFD 107 . WITHDRAWN
AGFD 108 . Characterization and classification of biochars with NIR hyperspectral imaging. B. Park, K. Ro, J.C. Sanchez-Hernandez, A. Szogi, S. Chang
AGFD 109 . Emodin, a constituent of polygoni multiflori radix, induces endoplasmic reticulum stress, Aatophagy, and apoptosis in HepG2 cells. S. Park, G. Cho, H. Choi, J. Lim, H. Chun
AGFD 110 . Guaraná peel is rich in carotenoids with antioxidant potential. L.S. Pinho, M. Thomazini, C.d. Rodrigues, J. Cooperstone, O. Campanella, C.S. Favaro-Trindade
AGFD 111 . Chemical synthesis of azetidinone, naturally occurring β-lactam antibiotics. D. Ren, Y. Lo, G. Ren, E.J. Parish, H. Honda
AGFD 112 . Eco-friendly strategy for mitigating microplastic pollution in agricultural soils using earthworms. K. Ro, J.C. Sanchez-Hernandez
AGFD 113 . Untapped potential of earthworms in plastic pollution of agricultural soils. J. Sanchez-Hernandez
AGFD 114 . Transcriptional regulatory mechanism of MK-4 converting enzyme UBIAD1 by PARP-1
. S. Sho, M. Imai, M. Kamao, Y. Suhara, H. Yoshihisa
AGFD 115 . Total phenolic contents and free radical scavenging capacity of sunflower seed flour. B. Santoso, H. Childs, U.E. Choe, L. Yu
AGFD 116 . Evaluation of the effects of different oak chips on dark and light beer. D. Sarkar, K. Vander, D. Steele
AGFD 117 . Evaluation of color-related phenolics, volatile composition, and sensory profile using oak chips in low-alcoholic beer. D. Sarkar, K. Vander, D. Steele
AGFD 118 . Infusion of jabuticaba peel extract in probiotic cells by passive and vacuum mechanisms. M.P. Silva, R. Rai, C.S. Favaro-Trindade, N. Nitin
AGFD 119 . Cranberry product composition and its effect on the growth of gut bacteria. J.R. Turbitt, B. Benson, M. Silby, V. Bucci, C.C. Neto
AGFD 120 . Identifying key odor compounds in bourbon using solvent-free aroma dilution analysis and a novel software for interpreting GC-O data. L. Vernarelli, J.R. Stuff, J. Whitecavage
AGFD 121 . Investigation of the absorption mechanism of smoke taint markers on to winegrapes. Y. Wen, C.M. Plaza, A. Oberholster, A.L. Waterhouse
AGFD 122 . Inhibitory effects of titanium dioxide nanoparticles on beneficial gut bacteria. Y. Wu, H. Du, D. McClements, H. Xiao
AGFD 123 . Total synthesis of aaptamine and their 3 alkylamino derivatives and antibacterial activity. F. Yang
AGFD 124 . Role of vitamin K in the brain - Measurement of vitamin K levels in human brain and the mechanism of vitamin K induced neuronal differentiation -. H. Yoshihisa, Y. Takagi, F. Ayako, K. Maya, T. Okano, Y. Suhara
AGFD 125 . Chemical composition of tetraploid Gynostemma pentaphyllum gypenosides and their suppression on inflammatory response by NFκB/MAPKs/AP1 signaling pathways. Y. Zhang, B. Wang, H. Chen, L. Yu

AGFD - J
General Papers Modern Food Chemistry
Y. Kim, H. Kim, Organizer H. Kim, Presiding
AGFD 126 . Optimization of enzymatic synthesis of EGC (epigallocatechin) mono-esters and their antioxidant activity as affected by the acyl chain length. H. Peng, F. Shahidi
AGFD 127 . Antiplasticization behavior of biobased additives on the structure, properties, and wet spinning of cellulose acetate fibers. M. Biswas, B. Bush, E. Ford
AGFD 128 . Interior versus exterior silver nanoparticle-incorporated cotton fiber: comparison of silver release behaviors during washing. S. Nam, S.E. Chavez, M.B. Hillyer, B. Condon, L. Sun
AGFD 129 . Chemometric characterization of aldehydes in oxidized oils: formation, transfer, and biological impact. C. Chen, J. Yuan, Q. Mao
AGFD 130 . Relationship between the antioxidant efficiencies of catechins and their concentrations in the interfacial region of corn oil-in-water emulsions. L. Cheng, Q. Huang
AGFD 131 . Transfer of pesticide residue during tea brewing: Understanding the effects of pesticide's physico-chemical parameters on its transfer behavior. X. Wang, Z. Chen, J. Gan
AGFD 132 . WITHDRAWN
AGFD 133 . Structural and functional characterization of Stx2k, a new subtype of Shiga toxin 2. A. Hughes, X. He, Y. Zhang
AGFD 134 . Determination of sodium, potassium, and calcium in dietary vitamins and sauerkraut by ion chromatography. M. Aggrawal, J. Rohrer

AGFD - K
Food Allergens: Discovery, Characterization, Detection, & Mitigation
Y. Zhang, Organizer L. Jackson, Organizer, Presiding
Y. Zhang, Presiding
AGFD 135 . Isolation and characterization of novel allergens from Sechuan pepper. T. Jin
AGFD 136 . Molecular characterization of the cross-reactivity between the N-terminal leader sequences of Ara h 1 and Jug r 2. G. Mueller, J. Nesbit, A. Foo, E.F. Derose, B. Hurlburt, H. Cheng, S. Maleki
AGFD 137 . Rethinking food allergen detection: Distinguishing cross-reactivity from true target signal in botanicals used in dietary supplements and spices with the xMAP food allergen detection assay. K. Ivens, E.A. Garber
AGFD 138 . Cross-reactivity and in vitro pepsin digestibility of allergenic oilseed legumins. S. Gupta, C. Liu, Q. Rao, S.K. Sathe
AGFD 139 . Oleosin: A novel major allergen in buckwheat seed. F. Chen
AGFD 140 . Crystal structure analysis and conformational epitope mutation of triosephosphate isomerase, a mud crab allergen. F. Xia, M. Li, Y. Yang, G. Liu
AGFD 141 . Extracellular Ca2+ is a stimulus signal aggravating the IgE-induced allergy reaction in mast cell through GPRC6A, a novel family C G-protein-coupled receptor. S. Han, H. Che, S. Jiang
AGFD 142 . Droplet digital PCR for detection of food allergens: Development and evaluation of a method for peanut. A. Eischeid
AGFD 143 . Assessing the efficacy of cleaning programs to prevent allergen cross-contact. L. Jackson

AGFD - L

Chemistry of Wine: Flavor, Quality, & Analysis

G. K. Jayaprakasha, C. Shao, Y. Wang, Organizers
M. Granvogl, A. L. Waterhouse, Organizers, Presiding
AGFD 144 . Effects of grapevine red blotch virus (GRBV) on grape development and resulting wine composition. A. Rumbaugh, B. Durbin-Johnson, M. Britton, R. Cauduro Girardello, M. Sudarshana, A. Oberholster
AGFD 145 . Effect of sun exposure on the evolution and distribution of anthocyanins in interspecific red hybrid winegrapes. C. Dadmun, A. Mansfield, H. Walter-Peterson
AGFD 146 . Effect of grapevine red blotch virus (GRBV) on cell wall composition and its impact on phenolic extractability. C. Medina Plaza, A. Rumbaugh, M. Sudarshana, A. Oberholster
AGFD 147 . Investigation of atypical aromas in Cabernet Sauvignon wines caused by vine frost exposure. S. Frost, D. Fox, T.S. Collins, M. Keller, J.F. Harbertson
AGFD 148 . Phenolics, volatile aroma and polysaccharide of Pinot noir wine in response toaAbscisic acid treatment of red blotch virus-infected grapevine. M. Brau, A. Alcazar, L. Huang, Y.L. Qian, P. Skinkis, J. Osborne, M.C. Qian
AGFD 149 . Investigation of the impact of pinot noir maturity on grape and wine composition and wine style. Y. Tseng, E. Sherman, C. Brenneman, H. Heymann, C. Grose, A. Oberholster
AGFD 150 . When nutritional quality meets taste. S. Sterneder, K. Liszt, C. Dugulin, R. Eder, J.P. Ley, V. Somoza

AGFD - M

Chemistry of Chocolate: From Bench to Market

S. E. Ebeler, B. D. Guthrie, H. Hopfer, J. Lambert, Organizers, Presiding
AGFD 151 . Food of the gods: Chemistry of chocolate from cacao bean to chocolate bar. H. Hopfer, S.E. Ebeler
AGFD 152 . WITHDRAWN
AGFD 153 . Impact of cultivar, harvest, and processing on plant metabolites vital to flavor in Theobroma caca. A.L. Brown, A.M. Wiedemer, G.R. Ziegler, H. Hopfer
AGFD 154 . Analysis of chocolate using Raman spectroscopy. S. Shidler, T. Prusnick, Y. Wong, R.W. Bormett
AGFD 155 . WITHDRAWN
AGFD 156 . Linking cocoa polyphenol composition to chocolate quality with average-mass-spectra fingerprints. N. Sommerer, N. Fayeulle, E. Meudec, A. Verbaere, J. Boulet, C. Hue, R. Boulanger, V. Cheynier

Everything You Ever Wanted to Know about Glyphosate: A Transparent Look at the Science

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Biostimulants in Agriculture: Chemistry and Regulatory Aspects

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AGFD - N

Processing & Storage Induced Food Toxicants (3-MCPD Esters, 2-MCPD Esters, Trans Fat, Acrylamide, Heterocyclic Amines, Polycyclic Aromatic Hydrocarbons et al)

C. Fang, L. Yu, Organizers
M. Granvogl, S. MacMahon, Organizers, Presiding
AGFD 157 . Analysis and updated occurrence of MCPD and glycidyl esters in infant formulas and processed foods. J. Beekman, M. Granvogl, S. MacMahon
AGFD 158 . Toxic effects and comparative proteomic analysis of 3-MCPD 1-monoleate and 3-MCPD 1-monostearate in a 90-day semi-long term toxicity study using Sprague–Dawley rat. B. Gao, P. Yang, y. zhang, L. Yu
AGFD 159 . Are process-induced chemical changes responsible for the atherosclerotic effects of saturated fats?. J.T. Brenna
AGFD 160 . Determination of acrylamide in vegetable chips. M. Granvogl, E. Gottstein, C. Oellig
AGFD 161 . Oil oxidation and the formation of acrylamide, 5-hydroxymethylfurfural and 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine in model reaction systems during frying. F. Chen
AGFD 162 . WITHDRAWN
AGFD 163 . WITHDRAWN
AGFD 164 . Simultaneous analysis method of mycotoxins using pre-treatment Injection mode with LC-MSMS. H. Jo, K. Hwang, J. Moon

AGFD - O

Food Allergens: Discovery, Characterization, Detection, & Mitigation

Y. Zhang, Organizer
L. Jackson, Organizer, Presiding
Y. Zhang, Presiding
AGFD 165 . Identification and cross-reactivity analysis of sarcoplasmic-calcium-binding protein: A novel allergen in Crassostrea angulata. T. Han, M. Liu, F. Xia, G. Liu
AGFD 166 . Epitope mapping pathogenesis class-10 panallergens. B. Hurlburt
AGFD 167 . Immunochemical methods for detecting fermented-hydrolyzed gluten in food: Challenges and recent progress. R. Panda, E.A. Garber
AGFD 168 . Allergen cross-contact due to the use of shared frying oil. L. Jackson
AGFD 169 . Allergenic amylase/trypsin-inhibitors in wheat cultivars from 1890 to 2010. S. Geisslitz, D. Pronin, K. Scherf
AGFD 170 . Biochemical characterization of sesame allergen Ses i 1. L. Zhu, T.c. Jin
AGFD 171 . Plant antimicrobial proteins and food allergens. Y. Zhang, H. Che
AGFD 172 . Molecular approaches for the detection, quantification and standardization of specific food allergen proteins,. M. Chapman
AGFD 173 . Thermal processing alters allergens. S. Maleki

AGFD - P

Omics-Based Natural Product Discovery

H. Chun, K. G. Lee, Organizers, Presiding H. Kim, Presiding
AGFD 174 . Understanding the complexity of interactions between phytochemicals and the network of mechanisms based on systems biology. J. Kim, O. Kwon
AGFD 175 . Set-based gene-environment interaction test using the hierarchical structural component model. S. Choi, T. Park
AGFD 176 . Two stage clustering analysis to detect pattern change of biomarker expression between experimental conditions. I. Huh, S. Choi, Y. Kim, S. Park, O. Kwon, T. Park
AGFD 177 . Pathway-based integration of metabolome and microbiome data. T. Park
AGFD 178 . Landscape of serum and urine microbiota based on extracellular vesicles and their implication to human health. S. Park, K. Kim, S. Lee, S. Won
AGFD 179 . Comparative genomic, transcriptomic and functional analyses provide new insights into diversity, distribution and evolution of natural products produced by the agriculturally important fungal genus Fusarium. H. Kim, S.P. McCormick, M. Busman, G. Hao, J.M. Lohmar, M.M. Vaughan, D.W. Brown, R.H. Proctor

AGFD 180 . Use of high content cellular imaging system to compare the cytotoxic effects of differently processed xanthii fructus in chang liver cells. H. Choi, H. Chun
AGFD 181 . Sulforaphene inhibited the invasion of breast cancer cells and the adipogenesis of 3T3-L1 adipocytes through tissue-specific regulation of the hedgehog signaling pathway. H. Lee
AGFD 182 . Multiple clustering methods and databases-based microbiome association test. K. Kim, S. Park, S. Won

AGFD - Q
Chemistry of Chocolate: From Bench to Market
S. E. Ebeler, B. D. Guthrie, H. Hopfer, J. Lambert, Organizers, Presiding
AGFD 183 . WITHDRAWN
AGFD 184 . Processing cocoa with water – new insights into aroma formation. L. Ullrich, S. Neiens, T. Hühn, M. Steinhaus, I. Chetschik
AGFD 185 . Roasting-induced changes in cocoa beans with respect to the mood pyramid. V. Lemarcq
AGFD 186 . Mean degree of flavanol polymerization is a superior predictor of α-glucosidase inhibitory activity compared to flavanol or polyphenol concentrations in cocoas produced by controlled fermentation and roasting. K. Racine, B.D. Wiersema, L.E. Griffin, L.A. Essenmacher, A. Lee, H. Hopfer, J. Lambert, A.C. Stewart, A. Neilson
AGFD 187 . Effect of genetics and post-harvest processing on the in vitro anti-inflammatory effects of cocoa. J. Lambert, T.N. Seymore, K. Racine, A.L. Brown, G.R. Ziegler, A. Neilson, H. Hopfer
AGFD 188 . Enhanced bioactivity of milk chocolate using extracts from food processing waste materials. L.L. Oehrl, B.J. Hess, C.M. Eickholt
AGFD 189 . Future challenges for chocolate. M.H. Tunick

Everything You Ever Wanted to Know about Glyphosate: A Transparent Look at the Science
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Biostimulants in Agriculture: Chemistry and Regulatory Aspects
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AGFD - R
General Papers Chemistry in Food Processing
Y. Kim, K. G. Lee, Organizer K. G. Lee, Presiding
AGFD 190 . Tempeh fermentation enhanced health-promoting potential of soybean by increasing bioavailability and efficacy of soy phenolics. A.D. Ahnan, H. Xiao
AGFD 191 . Microencapsulation applications for value added textiles. S. Chang, B. Condon, J. Smith
AGFD 192 . Laccase mimicking nanozymes and their applications in food analysis and food processing
. h. huang, L. Lei, J. Bai, M. Li
AGFD 193 . Natural vanillin production from Ischnoderma resinosum fermentations. P. Wickramasinghe, J.P. Munafo
AGFD 194 . Peptide production for food allergy studies. Y. Zhang, A. Vilches, C. Li
AGFD 195 . Effect of baking on phenolic acids in bread and muffin made from blends of hairless canary seed, wheat and corn. E.M. Abdelaal, I. Ralablski, M. Hernandez
AGFD 196 . Synthesis and characterization of hydrophobic polyurethane-co-perfluoropolyether coatings to reduce biofouling. A. Rudlong, J.M. Goddard
AGFD 197 . Compositional and bioactivity characterization of the emulsion fraction recovered during bioprocessing of fish by-products. S. Cheri Kunnumal Rajendran, A. Doucette, B. Mason
AGFD 198 . WITHDRAWN

AGFD - S
Improving Safety & Quality of Fresh Produce
V. Wu, Organizer X. Fan, C. Kunsong, Organizers, Presiding
V. Wu, Presiding
AGFD 199 . Molecular and functional diversity of organelle RNA editing mediated by RNA recognition motif-containing protein ORRM4 in tomato. Y. Yang, X. Liu, K. Wang, J. Li, G. Zhu, S. Ren, Z. Deng, B. Zhu, D. Fu, G. Qu, H. Zhu, Y. Luo
AGFD 200 . Metabolic adaptation of apple and pear peel during transitions in the postharvest environment. D. Rudell
AGFD 201 . A tomato lateral organ boundaries transcription factor, SlLOB1 specifically regulates the cell wall and softening component of ripening. Y. Shi
AGFD 202 . Capitalizing on plant genetics to enhance fresh produce safety. M. Melotto
AGFD 203 . BrNAC092 is involved in ABA-promoted leaf senescence in Chinese flowering cabbage by activating the ABA biosynthesis and GA catabolism. Z. Fan, W. Shan, J. Kuang, W. Lu, J. Chen
AGFD 204 . Citrus huanglongbing (HLB) and secondary infection by the fungus Lasiodiplodia theobromae (Diplodia) impact on citrus crop and juice quality. W. Zhao, E. Baldwin, J. Bai, A. Plotto, G. McCollum, J. Manthey, M. Irey
AGFD 205 . Effects of postharvest conditions on fruit flavor quality. B. Zhang, C. Kunsong
AGFD 206 . New postharvest technologies to control decay and retain fruit quality of fresh fruits. C. Xiao, S. Saito, D. obenland

AGFD - T
Nutrition & Gut Microbiome
Nutrition for Stress and Performance
L. A. Doherty, J. HWANG, M. Kobori, L. Liu, Organizers
J. W. Soares, Organizer, Presiding K. Mahalak, Presiding
AGFD 207 . Microbiota responses to dietary fiber structures are both highly individual and generalizable. S. Lindemann
AGFD 208 . Natural anthocyanins from berry fruits prevent diabetes through regulating gut microbiota. W. Chen, H. Su, T. Bao
AGFD 209 . Codium fragile extract increases muscle weight and exercise endurance by upregulating protein synthesis and ERRγ in adult mice. Y. Jang, J. Ahn, J. Ahn, T. Ha, C. Jung, H. Seo, M. Kim
AGFD 210 . Exploration of healthy and stressed gut microbiota metabolism via in vitro fermentation. L.A. Doherty, I. Pantoja-Feliciano, T. Branck, K. Racicot, S. Arcidiacono, J.P. Karl, J.W. Soares
AGFD 211 . Cereboost, an American ainseng, promotes microbial colonic SCFA production which potentially relates to its acute and chronic improvements of attention, memory and mood. P. van den Abbeele, L. Bell, C. Williams, C. Duysburgh, M. Marzorati, P. Fanca-Berthon, R. Le Cozannet
AGFD 212 . Gastric digestion simulator for visualizing and analyzing in vitro digestibility of foods. I. Kobayashi, H. Kozu, Z. Wang, Z. Wang, S. Ichikawa

AGFD - U
JAFC Research Article of the Year Award and AGFD Young Scientist Award Presentations
T. Hofmann, M. Granvogl, Organizers, presiding
AGFD 213 . Volatile sulfur compounds in wine: Recent findings and future challenges. B. Fedrizzi

AGFD 214. Transglycosylation products unique to sake are formed by a fungal α-glucosidase during multiple parallel fermentation in sake-brewing. M. Tokuoka, Y. Kojima, C. Honda, I. Kobayashi, R. Katsuta, S. Matsumura, I. Wagatsuma, M. Takehisa, H. Shindo, M. Hosaka, T. Nukada

Semiochemical Communications in Agricultural Ecology: Early Career s Symposium
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AGFD - V
General Papers Natural Product Chemistry
Y. Kim, H. Chun, Organizer H. Chun, Presiding
AGFD 215 . Nutrients characteristics of the leaf, stem and root of Eclipta prostrata (L) . O.O. Onawumi, A. Sodamade, P.B. Ayoola, O.A. Onawumi
AGFD 216 . A suberin look at time travel: Metabolite profiling of wound tissue extracts, polymeric barriers, and depolymerization products of potato tubers. K. Dastmalchi, M. Perez Rodriguez, A. Kligman, B. Yoo, R.E. Stark
AGFD 217 . Effects of potato processing and frying on oxidized fatty acid concentrations. Z. Zhang, M. Hennebelle, S. Emami, A. Taha
AGFD 218 . Quality and purity evaluations of avocado oil sold in the US. H. Green, S. Wang
AGFD 219 . Targeted next-generation sequencing using plant ITS2 for authenticating honey origins. D. Chavan, J.R. Adolacion, M. Crum, B.V. Vu, K. Kourentzi, A. Sabo, R.C. Willson
AGFD 220 . WITHDRAWN
AGFD 221 . SlGRAS4 mediates a novel regulatory pathway promoting chilling tolerance in tomato. Z. Li
AGFD 222 . Tomato ethylene response factor SlERF.F12 represses fruit ripening epigenetically by recruiting the co-repressor TPL2 and histone deacetylase HDA1/3. M. Liu

AGFD - W
Improving Safety & Quality of Fresh Produce
V. Wu, Organizer X. Fan, C. Kunsong, Organizers, Presiding V. Wu, Presiding
AGFD 223 . Food safety technologies in the era of the COVID-19 pandemic. A. Lacombe, V.C. Wu
AGFD 224 . Evaluation of the antimicrobial effects of vitamin K3 and vitamin B2. L. Sheng, Z. Zhang, G. Sun, L. Wang
AGFD 225 . Chlorine rechargeable halamine biocidal alginate hydrogel beads for highly efficient sanitization of fresh produce. G. Sun
AGFD 226 . Stabilization and controlled release of ethyl formate for in-packaging fumigation of fresh produce. A. Zaitoon, A. Jabeen, C.D. Scott-Dupree, L. Lim
AGFD 227 . Application of gaseous ozone as in-package and fumigation treatments to enhance microbial safety and maintain quality of tomato fruit. X. Fan
AGFD 228 . Reducing foodborne bacterial biofilms on biotic and abiotic surfaces with an engineered enzyme. H. Mayton, S. Walker, B. Berger
AGFD 229 . Use of lytic bacteriophages as an antimicrobial intervention to improve produce safety. Y. Liao, V.C. Wu
AGFD 230 . Influence of leafy green surface chemical composition on E. coli O157:H7 attachment and growth. M. Dong, H. Feng
AGFD 231 . Evaluation risks to consumers from exposure to pesticide residues on fresh food commodities for the California pesticide residue monitoring program. P. Dodmane, M. Leung, L. Scanlan, Q. Dong, A. Kalashnikova, M.C. Geier, K. Truong, B.M. Brown, C. Lewis, A. Rubin, P. Lohstroh, S. Koshlukova, M. Armstrong, S. DuTeaux, K.C. Morrison
AGFD 232 . Extension responses to food safety concerns for the food industry and consumers related to the COVID-19 pandemic
. E. DiCaprio

AGFD - X
Nutrition & Gut Microbiome
Nutrition for Stress and Performance
W. Chen, J. Hwang, M. Kobori, L. Liu, J. W. Soares, Organizers L. A. Doherty, Organizer, Presiding
AGFD 233 . Leveraging metabolomics to investigate the chemical space of the human gut microbiome. S. Couvillion, K. Bloodsworth, S. Colby, R. Renslow, B. Thrall, P. Demokritou, L.A. Doherty, J.W. Soares, T. Metz
AGFD 234 . Window into the microbiome: Saliva and its association with depression, diet, and human genetics.. A.P. Ahrens, E.W. Triplett
AGFD 235 . Cucurbitacin B transformed from cucurbitacin B 2-O-β-D-glucoside via gut microbiota for the suppression on hepatic lipid accumulation. L. Zhang, Z. Fang, K. Ma, F. Chen
AGFD 236 . Oxidized vegetable oil exaggerates colitis and colitis-associated colon tumorigenesis. G. Zhang
AGFD 237 . WITHDRAWN
AGFD 238 . Phytochemicals in Arcrium lappa reduce stress-hormone induced oxidative stress by inhibiting monoamine oxidases in mice. J. Lee

AGFD - Y
AGFD Award: Symposium in honor of Dr. Gary List
L. Yu, Organizer, Presiding M. Appell, Presiding
AGFD 239 . Gary list: Inspirational leader in agricultural and food chemistry and our community. M. Appell
AGFD 240 . Use of vegetable oils in industrial lubricants. S. Erhan, B. Sharma
AGFD 241 . Transference of lipid processing technologies to the cannabis-hemp platform. J.W. King
AGFD 242 . Chemistry of lipids in cheese. M.H. Tunick
AGFD 243 . Chemistry behind edible oil processing safety: 3-MCPD fatty acid esters. L. Yu
AGFD 244 . Health, nutrition, dietary fats: Never ending challenges to the food industry. G.R. List

Communicating Science to the General Public-How to Effectively Engage
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Residue Analytical Method Development for Global Use: Advances in Robust, Cost Effective, and Innovative Techniques
Spons. AGRO, Cospons. AGFD, ANYL

AGFD - Z
Sensor, Biosensor, and Artificial Intelligence Advances in Food & Agricultural Chemistry
Part I: From perception to lab-based platforms
M. Appell, A. Buettner, Organizers
J. Beauchamp, B. D. Guthrie, Organizers, Presiding
AGFD 245 . Sensing challenges in monitoring hygienic hazards in critical production areas. A. Buettner, M. Mauermann, T. Sauerwald, J. Beauchamp, E. Ortner
AGFD 246 . Sensory properties, volatiles, and non-volatiles using quantitative descriptive analysis and flavor instrumental analysis of ten strawberries grown in Texas. X. Du, G. Scott, C. Williams, R. Wallace

AGFD 247 . Odorants from the American matsutake mushroom (Tricholoma magnivelare). A. Murray, A. Moore, J.P. Munafo
AGFD 248 . Emerging role of taste receptors as metabolic sensors. V. Somoza
AGFD 249 . Metabolomics for horticulturists: Employing ambient mass spectrometry to assess inherent postharvest pepper quality characteristics. T.J. Mason, H.M. Bettenhausen, J.M. Chaparro, J.E. Prenni, M.E. Uchanski
AGFD 250 . Online mass spectrometry as a tool for the development and performance validation of sensor systems for food and agriculture applications. J. Beauchamp
AGFD 251 . Towards biomimetic smell sensors: New tools and applications. P. Aspermair, C. Reiner-Rozman, B. Pichler, M. Gora, U. Ramach, K. Kump, P. Fruhmann, J. Andersson, P. Pelosi, W. Knoll, J. Bintinger
AGFD 252 . Monitoring soiling removal in food processing lines. M. Mauermann, R. Murcek, A. Boye

AGFD - AA
Nutrition & Gut Microbiome Food for Elder Adults
W. Chen, L. A. Doherty, M. Kobori, L. Liu, J. W. Soares, Organizers
J. Hwang, Organizer, Presiding
AGFD 253 . Development of foods for the elderly people in Korea. B. Kim, H. Jang, J. Hong, M. Lee
AGFD 254 . Red cabbage microgreens modulation of the gut microbiota is associated with attenuation of high fat diet-induced risk factors in a diet-induced obesity mouse model. Y. Wu, R. Li, H. Huang, Q. Pham, X. Jiang, W.H. Yokoyama, Y. Luo, L. Yu, Q. He, J. Wang, T.T. Wang
AGFD 255 . Dietary quercetin and cognitive function. M. Kobori
AGFD 256 . WITHDRAWN
AGFD 257 . Lifespan extension through autophagy-inducing chestnut flowers extract. H. Seo, S. Park, E. Lee, C. Jung

AGFD - AB
Modification of Agricultural Biomass into Value Added Products
M. Sarker, H. Yosief, Organizers, presiding
AGFD 257 . Bulk process for purification and enrichment of capsinoids from capsicum sp. fruit. C.L. Cantrell, R.L. Jarret
AGFD 258 . Utilization of nanocellulose from cotton agricultural residues: Materials and applications. J.H. Jordan, M. Easson, H. Cheng, B. Condon
AGFD 259 . Preparation of cellulose-based soft materials using ionic liquids. J. Kadokawa
AGFD 260 . High-value utilization of low value xylans via novel enzymes. H. Cao, L. Sun, B. Wen, F. Xin
AGFD 261 . Development of biobased lubricant additives from vegetable oils. G. Biresaw, G.B. Bantchev, R.E. Harry-O'kuru
AGFD 262 . Lignin depolymerization via solvent liquefaction: Effects of pretreatments, process conditions and catalysts. C.A. Mullen, A.A. Boateng
AGFD 263 . Molecules and polysaccharides from agri-biomass modified via high-pressure homogenization to form nanoparticles and potential nanocarriers1. K. Evans, D.L. Compton, N.P. Price, C.D. Skory, S.F. Vaughn
AGFD 264 . Polyhydroxyalkanoate (PHA) biosynthesis: An integrated biorefinery approach. R. Ashby, G. Strahan, A. Nunez
AGFD 265 . Carbohydrate polymers based value-added co-products from sorghum bran, bagasse and biomass. M.P. Yadav, M. Sarker
AGFD 266 . Correlating the flocculation performance of modified bovine hemoglobin with their molecular structures and physicochemical properties. C. Liang, R.A. Garcia, P.X. Qi, C. Lee

AGFD - AC
Sensor, Biosensor, and Artificial Intelligence Advances in Food & Agricultural Chemistry Part II: From sensing to AI
J. Beauchamp, B. D. Guthrie, Organizers
M. Appell, A. Buettner, Organizers, Presiding
AGFD 267 . Nitrate ion-selective microresonator sensor. Z. Zhang, S. Guha, X. Zhang
AGFD 268 . Towards inexpensive high performing gas measurements – method and instrumentation for sensor system optimization. T. Sauerwald, J. Joppich, T. Baur, O. Brieger, A. Schütze
AGFD 269 . Tackling emerging plant diseases with in-field sensors. Q. Wei
AGFD 270 . Engineered bacteriophage-based electrochemical biosensor via hierarchical conductive nanofibers for rapid bacterial detection in food. A. El-Moghazy, N. Wisuthiphaet, G. Sun, N. Nitin
AGFD 271 . Growing structural proteins in advanced materials for food security and food safety. B. Marelli
AGFD 272 . Graph convolution neural network in environmental carcinogenicity prediction. H. Liu, Y. Tien, T. Cho, B. Su, Y. Tseng
AGFD 273 . Use of machine learning to increase access to nutritional information. J. Gao, M. Xiao
AGFD 274 . Quantum chemical and quantitative structure activity relationship (QSAR) assessment of the antifungal properties of phenolic compounds.. M. Appell, Y. Tu, D.L. Compton, K. Evans, L.C. Wang

AGFD - AD
Nutrition & Gut Microbiome Food for Elder Adults
W. Chen, L. A. Doherty, J. Hwang, L. Liu, J. W. Soares, Organizers
M. Kobori, Organizer, Presiding
AGFD 275 . Multiple analysis system for specific IgE using a microarray allergen biochip with a small amount of blood at clinics. Y. Ito
AGFD 276 . WITHDRAWN
AGFD 277 . Population level association analysis of Korean gut microbiome with intrinsic and extrinsic host factors. Y. Nam
AGFD 278 . Tribological approach using extended stribeck curves to understand oral processing for the elderly. J. Hong, B. Kim, Y. Choi
AGFD 279 . Simultaneous determination of vitamin D and K: vitamin nano-encapsulation and fortification for the elderly. H. Jang, T. Kim, G. Yoo, M. Lee, B. Kim
AGFD 280 . Physical stability and in vitro digestion of vitamin K loaded lipid nanocarriers for application to food for elderly. M. Lee

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Modification of Agricultural Biomass into Value Added Products
M. Sarker, H. Yosief, Organizers, presiding
AGFD 281 . WITHDRAWN
AGFD 282 . Biomass lignin-based stimulus responsive polymers. H. Chung, S. Kim, H. Liu
AGFD 283 . Application of crown ether functionalized lignin-based biosorbent for the selective removal of Pb(II). J. Can, G. Liu, G. Wu, S. Huo, Z. Liu, Z. Kong
AGFD 284 . Nanocellulose composites enhanced with zinc oxide and lignin for functional properties. N. Shahi, B. Min

AGFD 285 . Antimicrobial activity of medium chain fatty acid amides and their potential application as food preservatives. H. Yosief, S. Hussain, M. Sarker
AGFD 286 . Cover crop derived regenerated cellulose enhancing the physio-chemical and functional properties of PVA-based films. G.K. Joshi, B. Min, N. Shahi
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Analytical Technologies Supporting Agrochemical R&D
Spons. AGRO, Cospons. AGFD, ANYL

Biostimulants in Agriculture: Chemistry and Regulatory Aspects
Spons. AGRO, Cospons. AGFD, BIOL

Residue Analytical Method Development for Global Use: Advances in Robust, Cost Effective, and Innovative Techniques
Spons. AGRO, Cospons. AGFD, ANYL

Semiochemical Communications in Agricultural Ecology: Early Career Symposium
Spons. AGRO, Cospons. AGFD, BIOL, BIOT

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Food Macromolecules: Functionality, Health Benefits, & Delivery Systems
N. Nitin, W. H. Yokoyama, F. Zhong, Organizers, presiding
AGFD 290 . Synthesis of nano-coacervates from chitosan and pectin with improved stability and biocompatibility for anthocyanins delivery: An in vitro and in vivo study. M. Tan, X. Zhao
AGFD 291 . WITHDRAWN
AGFD 292 . Characterizing plant-based gums with DWS microrheology. C. Bretz, A. Vaccaro, D. Leumann
AGFD 293 . Improvement of drug delivery capacity of dry bean proteins by enzymatic hydrolysis. Y. Zhang
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AGFD 295 . Evaluating the structure-function relationship of radiofrequency processed egg white powder. A. Kar, J. Subbiah, K. Majumder
AGFD 296 . Excipient emulsion and black pepper synergistically enhanced oral bioavailability of carotenoid in humans. H. Luo
AGFD 297 . Investigation of biochemical and structural mechanisms for the release of phytochemicals from cell-based carriers. R. Rai, N. Nitin

AGFD - AG
Updates in Endocrine Disrupting Chemicals & Safety Assessment for Food Contact Materials
C. Wu, Organizer, Presiding
AGFD 298 . Endocrine disrupting chemicals in food contact materials. J. Boucher, K.J. Groh, B. Geueke, J. Muncke
AGFD 299 . In vivo, in vitro, and in silico evaluation of the toxicity and potential estrogenic activity of natural antioxidant and antimicrobial isomers: carvacrol and thymol in low concentrations. X. Zhang, C. Wu
AGFD 300 . Emerging public health concerns of food packaging: phthalates and reproductive/developmental health. T. Woodruff, J. Varshavsky
AGFD 301 . Endocrine disruptors and risk assessment of food contact materials. C. Nerin
AGFD 302 . Methoxy groups reduced the estrogenic activity of lignin-derivable replacements relative to bisphenol A and bisphenol F as studied through two in vitro assays. Y. Peng, K. Reno, T.H. Epps, C. Wu
AGFD 303 . Determination of select anionic herbicides, fungicides, and disinfection byproducts in homogenized food samples using ion chromatography coupled with electrospray ionization-mass spectrometry (IC-ESI-MS). T.T. Christison, J. Rohrer

AGFD - AH
Alternatives to Antibiotic Use
X. He, Organizer L. Cheng, Organizer, Presiding
X. He, Presiding
AGFD 304 . Developing next-generation antibiotic alternatives for animals. H.S. Lillehoj
AGFD 305 . Alternatives to antibiotics in aquaculture: Integrating genetic resistance and vaccination. G. Wiens, T.D. Leeds
AGFD 306 . Redox-active natural products for fungal pathogen control. J.H. Kim, K.L. Chan, L. Cheng
AGFD 307 . Alternatives to antibiotics in plants: A case study in Galactomyces of apples. K. Cox, A. Wallis, M. Choi
AGFD 308 . Self-assembled antimicrobials to reduce ecological toxicity and antimicrobial resistance. W. Hart-Cooper, J. McManus, J. Cunniffe, D. Marsh, A. Thompson, N. Vlahakis, J. Situ, K. Johnson, W. Orts
AGFD 309 . Porcine mycobiome as potential antibiotic alternative during weaning transition. A.M. Arfken, J.F. Frey, K.L. Summers
AGFD 310 . Natural compounds from plants and fungi as antimicrobials. C.C. Tam, J.H. Kim, K.M. Land, M. Friedman, L. Cheng
AGFD 311 . Development of a campylobacter phage product to decontaminate poultry meat in Kenya. T.E. Nagel, S. Kariuki, P. Muturi, A. Nyambura, G. Nganga, G.A. Odityo, J.K. Ngumo, R. Onsare, N. Carrigy, R. Vehring, L. Liang, P. Connerton, I. Connerton

AGFD ABSTRACTS

AGFD 1 CONTROL ID: 3412462
Determination of direct available phosphate and soluble potash in fertilizers by ICP-OES Regulatory laboratories are interested in the determination of phosphorus and potassium contained in fertilizers that are readily available for plant use, termed “direct available phosphate” (P2O5) and “soluble potash” (K2O), respectively. There are several AOAC (Association of Official Agricultural Chemists) methods available for the determination of P2O5cand K2O in fertilizers. These methods have worked well, but most are slow, labor-intensive, and require the separate determination

of each. Recently, more and more laboratories engaged in fertilizer testing are developing inductively coupled plasma-optical emission spectrometry (ICP-OES) methods for the determination of P2O5 and K2O because the instrument can determine several elements simultaneously in a wide range of concentrations. However, the use of AOAC extraction methods generate a large amount of waste. Moreover, they either can only determine P2O5 in both inorganic and organic fertilizers or can determine both P2O5 and K2O in inorganic fertilizers. Herein we report a new extraction method that allows the simultaneous determination of P2O5 and K2O in both inorganic and organic fertilizers by ICP-OES. Eleven inorganic and organic fertilizers from the Magruder check sample program were selected for this study. P2O5 ranged from 1.2% to 45.1% and K2O ranged from 0.2% to 60.3%. The recoveries, precision, and accuracy of P2O5 and K2O for all fertilizers meet the quality requirements for regulatory laboratories. The method detection limit is 0.007% for P2O5 and 0.012% for K2O. Compared to the AOAC extraction method, this extraction method generates 2.5 times less waste. This method offers the potential for an accurate, safe, and environment friendly alternative for P2O5 and K2O analysis in fertilizers. C. Tu, D. Chand, S. Aylesworth, M. Khosravifard, Center for Analytical Chemistry, California Dept. of Food and Agriculture, Sacramento Chuqiao.Tu@cdfa.ca.gov

AGFD 2 CONTROL ID: 3421960

Vitamins and minerals analysis of crinum jagus bulb as a measure of its anti- neurocardiogenic syncope potential Vitamins and minerals are essential nutrients needed in the body for good health. Crinum jagus which belongs to the Amaryllidaceae family is a plant that its bulb is mostly used traditionally together with other herbs in south-western region of Nigeria for preparing concoction for asthma cough. It is also used in treating neurocardiogenic syncope, an ailment commonly discovered in adolescents and adults, which is caused by the failure of the brain and the cardiovascular system to communicate and respond to each other adequately. This study analyzed Crinum jagus bulb for its vitamins and mineral contents as a measure of its anti-neurocardiogenic syncope potential using standard methods of analysis. The result of this study revealed that Crinum jagus is rich in vitamin C, ascorbic acid followed by vitamin E. It has low vitamin A content. Crinum jagus bulb has appreciable vitamins B1, thiamine, B2, riboflavin and B6, pyridoxine contents. The bulb contains calcium, sodium, potassium, nickel, manganese, iron, zinc, chromium, and copper. The presence of these vitamins and minerals in C. jagus bulb which are responsible for certain function in human system, such as maintaining healthy blood pressure and normal blood glucose levels, production of amino acids, neurotransmitters, and hormones. They are also maintaining steady heartbeat, sending nerve impulses, maintaining proper muscle contractions and balancing of body fluids, lowering cancer risks , serving as antioxidants, maintaining healthy brain and muscles , reducing the risk of heart diseases and others are supporting evidences that C. jagus bulb possesses anti-neurocardiogenic ability, and thus justifies its traditional use for this purpose. D.L. Abiona, O.O. Onawumi, S.O. Oladoye, Dept. of Pure and Applied Chemistry, Ladoke Akintola Univ. of Tech., Ogbomoso, Oyo, Nigeria D.L. Abiona, Dept. of Chemistry, The Polytechnic, Ibadan, Oyo, Nigeria modupeoluwa2013@gmail.com

AGFD 3 CONTROL ID: 3423450

Simultaneous measurement of saccharin and resveratrol in urine using UHPLC(ESI)-MS/MS To understand the efficacy of a lipid-based nutritional supplement (LNS) in nutritional intervention studies, the addition of a compliance marker is needed. Saccharin and trans-resveratrol were evaluated as compliance markers for LNS consumption, based on their stability in urine and foods, their long excretion half-lives, safety and cost-effectiveness. A method was developed for the simultaneous quantification of saccharin and the trans-resveratrol metabolites (trans-resveratrol-3-O-b-D-glucuronide [TR3G], trans-resveratrol-4-O-glucuronide [TR4G] and resveratrol-3-O-sulfate [RS]) in urine using multiple reaction monitoring (MRM) and ultra-high performance liquid chromatography with electrospray ionization coupled to a triple quadrupole mass spectrometer (UHPLC(ESI)-MS/MS). The linear range was from 3-1000 ng/mL with correlation coefficients of 0.999. Recovery of the compounds was evaluated at 10, 100 and 800 ng/mL of target compounds. Average recoveries at 100 ng/mL were 111.6% for saccharin, 108% for TR3G, 91.9% TR4G and 103.2% for RS. Ion suppression studies indicated that ionization for all compounds was significantly suppressed at urine concentrations > 10%. Twenty-three subjects consumed a single dose of 10 mg of saccharin and 24 subjects received 5 mg of trans-resveratrol in LNS. Urine samples were collected at time 0 and for 4 hours after consumption. At baseline, the average saccharin content was 1,909 nmol/L ± 1,325.63 nmol/L. After consumption (4hr) the average saccharin content in urine was 54,812.04 nmol/L ± 43,587. 04 nmol/L. The average content of resveratrol metabolites in urine at baseline was 0 nmol/L (TR4G), 15.5 ± 53.4 nmol/L (TR3G) and 4. 9 ± 23.4 nmol/L (RS). After consumption (4hr) levels increased to 507.8 ± 768.8 nmol/L (TR4G), 913.6 ± 927.5 nmol/L (TR3G) and 3,440 ± 4,160.1 nmol/L (RS). Studies indicate that either saccharin or resveratrol can be used to monitor nutritional compliance when added to LNS. V. Weinborn, A. Lehmkuhler, A.E. Mitchell, Food Sci. Tech., UC Davis S. Zyba, M. Haskell, Nutrition, UC Davis, California vweinborn@ucdavis.edu

AGFD 4 CONTROL ID: 3423864

Characterizing headspace volatile profiles of native, drought-tolerant California blue elderberry (Sambucus nigra ssp. cerulea) The purpose of this work was to characterize the headspace volatile profiles of California blue elderberries (Sambucus nigra ssp. cerulea) grown in hedgerows. These native elderberries are drought- and fire-tolerant and may serve as a value-added crop for California farmers. While European varieties of elderberry (Sambucus nigra ssp. nigra) have historical use as medicinal plants and are now used in a variety of commercial food and beverages today, there is a growing interest to utilize the California blue elderberry in similar applications. An important step to reach this goal is to understand the organoleptic properties of the blue elderberry and how they compare to the European elderberry varieties. California blue elderberries were harvested from 17 hedgerows on five farms over the growing season in 2018 and 2019 and analyzed by HS-SPME/GC-MS. Herein, 95 volatile compounds were identified in S. nigra ssp. cerulea, including alcohols, hydrocarbons, aldehydes, ketones, esters, terpenes, furans, and acids. Dihydroedulan, reported to be a key volatile in the aroma of several cultivars of S. nigra ssp. nigra, was observed in the blue elderberry. However, the other characteristic aroma-active compound, β-damascenone, was not observed. Predominant volatile compounds by relative concentration include ethyl acetate, 1-hexanol, cis-3-hexen-1-ol, hexanal, and methyl acetate. These compounds have been identified in European elderberries. Several compounds identified here in the California blue elderberry appear to be unique to the subspecies, including 2-propenal, 2,3-butadione, amyl acetate, and benzeneacetaldehyde. These aroma-active volatile compounds may contribute fruity or grassy notes to value-added products made with California blue elderberries. Overall, the similarity between the California blue elderberry and European elderberry varieties suggest that the California blue elderberry could be used in similar applications and deliver the familiar organoleptic properties of S. nigra ssp. nigra while potentially also offering a unique aroma profile. K. Uhl, A.E. Mitchell, Food Sci. Tech., UC Davis kruhl@ucdavis.edu

AGFD 5 CONTROL ID: 3429998
Simultaneous determination of nitrate and nitrite in spinach and meat by ion chromatography Nitrate and nitrite salts are often used as food additives in processed meats like bacon, ham, sausages, etc. to stabilize the color of red meat. They also function as preservatives, helping to prevent the growth of microorganisms that cause food poisoning. The presence of nitrite/nitrate in processed meat is believed to increase the risk of cancer in the digestive tract. For these reasons, use of nitrate and nitrite salts as food additives is strictly regulated worldwide. For example, the European Commission established the maximum allowable concentration for nitrate and nitrite salts in processed meat as 150 mg/Kg. Nitrate and nitrite are also found naturally in vegetables and fruits. Most vegetables usually have low levels of nitrate, with leafy vegetables such as lettuce, spinach, arugula etc. having the highest levels. Conversely, only trace amounts of nitrite (<10 mg/kg) are present in vegetables. Ion chromatography (IC) is a well-established technique for the analytical determination of nitrite and nitrate. In this work, we developed an IC method using a high capacity version of the DionexTM IonPacTM AS11 column to separate nitrite and nitrate from other anions present in a meat homogenate and slurried spinach. The Dionex IonPac AS11-HC column is a high capacity column, which allows relatively large injection volumes, thus facilitating the determination of low nitrate and nitrite concentrations. Nitrate and nitrite were separated on a 2 × 250 mm IonPac AS11-HC column at a 0.38 mL/min flow rate using potassium hydroxide (KOH) eluent produced by the DionexTM EGC 500 KOH Eluent Generator Cartridge. After the separation, nitrate and nitrite were detected by suppressed conductivity detection. The two food samples were extracted with deionized water and subjected to a series of simple clean up steps before they were injected into the IC system. The method showed good precision with RSDs <0.2%, and <5% (n=9), for retention time and peak area respectively. The recoveries from meat homogenate and slurried spinach sample ranged from 89-100%. The limit of detection (LOD) and the limit of quantitation (LOQ) were 2.26 ppb and 7.52 ppb for nitrate and 1.33 ppb and 4.42 ppb for nitrite respectively. M. Aggrawal, Ion Chromatography- Sample preparation, Thermo Fisher Scientific, Sunnyvale, California, J. Rohrer, Thermo Fisher Scientific, Sunnyvale, California manali.aggrawal@gmail.com

AGFD 6 CONTROL ID: 3431162
Changes in Tennesse whiskey odorants by the Lincoln County process Charcoal filtration is a common step in the production of distilled beverages, including vodka, rum, and whiskey. To qualify for the label of "Tennessee Whiskey," a charcoal filtration step known as the Lincoln County Process (LCP) is required. This step is performed by passing fresh distillate through a bed of charcoal, typically prepared from the sugar maple (Acer saccharum Marshall) prior to barrel aging. To have the designation "Tennessee Whiskey" on the label, in addition to the LCP step the liquor must be produced in the state of Tennessee from at least 51% corn and have been aged in Tennessee for at least two years in unused charred oak barrels. The LCP step is believed to impart a smoother flavor to the distillate; however, no studies have yet been published that fully characterize the process for this achievement. The present investigation had three objectives: 1) to isolate volatiles in corn distillate by solvent assisted flavor evaporation (SAFE); 2) to identify odorants using aroma extract dilution analysis (AEDA); and 3) to use stable isotope dilution assay (SIDA) to quantitate selected odorants and calculate odor activity values (OAVs) before (bLCP) and after (aLCP) for 24 hours. Forty-nine odorants were identified in the samples. Selected odorants, including (2E,4E)-nona-2,4-dienal (fatty), 3-methylbutanoic acid (sweaty, rancid), 2′- aminoacetophenone (foxy), and 2-acetylpyrroline (roasty) dropped below detection thresholds (OAV < 1) following LCP treatment. Changes in lipid-derived aldehydes, organic acids, and corn-derived odorants will also be discussed. This presentation will highlight the effects of LCP on selected odorants present in freshly prepared corn distillate, to provide insights for Tennessee Whiskey manufacturers into how to optimize flavor of the product. T. Kerley, J.P. Munafo, Food Sci., Univ. of Tennessee, Knoxville, tkerley@vols.utk.edu

AGFD 7 CONTROL ID: 3433080
Investigation of chemicals extracted from smoke and leaves vegetation: Non-targeted characterization comparison using 2D GCxGC TOFMS of solvent extractions The chemicals emitted in the atmosphere from wildland fire have been topic of interest. Many studies have been done in the field and laboratory to characterize these chemicals from burnings. Trace volatile organic compounds (VOC) found in the atmosphere are derived from biomass burnings. It is assumed the chemicals are precursors to secondary pollutants such as ozone and fine particles. Some of the health effects are direct cause of VOC from burnings. In this research project chemical components of solvent extractions of vegetative smoke and leaves were compared. Pegasus BT 4D GCxGC TOFMS with a liquid Nitrogen Thermal Modulator will be used to analyze and characterize high value chemicals isolated from vegetative smoke and leaves. The number of chemicals extracted from the smoke were less than the chemicals found in the leaf. The various functional groups were categorized to investigate numbers chemicals isolated the from the smoke and leaves. There were similar functional groups found in the smoke and leaf. However, alkynes were not found in the smoke extractions. The alcohols and ketones were the most abundant functional groups found in both. Other types of chemicals were investigated like specific chemical groups like phenols and furans. R.K. Moore, D. Mann, Forest Service, Madison, Wisconsin, roderquita.k.moore@usda.gov

AGFD 8 CONTROL ID: 3400450
Advanced and innovative biosensing technologies for food safety Foodborne illness is a continuing cause of morbidity and mortality in the United States. Early detection of bacteria in food matrices can significantly reduce the potential of foodborne disease. In my research program, I am focusing on the development of advanced and innovative tools to detect foodborne pathogens using nanomaterials, bacteriophage, and CRISPR. Firstly, phage-conjugated magnetic beads were demonstrated to detect viable Escherichia coli (E. coli) in drinking water. During the bacteria detection, phages can specifically recognize the target E. coli and release intracellular β-galactosidase (β-gal) enzyme, which was enzymatically measured as the indicator for the presence of E. coli cells. In order to improve detection limit and shorten detection time, nanomaterials and engineered bacteriophage were explored: (1) magnetic beads were replaced with magnetic nanoparticles to increase capture efficiency and (2) bacteriophages were genetically engineered with lacZ operon to overexpress β-gal enzyme during bacteriophage infection. Lastly, the recently innovated genome-editing tool (CRISPR) was introduced in the application for food safety. These studies demonstrate the potential of combining the fundamental and advanced approaches to address the challenges in food safety. J. Chen, Biological Systems Engineering, Virginia Tech, Blacksburg, Virginia juhong.chan@gmail.com

AGFD 9 CONTROL ID: 3426845
Centrifugal partition chromatography (CPC): Purifications from benchtop to industrial scale Centrifugal partition chromatography (CPC) is a highly adaptable chromatographic technique that is well-suited for difficult separation problems. As an application of liquid-liquid chromatography, this Tech. can be easily scaled for purification operations ranging from benchtop to industrial. The main component of the CPC is a rotor comprising a series of connected

cells. The stationary phase from a biphasic system is immobilized in the rotor by a centrifugal force, performing the function of a solid stationary phase; the liquid mobile phase can then be eluted through the immobilized phase. The rotor is manufactured in various volumes, facilitating loading capacities from milligrams to kilograms per injection. CPC offers various advantages over traditional solid-phase chromatography, including low relative solvent consumption, no irreversible adsorption, total sample recovery, no decomposition of fragile compounds, infinitely adjustable selectivity, linear scale-up abilities, and adaptability to both natural and synthetic products. The effective application of CPC in pharmaceutical, nutraceutical, and cannabis markets is evidenced by API purification under GMP production, isolation of nutraceutical active ingredients, pesticide removal, and isolation of individual cannabinoids. Multiple operating modes of CPC offer unique approaches to compound isolation that are suitable for manufacturing. For example, a CPC technique based on pH-zone refining provides high loading capacities and yields high purity isolates with short run times. As a technique for challenging and unique purifications, CPC has an undervalued potential in large-scale separations of valuable compounds. V. Glinski, Planta Analytica, New Milford, Connecticut, B. Silverman, Planta Analytica, LLC, New Milford, Connecticut, v.glinski@plantaanalytica.com

AGFD 10 CONTROL ID: 3429764
Nut polyphenols: from bioaccessability to bioactivity
Polyphenols contribute to the taste, stability, and health benefits of nuts. The polyphenol profiles of nuts are unique and consist of condensed and hydrolysable tannins, flavonoids, phenolic acids and stilbenes, among others. The polyphenol content and profile of nuts change during processing and storage. Upon consumption, the extraction of polyphenols into saliva and interaction with taste receptors leads to the characteristic astringency or bitterness of polyphenol-rich nuts. Nut polyphenols are further extracted in the stomach and intestine, where metabolism and absorption begin. Unextracted and unabsorbed polyphenols transit to the colon, where they are further extracted and metabolized by gut microbiota. Microbial catabolism of polyphenols results in release of lower-molecular weight phenolics. The microbial catabolism and pharmacokinetics of polyphenols are highly variable between individuals. Defining the extent variability of polyphenol metabolism relates to health outcomes has been challenging. Nut polyphenols can plausibly impact health by modulating the gut microbiota, reducing oxidative stress, altering lipid metabolism, and improving immune function. The structure-function of polyphenols and their metabolites govern the molecular and biochemical mechanisms that mediate these health outcomes. Tree nuts have favorable fatty acid profiles and are rich in micronutrients, so the functional health benefits of polyphenols need to be considered in totality of the food matrix, as well as in the perspective of overall dietary patterns B.W. Bolling, Univ. of Wisconsin-Madison bwbolling@wisc.edu

AGFD 11 CONTROL ID: 3433589
Almond milk protein digestion under normal and elevated
gastric pH conditions to mimic acid suppression therapy
Gastroesophageal reflux disease (GERD) affects 25% of the Western world. The most common treatment for gastroesophageal reflux disease is acid suppression therapy, which may be achieved through proton pump inhibitors, histamine-receptor antagonists, and/or antacids. These therapies work to increase the gastric pH (typically ~1-2) to >4, which minimizes acidic gastric content entering the esophagus. However, modifications in gastric pH may impact digestion of food nutrients, due to the pH-specificity of salivary and gastric enzymes. The impact of altered gastric pH on digestion of plant-based proteins, specifically those from almonds, is unknown. The objective of this study was to quantify the influence of varying in vitro gastric pH on protein digestibility in almond milk. Almond milk was prepared by soaking almonds in deionized water (140 g/L) followed by blending and sieving. Almond milk underwent oral (30 sec), gastric (60 min), and small intestinal digestion (120 min) at 37°C. For in vitro gastric digestion, simulated gastric juice was added and the pH was maintained at 2, 2.5, 3, 4, 5, or 6.5 or followed a pH profile decreasing from 6.5 - 4.7, 6.4 – 4.1, or 4.9 – 2.0, to mimic profiles observed in vivo. Protein digestibility was monitored using SDS-PAGE and quantified by image analysis. Free amino groups were monitored using the O- phthalaldehyde assay. Particle size distribution was measured using dynamic light scattering. Free amino content was significantly influenced by gastric pH and digestion time ($p<0.0001$). At the end of small intestinal digestion, samples that underwent gastric digestion at pH 6.5 and the pH profile from 6.5 – 4.7 had the lowest free amino groups (133.1-237.4 μg/mL), while samples that underwent gastric digestion at pH 3 had the highest free amino groups (489.1 ± 28.8 μg/mL). SDS-PAGE analysis showed that after small intestinal digestion, the 20-22 kDa subunit of amandin was 95.7% hydrolyzed in gastric pH 2, but only 57.7% hydrolyzed in gastric pH 5. These results demonstrate the impact of gastric pH on protein hydrolysis. In developing new food products from almonds, it is critical to understand the protein digestibility in a range of gastrointestinal conditions. This will allow for optimal formulation and processing of almond products to increase protein hydrolysis and decrease potential for allergenicity for both healthy adults and consumers with varying health conditions and medications, such as acid suppression therapy. G. Bornhorst, A. Afsarifad, Biological Agricultural Engineering, Univ. of California Davis, G. Bornhorst, K. Rios-Villa, T. Estevez, Food Sci. and Tech., Univ. of California, Davis, gbornhorst@ucdavis.edu

AGFD 12 CONTROL ID: 3411608
Influence of almond pasteurization on rancidity in almonds
Almonds harvested in California can be stored as raw kernels for up to 2 years. Over the past 5 years, more than 65% of the almonds produced in California were exported as shelled raw almond kernels. With this large quantity of raw almonds being stored throughout the year, the process and characteristics of rancidity development in raw almond kernels needs to be better understood. Since 2007, it has been mandatory for processors to pasteurize almonds from California prior to exporting due to safety concerns. Currently, there are two major methods to achieve pasteurization for raw almonds, steam treatment and propylene oxide (PPO) treatment. Both methods are widely used in the almond industry. To understand the chemical changes of raw almonds during storage, one batch of almonds was split into three groups; raw (unpasteurized), steam treatment, and PPO treatment. All three types of shelled almonds were then stored under accelerated shelf-life conditions (32°C, 60% RH) that promote rancidity development. Almonds were evaluated monthly over 12 months for peroxide value (PV), free fatty acid value (FFA), conjugated dienes (CD), and headspace volatiles. A significant difference in FFA and CD were found for each treatment throughout the 12 month accelerated storage. Peroxide values were not significantly different for the same treatment throughout storage nor between treatments. Both PV and FFA did not exceed the current industry maximum standard of 5 mEq/kg oil and 1.5% Oleic acid respectively. The relationship between the headspace volatiles and chemical markers suggested potential markers that can be better used for monitoring rancidity development of raw almonds. K. Luo, A.E. Mitchell, Food Sci. Tech., UC Davis, California, kkluo@ucdavis.edu

AGFD 13 CONTROL ID: 3433237
Analysis of almonds from an underwater archaeological site:
Non-destructive characterization by headspace GC-MS The analysis of almonds by headspace GC-MS normally involves the destruction of the sample by grinding or pulverizing in order to

facilitate the transfer of volatiles to the headspace. Samples collected from archaeological sites are often limited in number and therefore must be used for multiple analyses that require different sample preparations. Whole, intact almonds from sealed, intact amphora that were collected from an underwater archaeological site were analyzed for volatiles. Two headspace methods (stir bar sorptive adsorption and solid-phase microextraction) were employed to trap the volatiles, which were subsequently analyzed by gas chromatography coupled to mass spectrometric detector. Prior to analysis the analytical parameters of fiber length, exposure time, and temperature were optimized for the analysis of whole almonds using both bitter and non-bitter almonds. Datasets were analyzed by spectral deconvolution and volatiles were tentatively identified by spectral library match and retention index. Based on the headspace method the number of tentatively identified volatiles in the archaeological samples ranged between 60-90 volatiles. Hierarchical cluster analysis and principal component analysis were used to compare the volatiles from the archaeological almonds to those from the bitter and non-bitter almonds. Based on these analyses it appears that the almonds from the archaeological site are most likely bitter almonds L.A. Lerno, Viticulture and Enology, Univ. of California, Davis, K. Lapsley, Almond Board of California, Modesto, California, A.E. Mitchell, Food Sci. Tech., UC Davis, California, E. Jaszczak, Analytical Chemistry, Gdansk Univerity of Tech., Gdansk, Poland lalerno@ucdavis.edu

AGFD 14 CONTROL ID: 3427229
Utilization of almond processing residual biomass for soil biosolarization Soil biosolarization utilizes passive solar heating, organic amendments, and fermentation processes to create conditions that suppress agricultural pests and improve soil quality. Appropriate amendments are key to delivering fermentable nutrients, microorganisms, and biopesticides to soil to promote biosolarization efficacy. The utility of hulls and shells left over from industrial almond processing was assessed in the context of biosolarization. Soil bioreactor and field trial experiments indicated that hulls and shells inherently contain organic acid biopesticides. These acids may further accumulate due to microbial acidogenesis in the soil during biosolarization although this effect depends on the variety of almond associated with the hulls and shells. Biosolarization with hull and shell amendments was observed to promote inactivation of root lesion nematode (Pratylenchus penetrans) in the soil during pre-plant treatment of an almond orchard. Additionally, biosolarized soils exhibited significant elevation of nitrogen, potassium, carbon, and organic matter. Almond trees grown in biosolarized soils required differing adaptation periods depending on their variety. These results suggest that biosolarization may offer a new circular economy approach to valorizing almond hulls and shells E. Shea, E. Lopez, A. Parr, Y. Achmon, J. Toniato, S. Chen, C. Simmons, Food Sci. and Tech., Univ. of California, Davis J. Fernandez-Bayo, J. VanderGheynst, Biological and Agricultural Engineering, Univ. of California, Davis J. Milkereit, A. Hodson, Entomology and Nematology, Univ. of California, Davis R. Crowley, Nicolaus Nut Company, Chico, California, J. Stapleton, Agricultural and Natural Resources, Univ. of California, Parlier jdfernandezbayo@ucdavis.edu

AGFD 15 CONTROL ID: 3429982
Development of advanced harvest strategies to enhance sustainability of almond Production Traditional almond harvest requires a bare, dry orchard floor to facilitate tree shaking and nut drying leading to an extended tree water deficit and preventing the use of cover crops or soil ammendments or other soil health enhancing practices. Traditional harvest also delays crop removal from the orchard, requires repeated herbicide usage and increases insect and disease pressure from navel orangeworm (NOW), hull rot and mites. Together current practices compromise crop resilience and increase dependence on insecticides and herbicides. These problems can be ameliorated by advanced harvest methods, including both off-ground harvesting (collecting nuts with catch-frames) and early harvest (reducing fruit exposure to insect and disease pressure). Grower adoption of advanced harvest is hindered by lack of data demonstrating the benefits for tree health and yield and optimal irrigation management. Adoption of advanced harvest will (1) reduce the severity of water stress during harvest thereby, improving tree health, yield and water use efficiency; (2) reduce NOW damage and dependence on herbicides and insecticides; (3) improve air quality by diminishing the number of orchard equipment activity and improving orchard soil stability thereby reducing the threat of dust to workers and local communities and; (4) potentially improve crop quality and food safety . Collectively, advanced harvest will help the almond industry become more environmentally sustainable and resilient. P. Brown, Plant Sciences, Univ. of California Davis, phbrown@ucdavis.edu

AGFD 16 CONTROL ID: 3434609
Tailoring almond protein extraction for improved extractability, functionality, and biological properties The enzyme-assisted aqueous extraction process (EAEP) enables the fractionation of food matrices into oil- , protein-, and fiber-rich fractions that can be further converted into food, feed, and fuel, without the use of flammable solvent. Our research group investigated the effects of extraction conditions on oil and protein extractability, oil recovery, functional (solubility, emulsification and foaming properties) and biological (in vitro digestibility) properties of almond protein extracts. The use of enzyme in the EAEP increased overall oil and protein extractability and enabled the recovery of 93% of the extracted oil. More importantly, the the use of enzyme during the extraction significantly affected the functional and biological properties of the extracted protein. Higher protein solubility and emulsification capacity of EAEP skim proteins were observed at acidic pH (5.0), where almond protein solubility is hindered. Similarly, higher in vitro digestibility (88 vs. 80%) was observed for the EAEP skim protein. J. Moura Bell, UC Davis, California, jdemourabell@ucdavis.edu

AGFD 17 CONTROL ID: 3399865
Characteristics and chemical composition of monkey cola (Cola millenii K.Schum) seeds, mesocarp and oils: Nutrient and industrial potentials Studies were conducted on properties of seeds, mesocarp, and oils extracted from Cola millenii fruits. Proximate composition of Cola milleni seed and mesocarp were: 14.88 and 6.56% crude protein, 4.02 and 10.53% crude fibre, 0.01 and 4.01% ash, 4.01 and 2.03% lipid, 8.02 and 14.01% moisture and 69.06 and 62.86% carbohydrate. Mesocarp had higher contents (mg/kg) of potassium (4.98), sodium (1.66) and magnesium (1.35) than the seed. The amino acids profile revealed the presence of 8 essential amino acids and 9 non-essential amino acids. Glutamic acid was the highest while cysteine was the limiting amino acid in the seed sample. Viscosity increases with an increase in temperature for mesocarp, seed and seed cake. Evaluation of optimum oil yield using the mixtures of petroleum ether, n-hexane, methanol and ethanol as extracting solvents showed the highest yield of 11.41% seed oil, 46.81% of mesocarp oil from the mixture of 100ml methanol and 100ml ethanol, the lowest yield of 2.43% seed oil from 200ml of n-hexane and 0.43% mesocarp oil from the mixture of 100ml petroleum ether and 100ml of n-hexane. The phytochemical screening of the methanol and n-hexane extracts of seed revealed the presence of terpenoids, steroids, cardiac glycosides, while the methanol and n-hexane extracts of mesocarp indicated the presence of flavonoids, steroids, and saponins. Changes were not observed in the specific gravity, refractive index and the viscosity of the seed and mesocarp oil; there

was a reduction in the acid, iodine and saponification values, but an increase in the pH and peroxide values after refining. The fatty acids profile revealed that the seed and mesocarp oils contain saturated fatty acids (23.9% and 22.43%) and unsaturated fatty acids (76.11% and 77.57%) respectively. The results obtained show that the seed, mesocarp and their oils can be exploited for various nutritive and industrial applications. M.O. Bello, A.O. Ibrahim, T. Edewor, Pure and Applied Chemistry, Lautech, Ogbomoso, Nigeria, Oyo State, Ogundola, Pure and Applied Biology, Lautech, Ogbomoso, Nigeria, , Oyo H. Adedosu, A.O. Akintola, Science Laboratory Tech., Lautech Ogbomoso, Nigeria, Oyo, A. Alade, Chemical Engineering, Lautech, Ogbomoso, Nigeria, Oyo mobello@lautech.edu.ng

AGFD 18 CONTROL ID: 3431534

Measuring aflatoxins in macadamia nuts: Evaluation of current analytical methods Aflatoxins, carcinogenic mycotoxins generated by Aspergillus molds, are an emerging problem for the macadamia nut industry. However little research has been done investigating the field and factory conditions that contribute to aflatoxin contamination in macadamia nuts. Nor has any research paper been published evaluating current commercial methods for their viability of measuring aflatoxin in macadamia nuts. Herein, we examined two AOAC methods developed for measuring aflatoxin in peanuts for their applicability in macadamia nuts; (1) total aflatoxin quantified by fluorescence after reaction to bromide and (2) individual aflatoxin quantified after HPLC- FLD and post-column derivatization by a photoreactor. Methods were compared to one another for sensitivity, selectivity and precision and then evaluated with field samples. Macadamia nuts were sourced from six units in a commercial orchard with varying elevations, average rainfall, and temperatures. Nuts were culled in the laboratory according to factory guidelines, and both culled and passed nuts were measured for Aflatoxin concentration. R. Johnson, Daniel K. Inouye U.S. Pacific Basin Agricultural Research Center: Hilo, USDA, Hawaii, rebeccajohnso@gmail.com

AGFD 19 CONTROL ID: 3434336

Effect of regionality on the sensorial and chemical aging characteristics of Pinot noir grown on the U.S. West Coast The study objective was to investigate the sensorial and chemical differences among Pinot noir wines from different vineyard locations. Grapes of a single Pinot noir clone were grown on twelve different vineyard sites along the U.S. West Coast. For the first time, sensorial and chemical differences were observed among these wines at two bottle aging intervals (after 8 and 20 months). Single vintage (2015) wines were made at UC Davis using standardized winemaking procedures. We described wine sensory profiles from the sites with descriptive analysis (DA). Chemical profiles for volatiles were determined with HS-SPME-GCMS, and phenolic profiles were measured with reversed RP- HPLC. Data sets collected were correlated using several multivariate techniques to describe differences among vineyard locations. Overall, short term aging caused an evident change in the chemical and sensorial parameters from 8 to 20 months. Differences in the volatile profile for the single vineyards due to aging were more consistent than phenolics. We saw a strong trend between latitude and the chemical/sensorial attributes. Vineyards from the same AVAs had similar profiles with a few exceptions. Although different terms were generated in the DAs at 8 and 20 months, the wines made from southern vineyards were described e.g. as more “musty,” “tomato,” “leather”, while the northern wines were perceived as more astringent and higher in “green apple,” “floral,” “strawberry,” and “red cherry” qualities. This is strong evidence that single clone Pinot noir grapes made under standardized winemaking but grown in different regions produce wines chemically and sensorially unique that persist during aging. At this point, we can only speculate about these vineyards what may be leading to these unique profiles (e.g., soil type, climate, rainfall), and further research is needed. A. Cantu, S. Lafontaine, I. Frias de Locio e Silva, M. Sokolowsky, A. Yeh, P. Lestringant, S. Byer, H. Heymann, R. Runnebaum, Viticulture and Enology, UC Davis, California acantu@ucdavis.edu

AGFD 20 CONTROL ID: 3417858

Rapid quantification of Brettanomyces derived volatiles in wines by parallel extraction onto sorbent sheets coupled to high resolution mass spectrometry Contamination of wine by the spoilage yeast Brettanomyces bruxellensis can lead to off-aromas, due in part to formation of 4-ethylphenol (4-EP) and 4-ethylguaiacol (4-EG). These volatiles are often used as markers for the presence of Brettanomyces, and are typically measured by a suitable sample preparation step such as solid phase microextraction (SPME) followed by gas chromatography-mass spectrometry (SPME-GC-MS). However, SPME-GC- MS has relatively long analysis times (>30 min per sample) due to the SPME extraction and GC separation steps, which decreases throughput. We evaluated the use of, and now describe improvements to, laser-etched sorbent sheets (SPMESH Sheets) for rapid, parallel extraction of 4-EP and 4-EG from the headspace of samples in multiwell plates. In previous work, we demonstrated that SPMESH-DART-MS is capable of analyzing trace volatiles in 24 wine samples in ~17 min. However, we determined that this approach was not appropriate for 4-EP and 4-EG due to their poor response on DART-MS and the low extraction efficiency of headspace SPMESH. As an alternative approach, volatiles were desorbed from the sheets using acetonitrile:water droplets, which permitted volatile quantification by flow injection analysis-high resolution mass spectrometry (FIA-HRMS) requiring only ~25 s per sample. Extraction efficiency onto SPMESH sheets was improved 8-fold by directly contacting the SPMESH sheet with the sample. The resulting approach can measure 4-EP and 4-EG at low µg/L levels in wine J. Rafson, M. DiGregorio, G.L. Sacks, Food Sci., Cornell Univ., Ithaca, New York jr2255@cornell.edu

AGFD 21 CONTROL ID: 3418863

Odorants from aged riesling (Joh. Jos. Prüm) Riesling wines are favored by sommeliers and wine drinkers alike for their fresh floral, citrus, and balanced petrol character. Most Riesling wines are enjoyed young, within the first few years after bottling. However, Riesling’s high acidity and sugar content also make it suitable for aging. Aged Rieslings have more robust aroma profiles than young Rieslings, often displaying notes of sherry, honey, and caramel. Previous studies have shown that several esters and alcohols contribute to the fruity and floral attributes of young Rieslings, although the odorants that differentiate aged Rieslings have not yet been identified. Therefore, the goal of this study was to employ aroma extract dilution analysis (AEDA) to identify odorants present in a ten-year-old Joh. Jos. Prüm Riesling produced in the Mosel valley of Germany. Thirty-five odorants were identified, including 18 with flavor dilution (FD) factors ≥ 64. Odorants with high FD factors (FD 1024) included ethyl butyrate and 2-phenylethyl alcohol, respectively exhibiting fruity and rose aroma qualities. Other fruity odorants were identified (FD 256) including ethyl 2-methylbutanoate, ethyl 3- methylbutanoate, ethyl hexanoate, ethyl octanoate, and β-damascenone. Additional identified odorants included furaneol (FD 256), 5-ethyl-3-hydroxy-4-methylfuran-2(3H)-one (FD 256), wine lactone (FD 64), sotolon (FD 16), 2- phenylacetic acid (FD 16), 4-hydroxy-3-methoxybenzaldehyde (FD 16), and 1,1,6 -trimethyl-1,2-dihydronapthalene (FD 4). As a result of this study, a collection of odorants were identified that may contribute to the complex aroma profile of an aged Riesling. This presentation provides a foundation for future quantitative and sensory evaluations for determining the impact of each odorant on the overall aroma of aged Riesling. M. Dein, T. Kerley, Food Sci., Univ. of Tennessee, Knoxville J.P.

Munafo, Food Sci., Univ. of Tennessee, Knoxville m.foley2889@gmail.com

AGFD 22 CONTROL ID: 3431330
Impact of different amelioration techniques on the chemical composition and sensory characteristics of smoke impacted wines The increasing incidences of wildfires in winegrape growing regions pose a significant risk to the grape and wine industry. One risk is the potential for persistent exposure to smoke to compromise the quality and value of winegrapes and adversely affect wines made from smoke exposed grapes. A wine is seen as smoke impacted or tainted when there is an overpowering smoky, medicinal, chemical, burnt or ashy aroma on the nose and a distinctive retronasal ash tray-like character in the mouth. Several solutions for smoke taint have been promoted such as treatment with enzymatic enzymes, fining, reverse-osmosis and spinning cone treatments. In this study the different amelioration techniques were investigated using smoke impacted wines made from Cabernet Sauvignon grapes from Napa and Lake Counties (UC Davis Teaching and Research Winery) in 2017 and 2018. The impact on wine composition, specifically smoke taint marker compounds (both free and bound volatile phenols as determined by GC- MS/MS and LC-MS/MS) as well as other key volatile and non-volatile compounds important for wine quality were evaluated to determine its effectiveness. Results indicated that although most amelioration techniques removed some smoke taint markers (both free and bound) and decreased smoke taint perception, it lacked specificity and impacted the overall attributes of the wine, in a negative way. However, the impact depended on the level of treatment needed and the decrease in mouthfeel could be adjusted using TTB approved products or blending. In conclusion, amelioration techniques are not 100% fixes of smoke taint but can significantly decrease smoke taint perception and with further research recommendation can potentially be made to the feasibility of treatment success based on the wine matrix so that winemakers can make informed decisions. A. Oberholster, Y. Wen, S. Hay, S. Dominquez Suarez, C. Brenneman, H. Heymann, S. Lafontaine, R. Cauduro Girardello, A. Rumbaugh, Viticulture and Enology, Univ. of California, Davis, aoberholster@ucdavis.edu

AGFD 23 WITHDRAWN

AGFD 24 CONTROL ID: 3424379
Rational approach to identifying novel wine grape odorant targets in grape germplasm based on expected stability during fermentation and storage Grape variety has a large influence on wine sensory characteristics, and grape breeders are interested in developing new wine grape cultivars with novel aromas. However, non-targeted screening by gas chromatography - mass spectrometry (GC-MS) of volatiles in grape germplasm collections is inappropriate because the majority of detected volatiles are well above their sensory thresholds. Detection of trace level volatiles would be laborious, if not impossible, to identify via this type of non-targeted GC-MS analysis. Additionally, screening germplasm by sensory evaluation is tedious, and will be further challenged by the potential for masking effects or for odorant instability during fermentation and storage. To facilitate efficient GC-MS screening of grape germplasm, we developed a set of empirical rules to determine appropriate odorant targets. Starting with a recently published list of known food odorants, we eliminated odorants that met one or more of the following criteria, i) known to be targets for yeast reductive activity (most carbonyls), ii) susceptible to hydrolysis or ethanolysis at wine pH (many esters), iii) exist in an ionized form at wine pH (most amines), iv) susceptibility to bisulfite addition or sulfitolysis, v) are highly hydrophobic based on published partition coefficient (log P) values. Odorants that are known to exist at high concentration in wines were also eliminated. Using these criteria, we identified 26 target compounds with a broad range of odor characteristics. Ongoing work is screening wild Vitis species from the USDA Cold Hardy Grape Germplasm by targeted GC-MS analysis for these compounds. T. Bates, X. Kuang, Food Sci., Cornell Univ., Ithaca, New York, G.L. Sacks, Food Sci., Cornell Univ., Ithaca, New York, tlb247@cornell.edu

AGFD 25 CONTROL ID: 3430457
Identification of monoterpene glycoside aglycones and changes in free and bound monoterpene content in Vitis vinifera cv. Riesling juice fermentations across four commercial yeast strains Monoterpene glycosides can serve as a reservoir for aroma active terpenes during wine fermentation and storage. For this study, relative abundances of monoterpene glycosides and their respective free volatiles were monitored by solid-phase microextraction gas chromatography mass spectrometry (SPME-GC/MS) and ultrahigh performance liquid chromatography quadrupole time of flight mass spectrometry (UHPLC-QTOF/MS) during alcoholic fermentations of Vitis vinifera cv. Riesling juice with four different yeasts across two successive years. Aglycones of monoterpene glycosides were identified using high performance liquid chromatography fractionation paired with SPME-GC/MS following acid and enzyme hydrolysis experiments. Complex relationships between the free volatile content and the monoterpene glycoside content were observed throughout the fermentations. Hydrolysis of glycosides also varied across both the yeast strain and year, with the greatest changes in relative abundances occurring during the first half of fermentation. A. Caffrey, L.A. Lerno, S.E. Ebeler, Dept of Viticulture and Enology, Univ. of California, Davis, J. Zweigenbaum, Agilent Technologies, Wilmington, Delaware ajcaffrey@ucdavis.edu

AGFD 26 CONTROL ID: 3404519
Encapsulation of food supplements including curcumin, in sporopollenin microcapsule obtained date palms and released in large intestine Emerging issues of health are a concern to the world population, and therefore the food industry has taken much attention to the search for novel food products bioactive compounds which are containing little or no synthetic ingredients in order to health-promoting. Based on this, our team studied the natural sporopollenin macroporous capsules (SMCs), extracted from date palm (Phoenix dactylifera L.), is loaded inside with curcumin (C) and bioactive colored compounds (B). SMCs/C and SMCs/BC were encapsulated by a natural polymer such as chitosan. SMCs/C, SMCs/BC, SMC/Cs@poly and SMCs/BC@poly were characterized by scanning electron microscope (SEM) in order to measure the length and pore sized, surface area (BET), Fourier-transform infrared (FT-IR), X-ray diffraction (XRD), differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA). In vitro releasing of the curcumin and bioactive colored compounds at different pH from sporopollenin. The encapsulated material will be used in the in vitro digestive simulation system (SHIME) and the release of functional curcumin and bioactive colored compounds will be measured in all GI compartments. A. Aldalbahi, Chemistery, King Saud Univ., Riyadh, Saudi Arabia aaldalbahi@ksu.edu.sa

AGFD 27 CONTROL ID: 3411710
Rapid quantitation of 14 mycotoxins by liquid chromatography-tandem mass spectroscopy A rapid and simple analytical method was developed for the simultaneous quantification of aflatoxins (AFB1, AFB2, AFG1 and AFG2), ochratoxin A (OTA), zearalenone (ZON), deoxynivalenol (DON), nivalenol (NIV), diacetoxyscirpenol (DAS), fumonisins (FB1, FB2 & FB3), T-2 toxin (T-2), and HT-2 toxin (HT-2) in corn. Sample preparation was based on the extraction with acetonitrile, QuEChERS and cleanup with EMR lipid removal. Reconstitution process in methanol/water was used to improve the MS responses and then the extracts were analyzed by LC-MS/MS.

Mixed matrix-matched calibration standards were prepared by using the same matrix blank. The recovery ratios for all mycotoxins are between 69-98% except NIV with 55% at different fortification levels and method detection limits are lower than the established EC and FDA action levels. The optimized method was then applied to a wider commodity range. Since there is no robust, reliable and official technique for determination of all these 14 mycotoxins in different agricultural products, a sensitive and versatile method in daily practice is highly desired. The reliability of this mycotoxin analysis was approved by participating in several AAFCO proficiency tests and a comparison study project. In this study, a wide variety of sample preparation, extraction solvents, mobile phases, and cleanup techniques were applied. This present manuscript introduces a simplified method based on a QuEChERS approach with significant improvement on matrix effects and wide physicochemical properties of mycotoxins as limitations and challenges. B. Nakhjavan, N. Ahmed, M. Khosravifard, CA Dept. of Food and Agriculture, Center for Analytical Chemistry, Sacramento, California, bahar.nakhjavan@cdfa.ca.gov

AGFD 28 CONTROL ID: 3415463
Non-targeted screening study of chemical hazard factors in rice based on metabolomics strategy Rice samples from different regions of the country are taken as research objects. By optimizing extraction methods, the endogenous small molecular components in rice are comprehensively detected by ultra-high performance liquid chromatography tandem time-of-flight mass spectrometry (UPLC-QTOF MS), and the results are processed by the combination of metabolomics strategy and chemometrics. The endogenous spectrum library of small molecular compounds in Chinese rice was constructed. In addition, the non-target model for screening contaminated and illegally added rice was constructed and the validity of the model was evaluated with simulated contaminated samples. The results showed that two data processing methods, Perato scaling and variance unit, were used to build the model. The predictive effect of the model was evaluated by using 10%, 20%, 30%, 50% and 100% doped samples as test sets. Four suspicious compounds were screened by partial least squares (PLS) model. All these results showed the potential application of combining metabolomics strategies and chemometrics in improving the analytical approaches of rice qualities, and enlarge the specific application to other foodstuffs in the future. B. Gao, Univ. of Maryland, College Park, Maryland, W. Zheng, M. JIn, Shanghai Jiao Tong Univ., Shanghai, China L. Yu, Nutrition and Food Sci., Univ. of Maryland, College Park zhengwenhao@sjtu.edu.cn

AGFD 29 CONTROL ID: 3415477
Geographical origin discrimination of Chinese wheat using ultra-high-performance-liquid-chromatography tandem mass spectrometry (UPLC-MS) coupled with multivariate data analysis Wheat is the staple food of an enormous number of people around the world. Wheat with specific geographical origin is usually considered as specific product quality together with corresponding commercial value. Aiming at geographical origin discrimination of wheat, analytical methods need to be established. A total of 94 wheat samples originating from 8 provinces of China was studied. Based on the optimization of extraction method, ultra-high- performance-liquid-chromatography tandem time-of-flight mass spectrometry (UPLC-QTOF MS) was used for the detection. Principal component analysis (PCA) and partial least squares discriminant analysis (PLS-DA) were associated and compared in different provenances. As the results, UPLC-MS together with both multivariate data analysis methods were able to distinguish wheats from different origins. In addition, the results indicated that wheat in Henan Province distributed in the center of the PCA scores plot, which is consistent with its actual location of China. Wheat in Henan Province is the general representative of Chinese wheat, in terms of small molecular components. On the other hand, the profile of small molecules in wheat has been constructed to better understand the chemical composition of wheat. B. Gao, Univ. of Maryland, College Park, Maryland, M. JIn, W. Zheng, Shanghai Jiao Tong Univ., Shanghai, China L. Yu, Nutrition and Food Sci., Univ. of Maryland, College Park jmcstudy1997@163.com

AGFD 30 CONTROL ID: 3420014
Alternative testing methods for safety assessment associated with liver injury Adverse outcome pathways (AOPs) are conceptual frameworks to provide the relationship amongst a molecular initiating event (MIE) and key events (KEs) at different levels of biology, i.e. molecular, cellular/organelle, organ and whole organism. It is expected that AOP can be used to accelerate the screening and assess the thousands of chemicals that are currently in development for Integrated Approaches to Testing and Assessment (IATA). Here we suggest the alternative methods to screen the potential toxic compounds related to hepatotoxicity. First, we developed the pathway-sensing hepatocytes to screen the cellular stress and quantification method based on image analysis. Several transcriptional factors including AP-1, P53, Nrf2, and NFkb which are regulated during cellular stress response including cell proliferation, apoptosis, oxidative stress, and inflammation. To screen the cellular stress response, we constructed the established HepG2 cell lines to express the luminescence and GFP when only this transcriptional factors are activated using the transcription response element. The pathway-sensing hepatocytes is suitable for screening the hepatotoxicity and could give critical information about molecular mechanisms to initiate the cellular stress. Second, we developed the in vitro hepatic models to evaluate zone-specific hepatotoxicity in the liver. We generated a 3D hepatic zonal channel in which cytochrome P450 were differently activated depending on the zonal distance by a linear gradient of CHIR, Wnt signalling inducer. The potential to extend the applicability of the 3D hepatic zonal channel model for high-throughput screening of zonal hepatotoxicity was investigated by direct imaging analysis. The proposed 3D hepatic zonation system is a simple and robust model for generating a zonal distribution of drug metabolism and permits screening of zonal hepatotoxic drugs as well as sub-acute toxicity over several days. The zonal toxicity profiles can give information to explain the conflicting data on heterogeneous drug metabolism and to clarify the spatial heterogeneity of toxicological responses. These quantification methods can be used to classify the potential hepatotoxic compounds and develop the IATA based on AOP. J. Oh, Korea Inst. of Toxicology, Daejeon, Korea(The Republic of) jhoh@kitox.re.kr

AGFD 31 WITHDRAWN

AGFD 32 CONTROL ID: 3431217
Using mass spectrometry to quantify prion polymorphisms and phenotypes in heterozygous sheep and deer Prions (PrP sc) are molecular pathogens that replicate by inducing a natively expressed cellular prion protein (PrP c) to adopt the prion conformation. The efficiency of this conversion is highly dependent on the sequence of (PrP c) Homozygous sheep expressing arginine (R) at position 171 are resistant to classical scrapie. Such sheep, however, are highly susceptible to a novel sporadic scrapie strain referred to as Nor98, or atypical scrapie. Sheep and cervids (deer, elk, moose, etc.) each express at least 20 different (PrP c)polymorphisms. Unlike sheep, none of the cervid polymorphisms completely protect against chronic wasting disease (CWD) infection. (PrP c)contains post- translational modifications, variable asparagine glycosylation and a glycosylphosphatidylinositol (GPI)-anchor, which preclude a simple whole protein-based analysis. Trypsin, chymotrypsin, or a sequential

digestion of both enzymes was, therefore, used to generate a set of peptides suitable for a multiple reaction monitoring (MRM)-based analysis that spanned the known sheep and cervid (PrP c) polymorphic sites. Calibration curves relating the area ratios of the MRM signals from polymorphism-containing peptides to internal standard peptides were linear with excellent correlation coefficients. This approach was used to measure the relative amounts of PrP polymorphisms in heterozygous sheep naturally infected with classical scrapie and in deer experimentally infected with CWD. The same approach was also used to measure the relative propagation of PrP polymorphisms in heterozygous sheep naturally infected atypical scrapie. It was also used to quantify the relative amount of PrP polymorphisms in CWD strains whose propagation properties are substantially altered. In this way, mass spectrometry can be used to quantitate phenotypic differences in classical and atypical scrapie and CWD prions. C.J. Silva, M.L. Erickson-Beltran, Agricultural Research Service, United States Dept. of Agriculture, Albany, California, C. Duque Velásquez, J.M. Aiken, D. McKenzie, Centre for Prions and Protein Folding Diseases, Univeristy of Alberta, Edmonton, Canada I. Martín-Burriel, LAGENBIO, Laboratorio de Genética Bioquímica, Facultad de Veterinaria, Univ. of Zaragoza, Spain I. Martín-Burriel, J.J. Badiola, B. Marín, R. Bolea, Veterinary Faculty, Centro de Investigación en Encefalopatías y Enfermedades Transmisibles Emergentes (CIEETE), Univ. of Zaragoza, Spain J.R. Requena, CIMUS Biomedical Research Inst. & Dept. of Medical Sciences, Univ. of Santiago de Compostela, Santiago de Compostela, christopher.silva@ars.usda.gov

AGFD 33 CONTROL ID: 3432186

Rapid, portable detection of amatoxins (amanitins) by lateral flow immunoassay: Applications using mushrooms and urine samples With the continued emergence and spread of amatoxin-containing mushrooms globally, there is need for a rapid, accurate, and easy-to-use Tech. to identify deadly poisonous mushrooms and to improve clinical diagnosis of mushroom poisonings in humans as well as in animals. Globally, mushroom poisonings cause about 100 human deaths each year, with thousands of people requiring medical assistance. The mushroom poison that causes the most deaths is amanitin (or amatoxins). Current methods to sensitively and selectively detect these toxins are limited by the need for expensive equipment, or they lack accuracy due to high cross-reactivity with other chemicals found in mushrooms. In this work, we report the development of a competition-based lateral flow immunoassay (LFIA) for the detection of amatoxins. Our assay clearly indicates the presence of 10 ng/mL of α-AMA or γ-AMA and the method including extraction and detection can be completed in approximately 10 minutes. The test can be easily read by eye and has a presumed shelf-life of at least 1 year. We tested mushrooms (dried and fresh), as well as urine (human and dog) samples by LFIA. Mushrooms were extracted in a saline buffer in <1 min and a small aliquot of the sample was applied to the LFIA test strip. Human urine samples were fortified to recapitulate previously identified amatoxins concentrations from an exposure study. Dog urine samples were obtained from suspected mushroom intoxications as well as control samples from healthy and sick animals. Urine samples were directly applied to the LFIA test strip without sample preparation. The LFIA accurately identified 6 mushroom species that were known to contain amatoxins. Analysis of both fortified human urine samples and urine samples from intoxicated dog, using the LFIA test correlated well with liquid-chromatography mass spectrometry (LC-MS) methods. The efficiency of the LFIA in identifying amatoxin positive urine samples ranged from 78.9-94.6% with limited sample sizes (n=38 and n=96, respectively). The data illustrates excellent analytical performance of the LFIA for the rapid, sensitive, selective, and accurate detection of amatoxins. This assay can be used to address the shortcomings (speed, portability, cost) of current clinical diagnostics, holding high promise to identify fatal mushroom poisonings sooner. In addition, this LFIA can be used to aid mycologists and clinicians to quickly identify amatoxin-containing mushrooms. C. Bever, L. Cheng, L. Stanker, FTDP, USDA, Albany, California, R. Hnasko, USDA, Albany, California, J. Kae, PESCM, San Rafael, California, R. Poppenga, M. Filigenzi, UC Davis, California, K.D. Swanson, E. Hamelin, ERB/DLS/NCEH, Centers for Disease Control and Prevention, Dunwoody, Georgia, C. Adams, UC Berkeley, California Candace.bever@ars.usda.gov

AGFD 34 CONTROL ID: 3427049

Bioactive compounds from porphyra tenera, a popular edible seaweed, with potential anti-inflammatory and anti-colon cancer activities Red seaweed Porphyra tenera, one of the popular edible seaweed in Asia countries, contains many bioactive compounds with potential health benefits. Most studies have targeted on the extractable bioactive compounds (EBCs), while non-extractable bioactive compounds (NEBCs) was largely ignored even though they may contribute to important health benefits. The aim of this work was to characterize the profiles of EBCs and NEBCs from whole porphyra tenera and evaluated their anti-inflammation and anti-colon cancer activities. Polyphenols, flavonoids, tannins, carbohydrates, proteins and anthocyanins were identified and quantified in EBCs and NEBCs. Both of EBCs and NEBCs showed anti-inflammatory effects in inhibiting the production of LPS-induced nitric oxide (NO) and reactive oxygen species (ROS) in RAW 264.7 macrophages in dose-dependent manners. Further test revealed that both EBCS and NEBCs downregulated the inducible nitric oxide synthase (iNOS), cyclooxygenase-2 (COX-2), proinflammatory cytokines such as IL-1β, IL-6, and TNF-α, and upregulated Heme oxygenase 1 (HO-1) and NADPH- quinone oxidoreductase-1 (NQO-1) in macrophages. EBCs and NEBCs fraction also showed inhibitory effects on the viability of human colon cancer cells in dose and time-dependent manner and regulated the expression levels of tumor suppressor proteins and cyclin-dependent kinases. EBCs and NEBCs caused cell cycle arrest at the G0/G1 phase and induced cellular apoptosis in colon cancer cells. Overall, our results suggested that both EBCs and NEBCs from porphyra tenera showed promising protective effects against inflammatory disease and colon cancer. L. Yi, Y. Han, Q. Wang, H. Xiao, Dept. of Food Sci., Univ. of Massachusetts, Amherst, Ylxiao9435@hotmail.com

AGFD 35 CONTROL ID: 3427767

Cottonseed-derived compounds regulate anti- and proinflammatory gene expression in mouse cells Plant bioactive compounds such as plant polyphenols have been used for the prevention and treatment of various diseases since ancient history. The objective of this study was to investigate the effect of cottonseed-derived gossypol and ethanol extracts on the cytotoxicity and regulation of anti- as well as proinflammatory gene expression in mouse cells. Mouse RAW264.7 macrophages were treated with various concentrations of gossypol and cottonseed extracts for 2-72 h. MTT, qPCR and immunoblotting assays were used to evaluate the effects on cell viability and gene expression in the mouse cells. Gossypol was toxic to macrophages under high concentration or long time treatment. No cytotoxicity effect was observed in macrophages treated with extracts from the coat or kernel of glanded and glandless cottonseed. qPCR assay showed that gossypol treatment stimulated antiinflammatory tristrataprolin (TTP) expression 6-20 fold after 2-24 h. Gossypol increased TTP homologous ZFP36L1, ZFP36L2 and ZFP36L3 mRNA levels by 58, 26 and 69 fold in 24 h-treated macrophages, respectively. Immunoblotting confirmed that gossypol increased TTP and ZFP36L1 proteins in macrophages. Gossypol also increased proinflammatory cytokines TNF, COX2, GM-CSF, INFγ and IL12b mRNA levels up to 39, 458, 136, 62 and 103 fold,

respectively. However, cottonseed extracts exhibited modest effect on TTP family gene expression in macrophages but glandless cottonseed coat extract significantly increased TTP mRNA and protein levels with a magnitude similar to cinnamon and green tea polyphenol extract and insulin. These results demonstrated that gossypol induced macrophage death that was accompanied with massive stimulation of antiinflammatory TTP family and proinflammatory cytokine gene expression and that cottonseed extracts are harmless towards the mouse cells and that glandless cottonseed coat extract stimulates TTP gene expression. We propose that glandless cottonseed could serve as a plant-based source of polyphenols with antiinflammatory property. H. Cao, K. Sethumadhavan, Southern Regional Research Center, USDA-ARS Southeast Area, New Orleans, Louisiana, heping.cao@usda.gov

AGFD 36 CONTROL ID: 3428669
Retinoic acid signaling pathways in development and diseases Animals are unable to synthesise vitamin A denovo, therefore, it must be obtained through the diet. Carotenoids, the main precursor of fat soluble vitamin A, including alpha/beta carotene, are converted to retinal and subsequently to retinoids.A number of studies have suggest that the active derivative of vitamin A, retinoic acid (RA), may be important for the development of mammalian embryos. Retinaldehyde dehydrogenase 2 (Raldh2) enzyme is an NAD dependent aldehyde dehydrogenase with high substrate specificity for retinaldehyde. Retinoic acid (RA) synthesised by the post implantation mammalian embryo is an essential developmental hormone whose lack leads to early embryo death. Influence of vitamin A (retinol) on growth depends on its sequential oxidation to retinal and then to retinoic acid (RA). Several members of the aldehyde dehydrogenase family of enzymes are able to catalyse irreversibly the oxidation of retinal to retinoic acid. It is understood that retinoic acid synthesis from its precursor retinol involves a two step oxidation that resembles the oxidation of ethanol to acetic acid. The short chain dehydrogenase/reductase family (SDR) includes microsomal enzymes reported to convert retinol to retinal. (RoDH1, RoDH2, CRAD1, CRAD2, RDH5). Biochemical conversion of carotenoid/retinoids to Retinoic acid (RA) is essential for normal regulation of a wide range of biological processes, including development, differentiation, proliferation and apoptosis. Retinoids regulate various physiological outputs by binding to nuclear receptors—retinoic acid receptors (RARs) and retinoid X receptors (RXR), which are DNA binding transcriptional regulators. Cellular RA binding protein (CRABP) allows RA to enter the nucleus where it can serve as a ligand, with various nuclear receptors including RAR and RXR, to mediate genomic and non-genomic mechanisms. H. Laxminarayan, Microbiology and Immunology, Univ. of Madras, Chennai, Tamil Nadu, India H. Laxminarayan, Applied Sciences, Darlington College, Darlington, County Durham, UK harinilaxminarayan@gmail.com

AGFD 37 CONTROL ID: 3429473
MiR-27a-5p regulates mitochondrial dysfunction and intrinsic apoptosis induced by acrylamide via targeting Btf3 Acrylamide (AA), as a neurotoxic and potential carcinogenic contaminant, usually generated during food processing at high temperature. Studies indicated that AA-induced mitochondrial dysfunction was closely related to its toxicity while the molecular mechanism is not clear. MicroRNAs (miRNAs) are a kind of endogenous, non-coding, small RNAs, the expression of which could be modulated by exogenous compounds. Our former research suggested AA increased the expression of miR-27a-5p in most tissues of SD rats. In this study, Btf3 was identified as target gene of miR-27a-5p by dual luciferase reporter system. MiR-27a-5p induced mitochondrial dysfunction and apoptosis by inhibiting the expression of Btf3 in normal rat liver cells (IAR20), and overexpressing Btf3 could partially counteract the effects caused by miR-27a-5p. Similarly, the effects of the miR-27a-5p-inhibitor were also rescued by Btf3-siRNA. Furthermore, we found that miR-27a-5p activated the ATM-p53-mitochondrial-apoptosis signaling pathway by down- regulation of Btf3. Therefore, we suggested miR-27a-5p-Btf3-ATM axis may play a key role in the regulation of AA induced mitochondrial dysfunction and apoptosis, which could provide a potential therapeutic target for AA induced toxicity. L. Zhang, L. Yang, L. Dong, F. Chen, China Agricultural Univ., Beijing lujiazhang0118@163.com

AGFD 38 CONTROL ID: 3431378
Sustainability indicators for selected greenhouse production facilities in North America Greenhouse crop production is increasing as consumer demand increases, specifically in areas where the natural climate is more hostile to the desired production. However, no assessment of the sustainability of existing facilities currently exists, and there is sufficient consumer demand for assessing this from seed to shelf. The purpose of this study was to assess the sustainability of current systems in North America. This was accomplished through the development of various sustainability or S-score equations. This report focused on greenhouse safety practices at observed facilities and specific factors affecting the subsequent S-scores. Approximately 20 hoophouse and greenhouse facilities in both the public and private sector volunteered to provide data for these equations. Each facility was assigned a region: Florida, Northeast, Midwest, Northwest and Southwest. Key parameters were organized according to four general categories based on economic, environmental, social and safety aspects. Each category was assigned a weight. Each weight was then incorporated into the master sustainability equation as coefficients. The final value was an "S-score" for each facility. The facilities ranged in size from seasonal, single-house hoophouse to large facilities ranking in the top 10 for indoor agricultural production. Additionally, facilities with either or both vegetable and ornamental production participated in this study. Overall, greenhouse facilities were found to have a range of S-scores. However, each facility required at least type of safety improvement. J. Thissen, P. Davidson, Univ. of Illinois Urbana Champaign, jaimethissen1@gmail.com

AGFD 39 CONTROL ID: 3432200
Changes in dietary patterns and associated human behaviors in southwestern US municipal wastewater during the COVID-19 global pandemic Individual dietary and recreational behaviors typically follow a routine due to patterns dictated by fixed work schedules and conventional societal norms (i.e., consumption of three meals per day and alcohol on the weekends). The COVID-19 global pandemic has uprooted these routines with shelter-in-place orders, closures of small businesses, and shortages of common dietary and sanitizing consumables. Isolation and uncertainty of this magnitude can place great stress on communities, resulting in changes to behaviors and, consequently, adverse health outcomes. Wastewater-based Epidemiology (WBE) is a proven Tech. to monitor trends in population-level activity by sampling municipal wastewater and measuring human biomarkers that are excreted in urine and feces. The success of WBE in monitoring such compounds such as illicit drugs has promoted its application to other health indicators of broader public health measures. This study aimed to investigate fluctuations in temporal trends, before, during and after spikes in COVID-19 reported cases, by examining human biomarkers indicative of diet, recreational behaviors, and stress in municipal wastewater. Composite samples collected over 24 hours were obtained for 15 days per month from a small sewer catchment located in a city in the Southwestern United States. Compounds of interest and corresponding metabolites included: isoflavones (daidzein, genistein, equol), lignans (enterolactone), alcohol (ethyl sulfate), nicotine (cotinine, hydroxycotinine) caffeine (paraxanthine), and

stress (cortisol, cortisone, tetrahydrocortisone, tetrahydrocortisol). Preliminary results indicate significant changes of these measured biomarkers (p= 0.05) prior to the start of the outbreak in the U.S., as compared to those measured during the shelter-in-place orders. This study highlights the utility of WBE to elucidate changing human behaviors as they unfold in times of crises; showcasing a unique case study during the COVID-19 event. Thus, results may provide relevant information for local, state, and federal stakeholders on unintended implications resulting from the US national emergency response. D.A. Bowes, E.M. Driver, R.U. Halden, Biodesign Center for Environmental Health Engineering, Arizona State Univ., Tempe, D.A. Bowes, R.U. Halden, OneWaterOneHealth.ORG, Arizona State Univ. Foundation, Tempe, dbowes@asu.edu

AGFD 40 CONTROL ID: 3433019

Human bitter taste sensing receptor T2R50 mediates the anti-inflammatory effect of trans-resveratrol in human gingival cells in culture Recent data have shown anti-inflammatory effects for trans-resveratrol (RSV) and rosmarinic acid (RA) in various immune competent cell models through inhibition of lipopolysaccharide (LPS)-induced TNF-α- and IL-6- release. Since both compounds have been reported to taste bitter, we hypothesized an involvement of human bitter taste sensing receptors (T2Rs) in the RSV- and RA-evoked anti-inflammatory effect in LPS-treated human gingival fibroblasts (HGF-1) in culture. First, the bitter taste intensity of RSV and RA was compared in a sensory trial with 10 untrained panellists of whom 90 % rated a 50 ppm RSV in water solution more bitter than 50 ppm RA. A mean 19% reduction of the RSV-induced bitter taste intensity was achieved by co-administration of 50 ppm of a bitter-masking compound. This characterization of RSV as the compound showing a higher bitter taste intensity than RA was verified by means of a human gastric cell model (HGT-1 cells) for which a T2R-linked proton secretion has been demonstrated as a suitable mechanism for the identification of bitter tasting and bitter taste modulating compounds. Next, the immune-modulatory effect of 50 ppm RSV was studied in 10 µg/mL LPS-treated immune competent HGF-1 cells. After 6 hrs of treatment, RSV reduced LPS-induced IL-6 gene expression and release by -46.2 ± 12.7 % and -73.8 ± 10.6 %, respectively. This RSV-evoked effect was abolished by co-administration of a bitter-masking compound. Since qRT-PCR analyses revealed a regulation of T2R50 in RSV w/o the bitter masking compound treated HGF-1 cells, an siRNA knock-down approach was applied to demonstrated involvement in the RSV-induced reduction of LPS-evoked IL-6 release in HGT-1 cells. Since a chemical interaction between RSV and LPS was excluded by LC-MS/MS analyses, the molecular mechanism of the interaction between RSV and the T2R50 has to be identified by means of a computational pharmacology approach. J. Tiroch, S. Sterneder, B. Lieder, A. Holik, V. Somoza, Nutritional and Physiological Chemistry, Univ. of Vienna, Austria V. Somoza, Leibniz Inst. of Food Systems Biology at the Technical Univ. of Munich, Germany |J.P. Ley, Symrise AG, Holzminden, johanna.tiroch@univie.ac.at

AGFD 41 CONTROL ID: 3406406

Viability of Lactobacillus rhamnosus GG microencapsulated in alginate/chitosan hydrogel particles during storage and simulated gastrointestinal digestion: Role of chitosan molecular weight Sodium alginate hydrogel particles coated with cationic biopolymers have been shown to be one of the promising means for probiotic encapsulation and protection. In this study, we aimed to systematically explore the effect of molecular weight of chitosan coating on the functional performance of sodium alginate hydrogel particles for improving the viability of Lactobacillus rhamnosus GG (LGG). We first electrostatically deposited three different molecular weights of chitosan coatings, i.e., chitosan oligosaccharide (COS), low molecular weight chitosan (LMW- chitosan) and medium molecular weight chitosan (MMW-chitosan) on sodium alginate hydrogel particles. Both SEM and FTIR results indicated that chitosan was successfully deposited onto the surface of the hydrogel particles. We then evaluated the effect of chitosan MW on the viability of LGG encapsulated in the hydrogels during long-term storage and simulated gastrointestinal digestion. Among them, the hydrogel particles coated with COS prevented the viability loss of LLG during long-term storage at different temperatures (4, 25 and 37 °C). However, we did not find any improvement in the viability of the encapsulated LGG by all three chitosan coatings during simulated digestion. X. Qi, J. Rao, plant sciences, North Dakota State Univ., Fargo xiaoxi.qi@ndus.edu

AGFD 42 CONTROL ID: 3429563

Spencer Award Address: A multidisciplinary journey through agricultural and food chemistry In this Kenneth A. Spencer symposium, I shall discuss my multidisciplinary involvement in the areas of agricultural and food utilizing chemistry, applied engineering, and number of aspects of a diverse portfolio of food Tech. applications. This has involved a number of research and development activities in academia, government, and industrial laboratories, in both basic as well as applied research projects spanning over 50 year period. These R&D activities have been connected through the use of separation and processing technologies, particularly using sub- and super-critical fluids whose use promote environmentally-sustainability and have resulted in many consumer-friendly products. The roadmap to these developments have included many collaborations both nationally and internationally - liaisons with researchers/institutions in Europe, Asia, and Latin America, including the USA-regulatory agencies of FDA, FSIS, FGIS, and EPA. Exploitation of synergisms that existed between chemistry-engineering using compressed-CO2 and water media will be discussed, often times citing multi-mode applications that involved extraction, fractionation, and reaction performed sequentially on food or energy crop materials to yield specific end-use products. Specific examples that will be cited are utilization of lipolysis esterification or hydrogenation coupled for synthesis, nutrient analysis, and characterization of archeological artifacts. Major investigative techniques that have been employed are Hansen- solubility parameter theory, physicochemical chromatographic-based measurements, and novel high pressure equipment for both processing and analytical purposes. A major R&D emphasis over this time period has been creating value-added by-products from agriculturally-derived processing wastes; grape/berry pomaces, deodorizer distillates, expeller-derived residues, and wood wastes. Seminal studies involving adsorbent-adsorbate interactions, high pressure phase equilibria-solubility modeling, and CO2 based cleaning-conversation processing have supported the applied studies on the above foodstuffs, biomass, and recently, cannabis-hemp. Finally, this presentation will conclude by presenting a collage of products the awardee has been directly or indirectly-involved in the development of using the critical fluid Tech. platform. J.W. King, CFS, Fayetteville, Arkansas, kingjw100@hotmail.com

AGFD 43 CONTROL ID: 3431671

Government/Industry teamwork to expand the uses of supercritical fluids There has been an expansion in the uses of supercritical fluids (SCF) over the past several decades. Then start-up company, Applied Separations was influenced by key investigators, Dr. Jerry King and another USDA researcher, Dr. Robert Maxwell. Under a government-industry sponsored CRADA, they teamed up to develop a safe, easy-to-use instrument to investigate the properties and uses of supercritical CO2. This culminated in the Applied Separations' Spe-ed SFE-2 instrument, followed by numerous associated instrumental developments. From an obscure mention in physical chemistry textbooks, normally only referencing its use in

decaffeinating coffee, there are now many new applications of SCFs as an extraction and reaction medium, largely fueled by the "Green Revolution", i.e. consumers demanding products and processes using non-organic solvents. Both for health and environmental concerns, more and more extractions of foods and natural products employ SCCO2. The adjustable power of these fluids under compression continues to open up exciting new possibilities in such fields as materials science, cleaning, energy, and most recently in cannabinoid processing. In this presentation, we will touch upon some of the many uses that today's researchers are using SCFs for, and the resultant end-products. R. Schlake, Applied Separations, Allentown, Pennsylvania, r.schlake@appliedseparations.com

AGFD 44 CONTROL ID: 3428038
Do berry volatiles play a role in health promotion? Berries are rich source of phytochemicals, especially polyphenolics that are thought to protect against a number of chronic diseases. Berries also contain volatile compounds comprising a complex mixture of monoterpenes, ketones, acids, esters, furans, aldehydes, alcohols and lactones that are responsible for the unique aromas of berries. However, information is lacking on volatile composition of berries and their potential health benefits. In this study we isolated phenolic and volatile fractions from fresh blueberries, blackberries, red raspberries, black raspberries, cranberries and strawberries. Black raspberries had the highest levels of total phenolics followed by cranberries, blueberries, blackberries, red raspberries, and strawberries. Blackberries had the highest levels of volatiles followed by black raspberries, strawberries, cranberries, red raspberries, and blueberries. Each berry contained a complex fingerprint of volatiles that impart unique aromas. Monoterpenes predominated in black and red raspberries, blueberries, cranberries, and strawberries, while acids predominated in blackberries. Phenolic and volatile fractions were evaluated for anti-proliferative activity using Caco-2 colon cancer cells at concentrations close to those found in fresh berries. The percentage inhibition of cell proliferation compared with the control for the phenolic fraction ranged from 3% for black raspberry to 58% for blueberry, whereas the values for the volatile fraction ranged from 5% for blackberry to 43% for black raspberry. The volatile fraction inhibited cellular proliferation much better than the phenolic fraction at 12 hr, whereas the phenolic fraction generally showed greater inhibition after 24 hr. Berry volatiles showed comparable anti-proliferative activity as phenolics despite being present in the fruit at 300 to 2700-fold lower concentrations. In addition to impacting aroma of berries, volatile compounds may play an important role in health-promotion. More research is needed to determine the bioavailability and mechanisms responsible for anti-proliferative activity of berry volatiles. L. Howard, S. Lee, C. Brownmiller, Univ of Arkansas, lukeh@uark.edu

AGFD 45 CONTROL ID: 3431825
Extraction of oilseeds with supercritical carbon dioxide. Effects on oil and meal properties Environmental issues surrounding the use of hexane for solvent extraction of oilseeds prompted development of technologies to replace the toxic and explosive hexane. In preliminary studies a number of oilseeds including, soybean cottonseed, and corn were extracted in batch reactors with super critical carbon dioxide. (SCF SC- CO2) at 50 C and 8000 psi followed by characterization of the oil and meal. Later studies showed the solubility of triglycerides in SC-CO2 at 80C and 12,000 psi to be infinite. Our preliminary studies carried out 50C and 8000 psi showed that SFE offers a number of advantages over hexane. The solubility of phosphatides in SC-CO2 is extremely low and therefore shows less refining loss compared to hexane extracted crudes SC-CO2 extracted oils are generally low in color as well. Crude cottonseed oil is quite dark because of gossypol and related pigments are soluble in hexane. Furthermore hexane or prepress solvent crude cottonseed oil upon storage undergoes color fixation that is difficult to remove by caustic refining and adsorbent bleaching. SFE extracted crude cottonseed oil showed less tendency to undergo color fixation The flavor and oxidative stability of SFE extracted oils were excellent .Soybean meal is characterized by off flavors described as beany. Under proper SFE extraction conditions of pressure moisture and temperature off flavors are markedly reduced in soy flakes. Improvements in corn germ flour were also evident. A process was developed where crude degummed soybean oil extracted with supercritical CO2 is fed directly from the extraction vessel to the deodorizer thereby eliminating caustic refining, The water washing, and adsorbent bleaching. Oils processed by this Tech. had excellent color, flavor and oxidative stability. G.R. List, List Consulting, Secor, Illinois, grlist@telstar-online.net

AGFD 46 CONTROL ID: 3430778
Application of solubility concept in bioprocessing industries Bioprocessing has been touted as sustainable alternate technological platform to produce several products that have been predominantly produced from petrochemical feedstocks. Significant advances were made in this Tech. with the improvements to bioengineering but, at scale, it is still affected by downstream processing costs that require separation of the products from the fermentation broth followed by purification. The fermentation broth is usually aqueous phase and contains nutrients, surfactants, vitamins, minerals (that are needed for growth of micro- organisms), unused sugars, and other secondary metabolites produced by the micro-organisms as part of their biochemical pathway. Traditional downstream processing operations are usually less efficient and/or energy-intensive depending on the nature of the fermentation broth or the product to be separated and hence, there is a need for better processes that are efficient and cost-effective. The solubility parameter concept has been used to predict optimal conditions and solvent for extraction of specific components from product matrices. However, the concept can also be used to efficiently predict solvent and conditions to extract products from aqueous fermentation broths. For example, with recent developments in bioprocessing to produce cannabinoids, fermentation processes need a solvent relay that is compatible with both the bioprocess as well as the cannabinoid compound being produced. The role of the solvent relay is to extract the cannabinoid product from the aqueous phase to prevent product inhibition or product saturation, due to their low aqueous solubility. Product saturation is particularly a problem in aerobic fermentations since excess cannabinoid products outside the aqueous phase can be lost to the atmosphere due to volatilization. In such cases, solubility parameter concept has been successfully used in determining solvents that can be used as relays to separate such compounds from the aqueous fermentation broth while being compatible with the bioprocess. Similarly, solubility parameter concept has also been applied to predict optimal conditions for extraction of high-value low- molecular weight organic acids such as acetic acid from fermentation broth and these predictions have been compared with experimental measurements. The goal of this study is to apply Hansen solubility parameters to solve problems with product separation and purification in the bioprocessing sector. K. Srinivas, BlueNalu, San Diego, California keerthivasan1@gmail.com

AGFD 47 CONTROL ID: 3427059
CBD extraction and capstone design The Faculty of Engineering at the Univ. of Alberta has been graduating chemical engineers for over seventy years and many of those engineers have made their careers in the oil and gas industry or the petrochemical industry. While these industries will continue to be a part of the Alberta economy, efforts to diversify the industrial base have become critical to young chemical engineers as they begin their careers. In an effort to encourage chemical engineering students to consider alternate career paths and options we began to look for alternative projects and

industry advisors for capstone design. Dr. Jerry King, a renowned SFE process expert was invited to join our industry advisor team in 2016 and he agreed. We began working on developing a project design basis. This contribution discusses the challenges and the successes of working with chemical engineering capstone design students on the extractive process. The most popular projects offered turned out to be CBD extraction from Hemp. The benefits to the students of stepping outside their comfort zone were high. Students working on these projects often needed data to define their process options and that data was not always readily available. They learned that assumptions impact the process design and that a robust design must account for that uncertainty. They also learned about scale-up. Dr. King has worked with us for the last four years, most recently with a team working on evaluating ethanol extraction methods. M.V. Jamieson, Chemical and Materials Engineering, Univ. of Alberta, Edmonton, Canada mvjamies@ualberta.ca

AGFD 48 CONTROL ID: 3429564
Study of operating conditions for supercritical fluid extraction equipment at industrial scale to obtain an enriched-CBD extract from Colombian cannabis The growing medicinal cannabis industry has significantly impacted the global economy. Colombia was granted a worldwide production quota of 21.9% for medical cannabis for 2020. Obtaining cannabis derivatives involves extraction processes on plant material and subsequent purification processes, which is a challenge for this industry. The present study focuses on the standardization of cannabidiol (CBD) extractive process at an industrial level using SFE. The variables studied with respect to the extraction yield and CBD content in the extract were the pressure and temperature combination, the flow, and the operation mode. The experimental ranges evaluated for temperature and pressure were 150 to 300 bar and 40 to 70°C. The flow was studied between 84 to 130 Kg/ h. The serial mode of extraction involves the use of at least three extraction vessels to take advantage of the initial part of the extraction curve where the extraction rate is high which facilitates subsequent extraction on second vessel, etc. This utilizes multiple plant material charges. The other operation mode evaluated is called soaking, in which initially the extraction container previously loaded with plant material is than filled with CO2 and the inlet and outlet valves closed to promote the solubility of the solutes. After a while, a continuous stream of CO2 is passed through the extractor to remove all the dissolved cannabis components dissolved in the CO2. The best kinetic extraction curve was found at a pressure and temperature from 190 to 240 bar and 50 to 70°C. The optimal CO2 flow range was found to be between 120 to 150 Kg/h. Finally, the best operation mode was in serial, was found to be 7.5 hour thereby allowing the processing of almost 50 Kg of plant material with a 12.54 % yield. A.C. Gallo Molina, A. García, Bogotá, Universidad Nacional de Colombia, Bogotá acgallom@unal.edu.co

AGFD 49 CONTROL ID: 3423918
Topological effects on separation of alkane isomers in metal-organic frameworks The separation of linear and branched alkanes from mixtures is an important industrial process, particularly for enriching the octane rating of gasoline. These separations are commonly done using distillation; however, adsorption offers a less energy-intensive alternative. Metal-organic frameworks (MOFs) are nanoporous, crystalline materials made from inorganic nodes connected via organic linkers. Owing to the large number of nodes, linkers, and functional groups that can be combined to make a unique MOF, there are a virtually unlimited number of possible MOFs. Computational screening can be used to choose materials tailored for a specific application, such as alkane separations. Nodes and linkers can also be connected in different topologies, or connection networks. In some cases the same set of nodes and linkers may be able to form multiple MOFs with different topologies. These polymorphs are made from the same chemical building blocks but may have radically different pore structures that can affect the adsorption of guest molecules. In this work, we examine the adsorption of C1-C6 hydrocarbons in a large set of topologically-diverse MOFs including many families of polymorphs. We will describe structure-performance relationships in this set of MOFs as they relate to the selective adsorption of linear and branched alkane isomers. We will discuss the influence of the topology on the adsorption capacity and selectivity for separating branched isomers of these alkanes based on the shape and size of the MOF pores and suggest some novel materials that exhibit good selectivity for branched alkane separations. A.S. Rosen, Chemical and Biological Engineering, Northwestern Univ., Evanston, Illinois, R. Snurr, Dept of Chemical Biological Engineering, Northwestern Univ., Evanston, Illinois, S. Bobbitt, Sandia National Laboratories, Albuquerque, New Mexico, sbobbit@sandia.gov

AGFD 50 CONTROL ID: 3427463
Quantification of active compounds in wine and deciphering their biosynthesis: Contribution of organic chemistry to the field Many active compounds in wine are difficult to analyze since they are present in very small quantities or they are unstable and thus prone to be degraded during the extraction or analysis processes. However, reliable data are needed to understand for instance (i) their contribution to the wine organoleptic properties, (ii) their biogenetic pathways and (iii) the impact of viticultural or enological processes. To meet this requirement, scientists have developed methods able to overcome the analytical difficulties and to provide accurate quantitative data for grape or wine characterization. For more than 15 years, we developed several chemical strategies to obtain analytical standards either as labelled analogues or as diastereomers to develop SIDA and DIDA analytical methods, respectively. These quantification methods afforded accurate and reliable results by suppressing analytical bias due to sample preparation. Several examples will be presented from deuterated analogues: furaneol and homofuraneol, varietal thiols, thiol precursors, ochratoxin A and hydroxycinnamic acids, and the overcome bias and the advantages linked to their use will be highlighted. The scale-up and optimization of chemical syntheses from µg to mg levels provided us with substantial amounts of molecules that could be used in metabolism studies. For example, we recently used labelled thiol precursors as tracers in Sauvignon Blanc musts for metabolism studies. Degradation of such tracers was monitored to highlight several key interconversion mechanisms and bring new elements in varietal thiol biogenesis knowledge. In these applications, the choice of the labelling position (for ochratoxin A for instance) or multilabelling possibilities (for thiol precursors) offer future opportunity to investigate detoxification process or to obtain insight in the metabolism of aroma precursors, respectively R. Schneider, Oenobrands, Montpellier, France R. Schneider, UMT Qualinnov, IFV, GRUISSAN, France F. Cavelier, UMR 5247 CNRS-UM-ENSCM, IBMM, Montpellier, France A. Roland, UMR SPO, Univ. Montpellier, INRAE, Institut Agro, INRAE, Montpellier, France fcavelier@umontpellier.fr

AGFD 51 CONTROL ID: 3426949
Can wine oxidizability be measured? Oxidation is a key aging reaction for all food, including wine. Some, including Pasteur, would say that oxidation defines a wine's aging life. We know that aging include many other reactions, but oxidation probably defines a wine's shelf life, whether that is measure in months or decades. An important question for a winemaker is how long will this wine last? From a chemical perspective, how much oxygen can the wine absorb or metabolize before it exhibits undesirable "oxidized" character? There have been some recent and not so recent reports of methods to measure this property. We will elucidate the chemical reactions that

define a wine's capacity to delay the onset of oxidized character and compare that to the published techniques. We will also propose modified methods to provide a better measure of this property. A.L. Waterhouse, T. Nguyen, Y. Miao, Viticulture and Enology, Univ. of California, Davis T. Nguyen, Agricultural and Environmental Chemistry, Univ. of California, Davis alwaterhouse@ucdavis.edu

AGFD 52 CONTROL ID: 3429589
Characterizing red wine astringency by chemistry, sensory and tribology The perception of astringency has been extensively characterized through chemistry (complexes between salivary proteins and tannins) and sensory analysis with trained panels to predict human perceptions. The physical aspect/human oral physiology of wine astringency perception has gained little attention until now, although saliva has been shown to be involved in this mouthfeel perception. Red wines with different tannin content and matrix as well as a model wine containing no tannins were chemically characterized. The chemical consequences of interactions between salivary proteins and red wine tannins were evaluated by turbidimetry and precipitation assay. The friction/lubrication properties of lubricant with and without red wines were measured. We previously observed that red wine containing large tannins and with a high tannin content was perceived to be dryer and to last longer in-mouth than wine low in tannins or model wine. This perception is correlated to the haze/aggregates formed between large tannins and salivary proteins. However, the measured friction coefficient was actually lower with high tannin wine - opposite to our expectations. We suggest that the lower friction coefficient observed for wine containing more large tannins was due to exclusion of the precipitants/aggregates and depletion of more polymeric and protein material from the contacting region during friction measurements. Further work using a tribometer was carried out on red wines with different matrix and saliva-like solution to confirm our hypothesis A.A. Watrelot, Food Sci. and Human Nutrition, Iowa State Univ., Ames, T. Kuhl, Dept. Chemical Engineering and Materials Science, Univ. of California Davis, G. Sivakumar, D. White, S. Sundararajan, Mechanical Engineering, Iowa State Univ., Ames watrelot@iastate.edu

AGFD 53 CONTROL ID: 3428975
Redox cycling of iron: Effects of chemical composition on reaction rates with phenols and oxygen in model wine Wine oxidation is mediated by the redox cycling of iron between two oxidation states: iron(II) is oxidized by oxygen and iron(III) is reduced by phenols. The effects of phenolic structure, pH, and copper on the rates of these reactions were evaluated in model wine. In the absence of a nucleophile, pyrogallol exhibited greater reactivity with iron(III) than 4-methylcatechol, though both compounds ultimately required aid from the nucleophile benzenesulfinic acid for unrestricted reduction of iron(III) to occur, illustrating the differential structure-dependent reactivities of phenols and the importance of nucleophiles to oxidation. It was hypothesized the rate of oxygen consumption would depend on the rate at which iron(II) is recycled from iron(III), though this was not found to be the case: while the rate of iron(III) reduction by 4-methylcatechol in the presence of benzenesulfinic acid decreased with higher pH, the opposite was observed for the rate of oxygen consumption. Furthermore, copper had no effect on the rate of iron(III) reduction, but significantly increased the rate of oxygen consumption, indicating the two reactions do not necessarily occur synchronously despite being coupled through iron. Pseudo-first order rate constants for oxygen consumption were much lower than those for iron(III) reduction, except when nucleophiles are absent, unlikely in wine, suggesting iron(II) oxidation is the rate-determining reaction for the wine oxidation pathway. Therefore, it is likely the rate at which wine ages is limited not by chemical composition, but by oxygen ingress. The overall capacity of wine for oxidation may still depend on constituent phenols and nucleophiles, and a method to assess these factors may be of interest. T. Nguyen, A.L. Waterhouse, Viticulture and Enology, Univ. of California, Davis thinguy@ucdavis.edu

AGFD 54 CONTROL ID: 3430563
Wine tannins : Analysis and implications on quality and biological aspects Tannins (grapes tannins and oak wood tannins) and polymeric pigments are two families of macromolecules which play important roles on red wine organoleptic quality as well as biological properties. Tannins and anthocyanins can contribute to multiple sensorial properties such as flavor, color, and taste (astringency and bitterness). Actual knowledges regarding their origin, their structures and their evolutions during red winemaking aging are important aspect for wine industry and consumers. New tannins structures have been identified (crown procyanidins, derived oak toasted ellagitannins, anthocyanins...) with evaluation of the environmental impact and the localization in different varieties of vines and to determine their evolution kinetics during the winemaking process as well as during the aging of red wine in bottles. Sensorial analyses as well as chemical analysis have been performed by UPLC-UV-QTOF and potential reliable and rapid method to obtain tannins quantification with Fourier Transform Infrared (FTIR) spectroscopy with robust models are in progress using samples from different vineyard located in the Bordeaux's region or from other areas. Some specific grapes extract present also interest on some specific chronic diseases (cardioheartdiseases, hypertension) or cognitive functions. C. Miramont, A. Vignault, A. Jouin, Z. Rasines Perea, K. Chira, M. Jourdes, P. Teissedre , Institut des Sciences de la Vigne et du Vin, EA 4577 - USC 1366 Oenologie, Université de Bordeaux, Villenave d'Ornon, France

AGFD 55 CONTROL ID: 3432149
Impact of anthocyanins on grape skin tannin during maceration Condensed tannin extraction and pigmented polymer formation are two of the cornerstones of red wine production. Without condensed tannin, red wine would lack the tactile feeling of astringency, and without the formation of pigmented polymer it would lack color stability. To understand how anthocyanins impact condensed tannin under non-oxidative conditions, an experiment was designed conducting model-wine skin extractions of Sauvignon Blanc harvested at various dates of maturity. Monomeric anthocyanins were isolated from color concentrate and added to these extractions. Following a 72-hour extraction, solutions were evaluated for recovery of monomeric anthocyanins, tannin concentration, and impact of anthocyanins on condensed tannin size. Anthocyanins showed no clear impact on the extraction of flavan-3-ol material over the course of the ripening phase, but significantly decreased the size of the condensed tannin extracted. These results suggest that under these conditions, the interflavan bonds are cleaving and anthocyanins are intercepting the flavanol fragments as nucleophiles, yielding pigmented products, while also decreasing the size of the modified, condensed tannin in solution. J.R. Campbell, A.L. Waterhouse, Viticulture and Enology, Univ. of California Davis F. Grosnickel, Inst. Universitaire de la Vigne et du Vin, Dijon, France J.A. Kennedy, Functional Phenolics LLC, Corvallis, Oregon, jcamp@ucdavis.edu

AGFD 56 WITHDRAWN

AGFD 57 CONTROL ID: 3424381
Alkynyl silver modified chitosan as a novel antimicrobial coating material for food packages Abstract: Antimicrobial agents with high efficiency and ensured safety have been greatly demanded to meet the public needs of microbial contamination prevention, food safety improvement, and food product shelf life extension. Ag-based

nanostructures have been widely studied as antimicrobial agents for their remarkable features of broad-spectrum antimicrobial activity, high surface to volume ratios, facile synthesis methods, and the property of not inducing drug resistance in microorganisms. However, the application of Ag-based nanostructures was limited by the challenges of improving antimicrobial efficacy, reducing application doses, and decreasing toxicities. Moreover, most reported Ag-based nanostructures (e.g. silver nanoparticles) endowed with silver cores, which underwent incomplete degradation during the application, and the residues could potentially cause heavy metal enrichment and pollutions to the environment. Therefore, to address these challenges, we have developed an Ag-based coreless structure by substitution alkynyl Ag to chitosan (Ag-CS). In this structure, Ag was substituted to chitosan (CS) through a reversible chemical bond to form a coreless structure that was environmentally friendly and antimicrobial efficient. Transmission Electronic Microscopy, Energy-Dispersive X-ray Spectroscopy, and Inductively Coupled Plasma and were carried out to characterize the Ag-CS; Inhibition zone, growth curve measurement, and minimum inhibition concentration determination were performed to evaluate the antimicrobial efficacy; Cell viability test was carried out to assess the toxicity. The Ag-CS was proved to offer potent antimicrobial efficacy over either AgOAc or AgNO3 with the MIC of 6.4, 13.4, and 12.8 μg/mL silver equivalents, respectively. Ag-CS also provided a prolonged Ag release with a superior release rate of 90% in 5 days. Overall, the study indicated Ag-CS as a novel antimicrobial coating material that is antimicrobial efficient and environmentally friendly L. Mei, Nutrition and Food Sci., Univ. of Maryland, College Park Q. Wang, Nutrition and Food Sci., Univ. of Maryland at College Park bud.x.mei@gmail.com

AGFD 58 CONTROL ID: 3424415

Effects of phytochemical composition on anti-inflammatory and antioxidant activities in cranberry fruit (Vaccinium macrocarpon) from different regions of the United States Cranberries contain phytochemicals relevant to human health, including flavonoids and triterpenoids, compounds known to possess antioxidant and anti-inflammatory properties. These secondary metabolites vary in content due to cultivar and environmental factors. The aim of this study is to compare the phytochemical composition of multiple cultivars cranberry fruit from two major US growing regions over two seasons, from the east coast (Massachusetts, MA) and west coast (Oregon, OR), and examine their impact on anti-inflammatory and antioxidant activities. Content of key bioactive constituents in fruit extracts was determined using HPLC-DAD and quantitative 1H NMR methods. Their antioxidant and anti-inflammatory properties were evaluated using a microplate DPPH assay for free-radical scavenging activity and by measuring expression of pro-inflammatory cytokines including tumor necrosis factor alpha (TNF-α), interleukin 1 (IL-1), and interleukin 6 (IL-6) in human leukemia monocytes (THP-1 cells), respectively. Flavonoid and triterpenoid content showed a significant dependence on growing region, with OR fruit more flavonoid-rich than MA fruit, and MA fruit more triterpenoid-rich than OR fruit. OR fruit showed stronger antioxidant activity, which was consistent with their higher flavonoid content. Cultivar also influenced flavonoid and proanthocyanidin content. Based on differences in phytochemical content, samples of two cultivars from both regions including a high-anthocyanin cultivar (Scarlet Knight) and a lower-anthocyanin cultivar (Stevens) were selected for anti-inflammatory evaluation. The ability of each extract to inhibit lipopolysaccharide (LPS)-induced cytokine production was determined using ELISA assays. All extracts significantly inhibited LPS-induced production of IL-6 at 100 μg/mL (by 19-49%). A subgroup exhibited dose-dependent inhibition of IL-6 at 10 and 100 μg/mL. TNF-α inhibition was observed at lower concentrations but did not appear dose-dependent. The data suggests that flavonoids and triterpenoids in cranberries could contribute to their anti-inflammatory activities, supporting the need to understand the factors underlying production of these compounds in cranberries grown in different regions. L. Xue, C.C. Neto, Dept. of Chemistry and Biochemistry and UMass Cranberry Health Research Center, Univ. of Massachusetts Dartmouth, North Dartmouth, C. Liu, H. Ma, N.P. Seeram, Bioactive Botanical Research Laboratory, Dept. of Biomedical and Pharmaceutical Sciences, College of Pharmacy, Univ. of Rhode Island, Kingston lxue1@umassd.edu

AGFD 59 CONTROL ID: 3424423

Chemical compositions of selected cold-pressed seed flour extracts and their health beneficial properties Seed flours are a byproduct of seed oil production. Investigating seed flours' potential health beneficial properties can add value to the oil industry and seed producers while reducing environmental contaminations. In this study, six cold-pressed seed flours including blackberry, broccoli, carrot, cucumber, tomato, and milk thistle seed flours, were extracted with 50% acetone and evaluated for their phytochemical compositions along with their potential gut microbiota modulating, free radical scavenging, anti-inflammatory, and anti-proliferative capacities. UHPLC-MS analysis detected thirteen, nine, ten, fifteen, four and thirteen compounds in the blackberry, broccoli, carrot, tomato, and milk thistle seed flour extracts, with sanguiin H-6, glucoraphanin, kaempferol, quercetin and silychristin as the major component of each, respectively. All six seed flour extracts enhanced the total number of gut bacteria and altered the abundance of specific bacterial phylum or genus in vitro. The blackberry seed flour extract had the greatest relative DPPH radical scavenging capacity and ABTS radical scavenging capacity of 362 and 267 μmol Trolox equivalent (TE)/g, respectively. The milk thistle seed flour extract showed the greatest oxygen radical absorbing capacity and hydroxyl radical scavenging capacity values of 634 and 10420 μmol TE/g, respectively. All six seed flour extracts suppressed LPS induced IL-1β mRNA expressions in J744A.1 mouse macrophages and the proliferation of LNCaP prostate cancer cells. The result might be used to promote the value-added utilization of these seed flours in improving human health. U.E. Choe, Nutrition and Food Sci., Univ. of Maryland, College Park T.T. Wang, J. Sun, P. Chen, USDA, Beltsville, Maryland, L. Yu, L. Yu, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park Y. Li, B. Gao, Shanghai Jiao Tong Univ., Shanghai, uchoe@umd.edu

AGFD 60 CONTROL ID: 3424561

Mechanistic study of anti-obesity effect of polymethoxyflavones through their bioavailability, biotransformation and interaction with gut microbiota in vivo Polymethoxyflavones (PMFs) are a unique group of polymethoxylated flavonoids that abundantly exist in the citrus peels. Nobiletin is the most prevalent one among citrus PMFs. Multiple health benefits, including anti- inflammation, anti-cancer, anti-diabetes and anti-obesity properties, have been reported for PMFs. Specifically, our previous cell and mouse studies demonstrated that PMFs could attenuate obesity through AMPK signaling. In this paper, we aimed to further explore the mechanisms underlying the anti-obesity activities. Firstly, the pharmacokinetic study demonstrated that the oral bioavailability of nobiletin was about 20% using the rat model. We found that most of nobiletin would enter colon and interact with gut microbiota after oral administration. The most common metabolic pathway of PMFs was the demethylation on the methoxy groups. Further excretion study had shown that higher demethylation extent of nobiletin was found in feces as compared to blood and urine. As the demethylated metabolites were reported to have higher biological activity than nobiletin, it suggested that gut microbiota might play an important role on bioactivity considering its higher biotransformation capability than the host. Secondly, we verified the modulation effect of PMFs

extracted from aged citrus peels on gut microbiota using high-fat diet (HFD) induced obese mice. Mice were assigned to HFD, HFD supplemented with 0.25%- and 0.5%-PMFs, and normal diet for 11 weeks. PMFs could significantly increase fecal short chain fatty acids by 43% for acetic acid, and 86% for propionic acid. Besides, PMFs could decrease Proteobacteria prevalence and the ratio of Firmicutes to Bacteroidetes by about 88% and 70%, respectively. Moreover, PMFs could significantly and dynamically promote beneficial bacteria, such as Akkermansia spp. and Allobaculum spp. Thirdly, we compared the nobiletin metabolism in obese and normal rats. Results indicated that the metabolism in host bodies was quite similar, but gut microbiota in obese rats had higher transformation activity on nobiletin than that in normal rats. In summary, our results suggest that the anti-obesity effects of PMFs may be related to their high bioavailability and interaction with gut microbiota. M. Zhang, Rutgers, the State Univ. of New Jersey, Edison, C. Ho, Food Sci., Rutgers Univ., New Brunswick, New Jersey, Q. Huang, Food Sci., Rutgers Univ, New Brunswick, New Jersey, zhangmanlucky@gmail.com

AGFD 61 CONTROL ID: 3425260

Development of microfluidic "lab-on-a-chip" device and internet-of-things technique to rapidly detect antimicrobial-resistant pathogens in foods The increasing prevalence of antimicrobial-resistant (AMR) pathogens in food products has been recognized as a serious threat to public health, making a demand for prompt detection and response. Conventional detection methods require the samples to be transported to centralized laboratories for tedious identification and antimicrobial susceptibility testing (AST), taking over 1 week. We developed a colorimetric-based microfluidic device for simultaneous detection and AST of pathogenic bacteria Campylobacter. In this microfluidic device (35 mm×45 mm), a 2×4 array of chambers for bacteria incubation was connected through a sample introduction channel. Bacterial chromogenic medium and antibiotics were pre-loaded into each chamber. The presence of pathogen was confirmed by visualizing color change due to chromogenic reaction. Colorimetric-based microfluidic approach showed a high specificity to Campylobacter while other foodborne pathogens (e.g., Salmonella, Listeria monocytogenes) did not generate any color signal. The device had the detection limits of 100 CFU/mL and 1,000 CFU/25 g Campylobacter in milk and chicken, respectively. On-chip AST was conducted to investigate the minimal inhibitory concentrations against multiple antibiotics. High coincidence rates (90.9%-100%) were achieved between on-chip AST and conventional agar dilution method. Overall, simultaneous identification and AST of pathogen in microfluidic device could be completed within 24 h. Furthermore, we established an Internet-of-Things (IoT) solution for real-time AMR surveillance study. In this IoT platform, images of colorimetric reaction in microfluidic device were automatically captured and uploaded to cloud SQL database through internet. A machine-learning algorithm (i.e., convolutional neural network) was developed for image recognition and classification, resulting in 100% correctness in determining Campylobacter AMR profiles. By comparing the monthly AMR rates to the previous annual surveillance reports, we generated an early alarming system for local food chains in Vancouver. This was the first time to combine microfluidics and IoT for on-site, real-time, and rapid screening of AMR bacteria in food products. Since IoT databases provide high transparency and available accesses, national and global surveillance studies can be conducted in more efficient manners to tackle the global AMR crisis. L. Ma, Food Sci., Univ. of British Columbia, Vancouver, Canada K. Chou, UBC Chemistry Dept, Vancouver, British Columbia Canada X. Lu, Food Sci., The Univ. of British Columbia, Vancouver, Canada luyao.ma@ubc.ca

AGFD 62 CONTROL ID: 3432073

Fatty acid ester of cellulose nanocrystals attached with polyethylene glycol for stabilization and targeted delivery of beta-carotene oil-in-water emulsion Cellulose nanocrystals (CNCs) offer a vast number of applications due to its unique surface characteristic, narrow diameter and small particle size, however, CNCs have several drawbacks such as poor re-dispersibility into the aqueous medium, hydrophilic surface characteristic and agglomeration at lower pH. In this study, palmitic acid with different molar ratio of CNCs (1:1, 3:1, 5:1 and 10:1) for different reaction period of 1, 2, 3, 4 and 5 hours was exposed on the surface of CNCs through esterification process to provide hydrophobic end, however, polyethylene glycol (PEG) was attached to provide hydrophilic end. FTIR spectra at 1742 cm-1 confirmed the ester (C=O) peak of fatty acid and PEG. The particle size of less 210 nm for the modified CNCs assured the excellent re-dispersity into the aqueous medium; however, unmodified dried CNCs had a particle size of 7852.83 nm. Modified CNCs was used as a coating material for the betacarotene loaded oil-in-water emulsion and investigated for its stability at different pH (1.0 to 9.0 pH) during storage. After a storage period of fifteen days, no significant ($p>0.05$) change in the average particle size was noticed for the modified CNCs stabilized nanoemulsion. However, an effective coalescence and phase separation was observed for the emulsion stabilized with unmodified CNCs as confirmed by confocal microscopic analysis. In-vitro gastrointestinal tract study of nanoemulsion stabilized with modified CNCs revealed the continuous stability into simulated gastric conditions; however, a significant increase in the average particle size of up to 5793.28 nm was recorded for the modified CNCs into small intestinal condition. FTIR spectra at 1742 cm-1 confirmed the hydrolysis of the ester bond of lauric acid and CNCs. Confocal analysis displayed no coalescence of nanoemulsion throughout the GIT phases. The study highlights the modified CNCs as a promising stabilizer for the hydrophobic food bioactive compounds into an aqueous medium and an advanced carrier material during the simulated in-vitro digestion system. A.S. Patel, Dept. of Food and Agriculture, Univ. of Maine, Orono, avinash.patel@maine.edu

AGFD 63 CONTROL ID: 3420795

Carbohydrate characterization in traditional Chinese medicine using rapid high-throughout mass spectrometry-based methods Traditional Chinese Medicine (TCM) are herbal remedies that have long been used to treat diseases and health conditions. There has been significant recent interest in characterizing the chemical components. With the most prominent component of TCM being polysaccharides, many have shown pharmacological properties such as antitumor, antivirus, and anti-inflammatory. The non-digestible oligosaccharides found and extracted from TCM such as fructose and galactose oligosaccharides have recently been used for dietary supplements. However, a major concern with TCM is the inability to characterize compounds such as polysaccharide due to the large diversity in monosaccharide compositions and glycosidic linkages present. Herein, we present the characterization of carbohydrates by elucidating the monosaccharide and glycosidic linkage compositions present in TCM using advanced liquid chromatography and mass spectrometry methods. In this study, 36 common TCM were lyophilized, bullet blended and incubated with water for complete homogenization. The samples were then derivatized and subjected to monosaccharide and glycosidic linkage analysis using Ultra-High-Performance Liquid Chromatography coupled with Triple Quadrupole Mass Spectrometry (UHPLC-QqQ MS). The standard anthrone assay was performed to validate the total carbohydrate in the samples. With this method, monosaccharide and linkage analyses were performed and the polysaccharide structures deduced for each TCM in the study. For example, the polysaccharides in Lily bulb showed a monosaccharide composition of 67.2% glucose, 27.6%

mannose, and 2.0% arabinose with the glycosidic linkages consisted of 12.8% T-glucose, 50.0% 4-glucose, 2.0% 4,6-glucose, 0.9% T-mannose, 22.7% 4- mannose, and 3.2% T-f-arabinose. This combination of monosaccharide and linkages suggest the abundant polysaccharides could come from glucomannan and possibly starch. This research will provide a greater understanding of the role of polysaccharides in TCM and could lead to the mechanism of action as well as lead to new form of therapeutics. Y. Chen, J.J. Castillo, E. Nandita, G. Couture, C.B. Lebrilla, Chemistry, Univ. of Califonia, Davis yapchen@ucdavis.edu

AGFD 64 CONTROL ID: 3431727
Analysis of chocolate using Raman spectroscopy We have utilized Raman microscopy to identify the lactose, sucrose and fats distributions in chocolate. Understanding the distribution of fats and sugars in chocolate allows the characterization and understanding of how changes in formulation and production methods improve the flavour, feel and stability of chocolate products. Raman spectral characterization is often problematic when used to study these distributions since chocolate, particularly milk chocolate, is often highly fluorescent and the surface geometry is complex. We have been able to show that Raman analysis of chocolate, and other food products, is made possible by recent advances in Raman instrumentation that enables the combination of high speed mapping (spectral acquisition at rates greater than 1000 spectra per second) while tracking the complex surface geometries without manual intervention. We show that Raman experimental analysis when optimized for studying the distribution of chemical ingredients in confectionary samples is a non- contact, non-destructive tool that provides sub-micrometre information. We show that Raman spectroscopy reveals both the chemical and crystal structures of materials, allowing individual ingredients/components to be identified and quantified. S. Shidler, T. Prusnick, R.W. Bormett, Renishaw Inc., West Dundee, Illinois, Y. Wong, Renishaw plc, Wotton-under-Edge, UK sarah.c.shidler@gmail.com

AGFD 64 CONTROL ID: 3421339
Detection and speciation of arcobacter bacteria using Raman spectroscopy Arcobacter bacteria have been identified as emerging foodborne zoonotic pathogens worldwide. The pathogenicity and epidemiology of Arcobacter are poorly understood due to the lack of suitable detection methods. Raman spectroscopy has a high discrimination power for bacteria by evaluating the fingerprinting features of the whole cells, which is fast, reagentless, and easy to perform. The aim of this study is to develop a rapid method for the detection and speciation of Arcobacter species via confocal micro-Raman spectroscopy coupled with chemometric analysis and machine learning. A total of 82 isolates of 18 Arcobacter species from clinical, environmental and agri- food sources in both Canada and Germany were included. Raman spectroscopy coupled with principal component analysis was capable of differentiating Arcobacter from other closely related genera with high similarity. The bacterial cultivation time and the temperature had no significant influence on spectral reproducibility and discrimination power of Raman spectroscopy. A high discrimination rate (94.13%) of identifying Arcobacter to the species level was achieved for all 18 Arcobacter species via convolutional neural network. In addition, a Raman spectroscopy-based back- propagation neural network model was constructed to determine the actual ratio of a specific Arcobacter species in a bacterial mixture ranging from 5% to 100% by biomass with accuracy over 99%. After enrichment, Arcobacter at a trace level (1- 10CFU/mL) in milk could be detected by Raman spectroscopy. In conclusion, Raman spectroscopy is a rapid and robust analytical approach to identify and speciate Arcobacter. The knowledge gained from this study can be applied to investigate the epidemiology of this microbe in the food chain. Y. Chen, Land and Food System , Univ. of British Columbia , Vancouver, British Columbia, Canada cassendra.cyx@gmail.com

AGFD 65 CONTROL ID: 3429902
HS-SPME-GC/MS method development and validation for volatiles in California blue elderberries (Sambucus nigra ssp. cerulea) Volatile compounds play an important role in the aromas and identity of a food. In California, Sambucus nigra ssp. cerulea, also known as blue elderberry, is a common hedgerow shrub used by farmers as barriers for their crops, but it is rarely harvested for food or supplement products. The volatile profile of these fruits is not yet been evaluated. To address this, we developed and validated a headspace solid phase micro-extraction GC/MS method (HS-SPME-GC/MS) to analyze the range of volatiles in California blue elderberry. Parameters investigated include elderberry sample preparation, sample volume, temperature, equilibration time, extraction time, and sample additives. Parameters were validated by using 20 µl ISTD 1ppm in samples with 3 repetitions each to find the best average number of compounds, peak area, SD and CV. Elderberry samples were tested for preparation, such as 5 g of puree, 5 g of juice, and 2.5 g puree + 2.5 g juice. Results showed that 5 g of puree had higher peak area. The influence of headspace: sample ratio was examined using 3, 5, and 6 grams of sample in 20 mL vials. It was found that 5 g of sample identified the most compounds and highest sum of peak area. The number of compounds identified and the average peak area of volatile compounds per sample increased with sample equilibration time and with temperature. The highest equilibration and extraction temperature evaluated, 50°C, extracted the greatest number of volatiles with the highest average peak area. Results showed that longer equilibration times did not significantly increase volatiles identified or average peak area; therefore 20 minutes was a sufficient equilibration period. Extraction times of 10, 20 and 30 mins were also evaluated. The results showed that 30 min extraction had the highest precision (82%) among the triplicates with an average of 92 compounds identified. The addition of sodium chloride to the extraction had only a non-significant impact on the number of volatiles extracted. Overall, the method was optimized using 5 g of pureed elderberry in 20 ml headspace vial with no added sodium chloride. Samples were equilibrated for 20 mins, followed by 30 mins of extraction time at 50°C. Using the optimized method, an average of 92 volatile compounds were identified in the elderberry samples using reference standards and compound libraries. A. Reagan, A.E. Mitchell, Food Sci. Tech., UC Davis, California ajreagan@ucdavis.edu

AGFD 66 WITHDRAWN

AGFD 67 CONTROL ID: 3430356
Viticultural performance of four Vitis vinifera L. cv. Petite Sirah clones, and determination of their respective wine characteristics Grapevine cultivars have several clones that may vary for specific viticultural and enological characteristics such as yield, cluster and berry size, and berry composition. Petite Sirah, also known as Durif, originates from the crossing between Vitis vinifera L. cv Syrah and Pelourisin and has become an important component of red wines in California. The wines produced by this cultivar are full-bodied, with deep color and long aging potential. However, little research has been done regarding the viticultural and enological traits of Petite Sirah clones in California. This study was performed at the Univ. of California, campus-based vineyard where four Vitis vinifera cv. Petite Sirah clones (FPS 1, FPS 3, FPS 4 and FPS 5) were planted in a randomized block design in 2010. Grape berries were collected from veraison until harvest for Brix, pH, and titratable acidity (TA) measurements. At harvest, phenotypical measurements including clusters/vine, cluster weights, cluster morphology, number of berries/cluster, berry weights, yields, and Ravaz Index were

determined. Grape berries were analyzed for basic chemical composition (Brix, pH, TA) as well as phenolic profile by RP-HPLC and protein precipitation assay, and volatile composition by HS-SPME- GC-MS. Wines were made from each clone and analyzed as described for grape berries at harvest, in addition to descriptive analysis. Wine sensory characteristics were also determined. Phenotypical characteristics such as yield, cluster weight, and cluster/vine were found to be significantly different among the clones. Berry chemical and phenolic composition were also demonstrated to be distinct, where clones FPS 3 and FPS 5 had significantly higher anthocyanin content than FPS 1 and FPS 4. Clonal wines had unique volatile profiles that correlated well with the sensory differences among the wines. R. Cauduro Girardello, A. Walker, H. Heymann, L. Chacon Rodriguez, A. Oberholster, Viticulture and Enology, Univ. of California, Davis rgirardello@ucdavis.edu

AGFD 68 CONTROL ID: 3424543

C13 -Labeled herbaceous (barley) feedstocks for chemical characterization of rangeland smoke effects on wine quality Climate change has been associated with increases in wildfire rates, duration, and amount of landmass affected. The smoke generated in these fires can directly impact the quality of agricultural crops due to the formation/incorporation of undesirable off-flavors in the products made therefrom. The economic loss from this waste is estimated to be in the billions of dollars; the carbon footprint consequences of smoke-related food waste are equally concerning. The wine industry has been particularly affected given many vineyards are located in areas where wildfires are common, such as Australia, California, Oregon and Washington. Wine and wine grapes have shown to be particularly sensitive to smoke, often acquiring a burnt-rubber aroma or ashy flavor. Effective strategies for minimizing the undesirable effects of wine grape smoke exposure are needed. Systematic approaches to the development of such strategies would benefit from knowledge of the origin and character of chemicals involved in off-flavor development. To this end, we have developed a system for uniform isotope-tagging of a representative herbaceous feedstock, barley (Hordeum vulgare), for use in smoke taint studies. Barley was grown from seed with intermittent exposure to C13 CO2 -enriched atmospheres for predetermined lengths of time at various growth stages in greenhouse cages. Biomass accumulation, percentages and extents of C13 CO2 - uptake, and anatomical partitioning of incorporated C13 were monitored. The study was conducted with the aim of minimizing the cost of feedstock (isotopically labelled) production by minimizing the amount of unincorporated C13 CO2 Treatments differed with respect to total amount of biomass produced, C13/C12 ratios in resulting feedstocks, and cost per unit harvested feedstock. The C13 labeled smoke derived from this feedstock is expected to greatly simplify the determination of the origin and nature of smoke derived compounds in wine. D.C. Cerrato, M. Penner, Food Sci. and Tech., Oregon State Univ., Corvallis, E. Tomasino, Oregon State Univ., Corvallis cole.cerrato@oregonstate.edu

AGFD 69 CONTROL ID: 3432432

Determination of phytic acid in beans and wild rice using tap water extraction and ion chromatography Phytic acid (myo-inositol hexaphosphoric acid or myo-inositol hexakisphosphate) is abundant in plant seeds, serving as storage for cations and phosphorus, a source of energy for germination, and a wound signal in plants. Phytic acid is nutritionally unavailable to monogastric animals, but other inositol phosphate compounds (IP2, IP3, IP4, and IP5) have important functions in signaling and apoptosis. The nutritional benefits of phytic acid are controversial. As a potent chelator of metals, phytic acid deleteriously impacts bioavailability of important minerals necessary for metabolomic processes, but also reduces free iron, thereby potentially reducing Reactive Oxygen Species (ROS).Therefore, determinations of phytic acid are needed for researchers studying botanical processes and the impact of phytic acid rich foods on human and animal nutrition. In this application, phytic acid was determined in extracts of kidney beans, pinto beans, wild rice, and almonds. Municipal tap water was used as the extractant to mimic home preparation of dried beans to determine its impact on the phytic acid content of prepared food. Phytic acid was measured by ion chromatography (IC). The IC separation used a potassium hydroxide mobile phase which converts the phytic acid to the phytate anion. Phytate is separated from other anions in the samples by anion-exchange chromatography and detected by suppressed conductivity. The extractions of phytic acid in whole and ground kidney beans were also measured over several days following the same method to compare the phytic acid yields to the whole samples. The method, which was shown to have good reproducibility, <1% RSDs, and good recovery (88-94%) of added standards except for kidney beans (39% recovery) revealed that little phytic acid is removed from whole samples by soaking overnight in tap water. As expected, increasing the sample surface area increased phytic acid extraction T.T. Christison, Ion Chromatography Products, Thermo Fisher Scientific, Sunnyvale, California, terri_christison@yahoo.com

AGFD 70 CONTROL ID: 3410264

Rheological study of emulsions of Some acacia gums Rheological study of solutions of authentic representative gum's samples of Acacia senegal var. senegal (ASG) and Acacia mellifera (AMF) from Vulgares series and Acacia seyal var. seyal (ASY) and Acacia tortilis var. raddiana (ATR) from Gummiferae series, was performed . Gum's O/W emulsions were prepared using different concentrations of isopropyl myristate (IPM) as dispersed phase. The rheological flow profiles of all gum's O/W emulsions showed oil's concentration dependence; The viscosity of ASG and AMF gum emulsions displayed Shear- thinning behavior at low shear rate, Newtonian flow behavior was also observed at shear rate beyond 50/s suggesting the alignment of gum molecules with the shear direction. ASY displayed a nearly Newtonian flow behavior in the whole range of oil's concentrations studied except for the 10% oil concentration. ATR gum emulsion flow profile exhibits a shear thinning flow behavior in general and a Newtonian flow beyond 100/s shear rate. The dynamic rheological study showed moduli frequency dependence pattern suggesting aggregations of the gum molecules around the oil droplets of the emulsion. The creep and creep recovery test showed a viscoelastic behavior for the four gum's emulsions with the ASY gum emulsion is more deformable followed by ASG, ATR and AMF is the least deformable. R.M. Daoub, Chemistry, Norther Border Univ., Al-Uwayqilah, Saudi Arabia R.M. Daoub, M. Misran, Chemistry, Univ. of Malaya, Kuala Lumpur, Malaysia R.M. Daoub, E.A. Hassan, M.E. Osman, Chemistry, Sudan Univ. of Science and Tech., Khartoum, Sudan rabiea.daoub@gmail.com

AGFD 71 CONTROL ID: 3428973

Identification of aroma-active compounds in pea proteins Pea protein is a growing plant-based protein ingredient. Pea proteins have characteristic undesirable flavors, leading to challenges in ingredient applications. An understanding of the sensory and aroma-active volatile compound profile of pea proteins can assist with product development. The objective of this study was to characterize the flavor of pea proteins using sensory and volatile compound analysis. Twenty-four commercial pea protein powders (9 concentrates, 15 isolates) from 11 manufacturers were sourced in duplicate lots. Proteins were rehydrated at 10% solids (w/w) with deionized water for sensory and instrumental analysis. Rehydrated proteins were evaluated in duplicate by a trained sensory panel using an established sensory lexicon. Volatile compounds were extracted in triplicate by

headspace solid phase microextraction (HS-SPME) and solvent assisted flavor extraction (SAFE). Volatiles were analyzed by gas chromatography-mass spectrometry (GC-MS), gas chromatography-olfactometry (GC- O) and gas chromatography-triple quadrupole mass spectrometry (GC-MS/MS). Seven sensory attributes were identified in most proteins at variable ($p<0.05$) intensities: cereal/grain, cardboard, green pea, beany/yellow pea, bitter, umami, and astringent. Other attributes, cheesy, doughy, sulfur, pyrazine, fecal, sweet aromatic and salty taste, were distinguishing flavors of some proteins. Sensory profiles were not distinct between pea protein concentrates and isolates ($p>0.05$). The key aroma-active compounds in pea proteins were hexanal (grassy), heptanal (brothy), nonanal (waxy), 2-methyl butanal (malty), E,E-2,4-decadienal (fatty), 2-heptanone (brothy), 1-pentanol (floral), 1-octen-3-ol (mushroom), 2-pentyl furan (solvent), γ-nonalactone (peachy), 2-acetyl thiazole (nutty), and 2-isopropyl-3- methoxypyrazine (pea/bell bepper). Volatiles compounds responsible for the majority of sample variation included 2- heptanone, (E)-2-hexenal (green), heptanal, octanal, (E)-2-octenal (waxy), methional (potato/fatty), 1-octen-3-one (mushroom), 2,3-diethyl-5-methyl pyrazine (musty, nutty), and 2-Isopropyl-3-methoxypyrazine (green). This study provides a sensory lexicon and volatile flavor profile of pea proteins which can facilitate product development and flavor masking of various pea protein applications. M. Drake, North Carolina State Univ, Raleigh Y. Liu, Food Sci., North Carolina State Univ., Raleigh yliu239@ncsu.edu

AGFD 72 CONTROL ID: 3428997

Efficient analytical methods to identify lipid oxidation in dairy products Formation of off-flavors through autoxidation is a concern for dairy producers as it is detrimental to product flavor and shelf life. Peroxide value (PV) remains an industry standard. Several simple tests exist to measure lipid oxidation, but their relevance to sensory detection of off-flavors is not known. The objective of this study was to compare the effectiveness of PV, thiobarbituric acid reactive substances (TBARS), and headspace solid phase microextraction gas chromatography mass spectrometry (SPME GCMS) as markers of lipid oxidation and sensory detection of off-flavors. Whey protein concentrates (WPC, n=2), skim and whole powders (SMP, WMP, n=6), butter (n=4), and fluid pasteurized whole milks (n=4) were obtained in duplicate lots. WPC, SMP, and WMP were stored at 21°C or accelerated (40°C) conditions. Milks and butters were stored at 4°C. Each product category had a specific timepoint sampling schedule. Sensory profiling by a trained panel, PV, TBARS, and SPME-GC-MS were applied at each timepoint. For all dairy products evaluated, hydroperoxide values increased ($p<0.05$) initially, but then decreased as hydroperoxides decomposed into alkoxyl radicals. This decrease created a discord between the PV data and sensory perception as PV values did not reflect increases in off- flavors perceived by sensory analysis with increased storage time. Results from TBARS were better correlated with sensory evaluation, showing steady increases ($p<0.05$) over time for all dairy products, but lacked specificity as the color reaction concomitantly occurred with nonlipid carbonyls. Volatile neutral aldehydes (SPME GCMS) permitted the most robust and specific instrumental platform for identification of specific target values for shelf life and sensory quality. Increases in specific neutral volatile aldehydes correlated ($p<0.05$) with sensory perception of oxidative off-flavors and enabled the additional advantage of targeting of non-oxidative flavor volatiles that contributed to product flavor deterioration. C.M. Reusz, D.C. Cadwallader, M. Drake, North Carolina State Univ, Raleigh creusz@ncsu.edu

AGFD 73 CONTROL ID: 3429466

Impact of plastic package and storage on off-flavors in fluid milk and cream Dairy products are susceptible to package off-flavors due to their mild flavor and minimal packaging. Few studies have addressed the effects of plastic package materials and the surrounding environment on adsorption and migration of volatile compounds in fluid dairy products. The objective of this study was to determine the effects of plastic package and storage on migration and scalping of volatile compounds from fluid milk and cream. Pasteurized skim milk (0.1% fat) or cream (12% fat) were packaged into three commonly used plastic package materials (polyethylene, metal polyethylene, and polypropylene) or glass (control). Samples were stored at 4C in the dark and sampled weekly for 3 weeks. Descriptive analysis (DA) was applied to document sensory profiles. Volatile compounds were extracted and identified using Solid Phase Micro-extraction (SPME) with gas chromatography mass spectrometry (GC-MS). Dairy products packaged in polyethylene pouches, metal polyethylene pouches and polypropylene cups for each fat content were compared using tetrad difference tests (n=30 milk consumers per tetrad, 12 tetrads) following 2 weeks storage. The experiment was replicated twice. Trained panelists determined that skim milk and cream (12%) had noticeable plastic and refrigerator/stale flavors by week 2 for each packaging type ($p<0.05$). Aroma active compounds detected associated with inks, solvents, and plastic residues from packaging included caprolactum, trichloroethylene, 3-carene, 2-ethylhexyl acrylate, toluene, p-xylene, o-cymene, beta-pinene, styrene, ethyl acetate, methacrylamide, N-propyl acetate, 2(3H)-furanone, dihydro-5-propyl-, methyl isobutyl ketone, and maltol. Higher concentrations ($p<0.05$) of package related off-flavor volatile compounds were documented in skim milk compared to cream. Consumers could detect differences between skim milk packaged in the polypropylene cups vs. polyethylene or metal polyethylene pouches ($p<0.05$), but not for cream ($p>0.05$). These results demonstrate that packaging choice plays a key role in the sensory and the chemical properties of fluid milk and cream. D.C. Cadwallader, C.M. Reusz, M. Drake, North Carolina State Univ, Raleigh, dccadwal@ncsu.edu

AGFD 74 CONTROL ID: 3429939

Sensory properties and consumer acceptance of mushroom-egg white blends 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 white products. The objective of this study was to develop mushroom-egg white blends and investigate their sensory properties and consumer acceptance. Sets of mushroom- white egg blends, including white button and cremini mushrooms with mushroom contents at 0, 10%, 20%, and 30% and either oven roasted or steamed, were developed. Quantitative descriptive analysis using a trained panel was conducted to investigate the sensory properties of the developed blends. Consumer tests were conducted to investigate the preference and acceptance of the blends. A total of 12 aroma descriptors (mushroom, earthy, dark meat, roasted, hay, soy bean, potato, woody, fried, eggy, cabbage, and sulfury) and seven taste and mouthfeel descriptors (salty, sweet, umami, astringent, bitter, firmness, and sponginess) were developed. Definition and reference for each descriptor were also developed. Mushroom-egg white 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 X. Du, A. Muniz, J. Sissons, M. Shanks, Nutrition and Food Sci., Texas Woman's Univ., Denton, xdu@twu.edu

AGFD 75 CONTROL ID: 3423781
Huanglongbing (HLB) disease's impact on pectin quality during grapefruit maturation Huanglongbing (HLB) is a plant bacterial disease responsible for citrus tree decline, reduced harvest yield, increased fruit drop, and reduced fruit quality. HLB threatens the entire US citrus industry. Florida citrus yields have dropped 85% since 2004, resulting in a considerable economic loss. Pectin is a major value-added co-product derived from citrus whose structural/functional properties might be detrimentally affected by HLB. Pectin's physio- chemical qualities are important to define pectin's functionality in food, personal care, and pharmaceutical applications. The physio-chemical qualities of pectin derived from HLB symptomatic grapefruit were compared against non-infected grapefruit at two stages of development to ascertain whether any significant differences in pectin's physio-chemical properties existed. Immature and mature grapefruit (Citrus paradise, cv. Ray Ruby) were collected from six year old potted trees, cultivated using two different systems: screen houses (non-infected trees) and open-air (HLB infected trees). Fruit samples from open-air trees were HLB symptomatic, producing smaller, greener and asymmetrical fruit compared to fruit produced from the screen houses trees. The grapefruit samples were washed and sanitized prior to the pectin extraction. The structural and functional properties of pectin derived from these grapefruit samples were analyzed. Pectin parameters including; molecular weight, degree of blockiness, absolute degree of blockiness, degree of methylesterification, and sugar composition significantly change ($P < 0.05$) depending on whether the grapefruit is fully mature and whether or not the grapefruit is HLB symptomatic. Understanding HLB's impact on pectin's physio-chemical properties during development may provide a deeper understanding of how HLB affects citrus fruit development, as well as provide pectin manufacturers and end-users insight on how HLB affects pectin structure and function. K. Ferguson, ARS, USDA, Fort Pierce, Florida, R.G. Cameron, US Dept of Agriculture, Fort Pierce, Florida, R. Ferrarezi, Univ. of Florida, Gainesville J. Bai, USDA, ARS, HRL, Fort Pierce, Florida, M. Cruz, Universidade Estadual de Londrina, kyle.ferguson@usda.gov

AGFD 76 CONTROL ID: 3423803
Comparative analysis of changes to the human gut microbiota community that occur in response to pectins with variable degrees of methoxylation Pectins are structural, plant cell wall polysaccharides that are consumed as part of a diet containing fruits and vegetables. They are heterogeneous polysaccharides with 3 structural domains, homogalacturonan, and 2 branched rhamnogalacturonan regions (RG-I and RG-II). The number of carboxyl groups that can be esterified with methyl groups determines the type of pectin and their degree of esterification. Inside the gastrointestinal tract, pectin cannot be metabolized by the mammalian cells lining the small intestine but is fermented by the gut microbiota of the colon to produce short chain fatty acids (SCFA) and other metabolites. Fermentation of pectin occurs due to the release of carbohydrate-active enzymes from the commensal species from genus Bacteroides and Prevotella. In addition, enzymes such as lyase, methylesterase, and acetylesterase are produced by the gut microbes to facilitate degradation of pectin. A number of studies have been performed looking at the effect of pectin on the gut microbiota. However, the results have been inconsistent, most likely due to differences in the chemical structures of the pectin used. In addition, these experiments were performed using short-term, batch cultures without the development of a mature gut microbial community. Here, we evaluated the effects of pectin, with varying degrees of esterification, on a stable and mature gut microbiota in vitro. Changes to the gut microbiota community structure and function were determined using advanced DNA sequencing and metabolomics. The results of this study provide information on how the different pectins modulate the gut microbiota and contribute to our understanding on how pectin structure and degree of esterification may impact this interaction. J. Firrman, L. Liu, R. Gadaingan, USDA, Wyndmoor, Pennsylvania, jenni.firrman@ars.usda.gov

AGFD 77 CONTROL ID: 3437454
Effect of cold atmospheric plasma on nutraceutical content of broccoli sprouts and microgreens Thermal processing is unsuitable for raw vegetable products such as sprouts and microgreens. Therefore, alternative methods are being explored to improve the safety of these products while still retaining product quality and consumer acceptability. Cold atmospheric plasma (CAP) is an alternative Tech. that may improve pathogen inactivation. CAP produces UV light, reactive oxygen species (ROS), and reactive nitrogen species (RNS) that may inactivate pathogens through oxidative cell damage. Understanding the interaction between the CAP products, pathogenic bacteria, and fresh produce is critical to optimizing the Tech. for use with high-risk, delicate foods. Broccoli is harvested at both the sprout microgreen stage and evaluated for color, texture, ROS content, total phenolic content, and glucosinolate content. CAP is applied at two points with a dielectric barrier discharge (DBD) electrode cultivation, immediately after the initial rinse, and then immediately following a post-harvest wash. For the pre-soaking antimicrobial treatment, CAP is applied to ungerminated seeds for 5, 10 and 15 minute at varying voltages. For the post-harvest treatment, CAP is applied to mature sprouts and microgreens for 30,60,90 and 120 second. An orbital shaker is also used to ensure greater contact by the plasma species. Cultivation using chlorine and plasma treated water as sanitizers are also carried out for comparison. Growth rate will also be compared for the three sanitization techniques. Spent irrigation water is also sampled at harvest and evaluated for nutrient content and microbial population. CAP products are effective antimicrobials, however, the use of this Tech. may result in loss of product quality when used as a treatment on more delicate products, such as leafy greens. Understanding how CAP effects plant defenses will be useful as a strategy to prevent cross-contamination during washing, or as incorporation as a hurdle Tech. for greater pathogen reduction. A. Gilbert, Nutrition and Food Sci., Univ. of Maryland, College Park, Maryland, R.V. Tikekar Drexel Univ., College Park, Maryland agilber1@terpmail.umd.edu

AGFD 78 CONTROL ID: 3437371
Mitigation effects of high methoxyl pectin on acrylamide formation in the Maillard model systems Acrylamide (AA) is one kind of potential carcinogens existed widely in heat processing foods. Finding an effective way to inhibit its formation has been become a research hotpot. Pectin is a family of galacturonic acid-rich polysaccharides, occur in fruits and vegetables. It has been found that the addition of pectin at chemical model systems can reduce the formation of AA. However, there is little knowledge about how pectin inhibits the AA formation in Maillard reaction model systems. The objectives of this study is to investigate the influence of addition of high methoxyl apple pectin (degree of esterification reached 82.6%) on the AA inhibition in Glucose (Glc)/Asparagine (Asn) Maillard model systems. Results showed that heating temperature, pH value, pectin addition amount, substrate concentration and substrate concentration molar ratio had significant influence on the inhibition of AA, and the highest inhibition rate of AA reached at 66.49% in model systems heated at 150 °C for 90 min with the

addition of pectin 2.0% (w/w). At same time, the pH value decreased significantly, and the consumption of Glc, and the concentration of Schiff base declined, whereas the melanoidin concentration increased. When pH changed between 6.0 and 7.2, the lower pH value, there is a higher inhibition rate. Lower reactant concentrations led to better performance. Moreover, the highest inhibition rate could be obtained at the mole ratio of Asn/Glc 1:1 and the addition of pectin 0.4% respectively. The further analysis indicated that the esterification degree of pectin and the content of galacturonic acid declined during heating, and 4,5-unsaturated galacturonic acid, main product of pectin of β-elimination reaction was identified by time-of-flight mass spectrometry. Therefore, the probable mechanism is speculated that the unsaturated uronic acids and Glc can react competitively with Asn through Maillard reaction, which could contribute to the AA inhibition. This study provided theoretical evidence for the control of AA in food processing. S. Guoyu, Y. Liu, P. Wang, Y. Zhu, X. Hu, College of Food Sci. and Nutritional Engineering, China Agricultural Univ., Beijing F. Chen, China Agricultural Univ., Beijing sgy7716@163.com

AGFD 79 CONTROL ID: 3424970
Phytochemical composition and bioactivity of clove (Syzygium aromaticum) oil and post-distillation biomass extract Clove (Syzygium aromaticum, syn: Eugenia caryophyllata) is a tree native to the Maluku Islands in Indonesia. The un-opened, dried flower bud is traditionally used in spices, dentistry, essential oils, and kretek cigarettes. However, little research has been done on the health-related bioactivity of the biomass remaining after oil distillation. Currently, it is considered a low value waste material used to fuel oil distillation. Additionally, there is a lack of information on the regional differences and the environmental factors that affect the yield and composition of clove bud, leaf, and stem oils. This research aims to determine the chemical composition and possible health benefits of the post-distillation biomass (PBD) extract, and to quantify the variation in composition and bioactivity of clove oil from cloves grown in different regions of Indonesia. In vitro anti-cancer activity of PBD extract and clove oil was determined against human colon, lung, and oral cancer cells. PBD extract inhibited lung, oral, and colon cancer cells by 40%, 26%, and 31% respectively, at 100 microg/mL. Clove oil was significantly less cytotoxic. Results from preliminary chemical analysis indicated that the Total Phenolic Content (TPC) of Indonesian oils was similar across all locations and the TPC of the PBD extract was half of that of the oil. Phytochemical composition of the oil was determined through gas chromatography-mass spectroscopy (GC- MS) with eugenol and β-caryophyllene present in all oils, but in varying quantities. Statistical analysis of the effect and composition of the clove PBD extract are ongoing. Results suggest that clove PBD extract could act as a potential anticarcinogenic agent and that the percentages of major components in the clove oil vary across locations I.M. Gutierrez, H. Hopfer, J. Lambert, Food Sci., The Pennsylvania State Univ., State College gutierrezfim@gmail.com

AGFD 80 CONTROL ID: 3423949
Correlation between the intercellular antioxidant activities and chemical structure changes of decapeptide IVTNWDDMEK-Ribose Maillard reaction conjugates In this study, a novel Maillard-reacted decapeptide (IVTNWDDMEK) that is released during the neutrase hydrolysis of scallop (Chlamys farreri) mantle was identified by peptidomics. Effects of Maillard reaction (MR) on characteristic antioxidant activity and hepatic protection of IVTNWDDMEK conjugated with ribose were investigated. The changes in peptide structures were determined by UV-vis, FTIR, and AFM, and the modification sites induced by MR of IVTNWDDMEK and ribose were monitored by HPLC-MS/MS. Maillard reaction products (MRPs) with enhanced reducing power, ABTS radical scavenging, ORAC, and Fe++ chelating ability over IVTNWDDMEK reduced the apoptosis and DNA damage of HepG2 cells induced by H2O2. In addition, after treatment with the IVTNWDDMEK- ribose MRPs, the activities of cellular antioxidative enzymes, such as CAT, SOD, GSH-Px, and GSH-Rx were significantly increased, while the content of MDA was decreased compared with (H O -) treated group, thereby 22 enhancing the intracellular antioxidant mechanisms. Taken together, these findings demonstrate the potential utilization of MRPs hydrolyzed peptides from scallop mantle, IVTNWDDMEK, as food antioxidants to control oxidative stress J. Han, H. Wu, B. Zhu, Food Science, Dalian Polytechnic Univ., Dalian, Liaoning, China J. Han, Q. Wang, H. Xiao, Dept. of Food Sci., Univ. of Massachusetts, Amherst jiarunhan@gmail.com

AGFD 81 CONTROL ID: 3428519
Novel development of an amperometric biosensor for serum cholesterol level determination A facile development of a mathematical model to simulate biosensor kinetic for cholesterol determination.: H. Honda, NPU, Fremont, California, Y. Lo, Bioengineering, Stanford Univ., Stanford, California, G. Ren, School of Economics, Shanghai Univ., China |M. Hsiao, Applied Chemistry, Chung Shan Medical Univ., Taichung, Taiwan bennylo@stanford.edu

AGFD 82 CONTROL ID: 3410359
Residues and dietary risk assessments of 2,4-D isooctyl ester, metribuzin, acetochlor and 2-ethyl-6-methyl aniline in corn or soybean fields Since 2,4-dichlorophenoxy acetic acid (2,4-D) discovered in the 1940s, 2,4-D and its derivatives remain among most commonly used herbicides in the world. There have been recent increases in using 2,4-D products in a combination with other herbicides such as metribuzin and acetochlor to control noxious weeds. However, accurate analysis of 2,4-D isooctyl ester remains to be improved due to long analysis time and rapid conversion of the ester to acid (i.e., under-reporting residues). In this work, a simple hydrolysis procedure was introduced to provide a quantitative hydrolytic rate of the ester (>95%) and did not affect the other pH-sensitive compounds. Analysis parameters and sample pretreatments were optimized for improved selectivity and accuracy. The hydrolysis- QuEChERS (quick, easy, cheap, effective, rugged and safe) technique for multi-determination of 2,4-D isooctyl ester, metribuzin, acetochlor and 2-ethyl-6-methyl aniline in corn and soybeans via high performance liquid chromatography- tandem mass spectrometry was established. The method had average recoveries of 74–109% with the relative standard deviations ≤ 13.5% and limits of quantifications (LOQs) of 0.05 mg/kg. The terminal residues of these compounds found in real edible matrices were less than the corresponding LOQs at harvest time. The risk quotients were far below 100%, indicating a low health risk to consumers. X. Zheng, J. hu, College of Chemistry and Biological Engineering, Univ. of Science and Tech. Beijing, People's Republic of China, Beijing, 1320578161@qq.com

AGFD 83 CONTROL ID: 3437533
Novel sensor array for intelligent analysis and differentiation of pesticides based on the inhibition of multiple enzymes Pesticide abuse is a serious threat to public health. It is very important to develop a rapid, efficient and selective method for the determination of pesticides in fruits and vegetables. However, traditional optical detection methods for pesticides based on the inhibition of acetylcholinesterase still have many shortcomings: low sensitivity and selectivity; only pesticides (organophosphorus and carbamate) with inhibitory effects on acetylcholinesterase can be detected; pesticide types cannot be distinguished, such as pesticides cannot be identified as organophosphorus or carbamate, and nor can the sensors distinguish dimethoate and chlorpyrifos (both of them are

organophosphorus pesticides). In our sensing system, multiple enzymes (cholinesterase, phosphatase, ascorbate oxidase, etc.) were utilized as identification units to constructing sensor array for pesticides. The differentiation of pesticide types was realized successfully based on the difference of inhibition effect of the pesticides on various enzymes, and combining with linear discriminant analysis (LDA) or principal component analysis (PCA). Our sensor array is sensitive, selective and precise, and can achieve the identification of pesticides with similarity main structure --- a challenge of facile optical detection methods for pesticide. H. Huang, J. Li, D. Song, S. Yan, Food Sci. and Engineering, Jilin Univ., Changchun, China H. Huang, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park, huanghui@jlu.edu.cn

AGFD 84 CONTROL ID: 3421167
Effect of metal ions on stability of vitamin C determined by HPLC Ascorbic acid, commonly known as Vitamin C (Vc), is ubiquitous in vegetables, fruits, and beverages, as well as in formulated nutraceuticals. However, Vc is unstable and subject to degradation under factors such as high temperature, UV light, alkaline pH, and metal ions. Metal elements can react with oxygen or hydrogen peroxide, generating hydroxyl radicals, which can further induce Vc degradation and adversely influence the food quality. Many food products, such as apple juice and orange juice, are rich of Vc, and also formulated with some metal ions, such as sodium, potassium, calcium, magnesium, etc. Therefore, stability of Vc in the juice might be affected by the existence of metal ions. In this context, the objective of this study was to investigate the effect of metal ions on the stability of Vc in model systems under temperature (4°C) in darkness. With aid of HPLC analysis, stability (or degradation) of Vc mixed with different concentrations of metal ions was determined in the course of the treatment. Compared to blank control, the chloride salts of alkaline earth metal ions (such as sodium, potassium, calcium, and magnesium) did not have significant effects on the degradation of Vc, but copper chloride significantly affected the VC stability. Besides, no significant difference was observed between the test divalent and monovalent ions on Vc degradation J. Huang, F. Chen, Dept. of Food, Nutrition, Packaging Sciences, Clemson Univ., Central, South Carolina, jhongyh@g.clemson.edu

AGFD 85 CONTROL ID: 3433190
Relationship between functional group evolution and copper adsorption of lignocellulose and non- lignocellulose derived biochars under different temperature In attempt to understand the functional group evolution controlling the copper adsorption of biochar, corn straw(CS) represented as lignocellulose and chicken manure (CM) represented as non-lignocellulose were pyrolyzed at selected increments between 200 and 800C in this work. Intrinsic characteristics of resulting biochars were firstly measured with the help of FTIR, XRD, and TEM technologies, followed by the batch experiments of copper adsorption and adsorption kinetics and isotherm study. The results suggested that the copper adsorption capacities for chicken manure based biochars (CMC) presented a relatively positive relationship with the highest heating temperature (HTT) and the best adsorption capacity for CM800 was 66.67 mg/g. However, the copper adsorption capacity of the corn straw based biochars (CSC) increased first with the increasing HTT from 25C to 500C (12.00-28.52 mg/g), and then decreased from 500C to 800C. Moreover, the copper adsorption capacity for CM200 (34.74 mg/g) was lower than other CM-based biochar, but CM200 still contained higher adsorption performance than the CS-based biochars. The characteristic peaks indicating oxygen functional groups in CMC grew sharper and stronger with the increase of HTT, while the intensities of characteristic peaks in CSC were lower than the CMC and showed no obvious dependence on the HTT. The results show that the evolution of functional groups was related to the copper adsorption capacity for biochars prepared at various HTT. X. Jian, Y. Feng, X. Chen, Q. Chen, South China Agricultural Univ., Guangzhou, China jian_xiumei@qq.com

AGFD 86 CONTROL ID: 3412831
Multi-analytical method of pesticides from meat using LC/MSMS Multi-analytical method using LC/MSMS for pesticides from Meat (beef and pork) for monitoring was developed with QuEChERS preparation. After Sample weighing (5 g) in a 50 mL conical tube, ascorbic solution (0.5 mL) was added. 10 mL acetonitrile contained 1% acetic acid and QuEChERS extraction salt (AOAC method, 6 g $MgSO_4$, 1 g CH_3COONa) were added to the sample in the 50 mL conical tube. The mixture was strongly shaken for 10 min and was centrifuged at 3,000 g for 10 min. The acetonitrile layer was purification with dSPE (150 mg $MgSO_4$, 25 mg C18) and was centrifuged at 13,000 g for 3 min. The supernatant was filtered with a membrane filters (pore size: 0.2 um) before analysis. ME (%, Matrix effect) for almost analytes range were -30.6 to 36.8%. MLOD (Method LOD) and MLOQ (Method LOQ) was calculated by S/N ratio. MLOQs were 0.01 mg/kg. The linear correlation coefficients (r squared) were > 0.99 within the range of 2 ~ 100 ug/kg for all of the 70 pesticides. The percentages (of 70 pesticides) recovers were in the range of 70.4 ~ 117.2%(0.01 mg/kg level) and 74.7 ~ 112.4%(0.1 mg/kg level) and 70.1 ~ 116.6%(0.5 mg/kg level) within the validation criteria (recover; 70-120% with RSD < 20%) H. Jo, Hankyong Nation Univ. Industry Academic Cooperation Foundation, Anseong, Korea (The Republic of) H. Jo, K. Hwang, K. Jeong, H. Kim, T. Lee, J. Sun, J. Moon, Hankyong National Univ., Ansung, Korea (The Republic of) hyeongwook.jo@gmail.com

AGFD 87 CONTROL ID: 3432858
Investigating and comparing arabinoxylan structures in cool-season pasture grasses from central Kentucky Arabinoxylan (AX) is a polysaccharide that constitutes a major structural component in the cell walls of monocots such as cereal grains and pasture grasses. The AX backbone consists of β-D-xylopyranoses linked via β- (1→4) linkages, with α-L-arabinofuranose substituents attached to the backbone via α-(1→3) and/or α-(1→2) linkages. In addition, AX contains complex hydroxycinnamic acids, such as ferulic and p-coumaric acids, which are esterified to α-L-arabinofuranose at the O-5 position and decrease digestibility. The backbone substituents are arranged in a random pattern, making AX difficult to rapidly characterize. AX structures differ between plant species and tissue types and these differences impact gut microbial fermentation and production of short chain fatty acids (SCFA) in livestock consuming forage. With a better structural understanding of forage AX, the impact of structure on microbial fermentation and other metabolic consequences in cattle can be elucidated. In this project, the AX structures in the foliage of four central Kentucky cool-season pasture grasses (bluegrass, tall fescue, timothy, and perennial ryegrass) were characterized. The monosaccharide profile of insoluble cell wall material was determined via Saeman hydrolysis and High Performance Anion Exchange Chromatography with Pulsed Amperometric Detection (HPAEC-PAD). The esterified phenolic acid profile was determined after alkaline hydrolysis. Foliage AX is being digested with endo-xylanases, creating AX oligosaccharides that will be separated with an optimized HPAEC-PAD method and identified with commercially available AX oligosaccharides standards. The arabinose/xylose (A/X) ratio was significantly different ($p<0.05$) between bluegrass, tall fescue and perennial ryegrass. Timothy grass had significantly different ($p<0.05$) amounts of trans-coumaric, cis-coumaric and cis-ferulic acid from the other three pasture grasses. Perennial ryegrass also contained significantly different ($p<0.05$) amounts of trans-coumaric and cis-coumaric acid

from the other pasture grasses. G. Joyce, R. Schendel, Food Sci., Univ. of Kentucky, Lexington, H. Gaul, Food Chemistry and Phytochemistry, Karlsruhe Inst. of Tech., Karlsruhe, Baden-Württemberg, Germany glenna.joyce@uky.edu

AGFD 88 CONTROL ID: 3429124
Black raspberry phytochemicals and anti-inflammatory effect in vitro Black raspberries have been studied for their anti-cancer and anti-inflammatory effects, which are mainly attributed to their high polyphenolic content. Black raspberries also contain volatile compounds, which could contribute to their beneficial health effects. In this study, polyphenolic and volatile compounds of black raspberries were identified and quantified using HPLC/ESI-MS and GC/MS methods, and the anti-inflammatory potentials of the two fractions at different concentrations were assessed by measuring nitric oxide (NO) reduction in RAW 264.7 cells stimulated with lipopolysaccharide. The polyphenolic profile of black raspberries was largely dominated by anthocyanins (6,970 μg/g fresh berries), with cyanidin-3-rutinoside accounting for 68% of the total anthocyanins. Black raspberries also contained flavonols, and ellagitannins and ellagic acid derivatives with the most abundant compounds being lambertianin C, quercetin-3-rutinoside and quercetin-3-glucuronide. The volatile composition of fresh berries and three essences distilled at 40, 50 and 60 °C was evaluated. Sixty volatiles were identified in the fresh berries and all the volatiles except α- and β-pinene were recovered in the essences. The total volatile concentration in the berries and the essences ranged between 2.5 and 3.9 μg/g and was dominated by monoterpenes. Octanoic acid, myrtenol and hexanal were the most abundant volatiles in both the fresh berries and the essences. α-pinene was also an important compound in fresh berries, while carveol and α-terpineol were present in higher quantity in the essences compared to fresh berries. The production of NO by murine macrophages treated with phenolic (10-fold dilution) and volatile (2-fold dilution) extracts showed comparable ability to reduce NO production, 40 and 34%, respectively. This suggests that both the phenolic and the volatile fractions of black raspberries exhibit in vitro anti-inflammatory effect. Additional research is needed to determine the bioavailability of volatiles and validate their anti-inflammatory effect in vivo. L. Lavefve, L. Howard, C. Brownmiller, S. Lee, Dept. of Food Sci., Univ. of Arkansas, Fayetteville ldlavefv@uark.edu

AGFD 89 CONTROL ID: 3421018
Dietary exposure assessment for volatile N-nitrosamines from processed meat products for the U.S. population N-nitrosamines are formed from the reaction of amines with nitrites and nitrates present in food. In particular, meat processing procedures, such as curing and smoking, can result in the formation of N-nitroso- compounds. Nitrite-cured meats, particularly fried bacon, are one of the major contributors to dietary N-nitrosamine exposure. Historically, volatile N-nitrosamines were of regulatory interest due to their carcinogenicity. However, their presence in food, and the resulting chronic dietary exposure at low doses is considered to be of toxicological importance to humans. The dietary exposure of volatile N-nitrosamines from the consumption of processed meat products was estimated for the U.S. population aged 2 years or more and for children aged 2 to 5 years using 2-day food consumption data from the combined 2013-2016 National Health and Nutrition Examination Survey (NHANES), and the levels of volatile N- nitrosamines in processed meat products available in a database from recent studies and reports in the literature. Over 1800 samples, including bacon, ham, salami, sausages, and various other processed meat products, have been analyzed for the presence of volatile N-nitrosamines and resulting data in the literature were compiled into this database. This study summarizes the results of the dietary exposure assessment for volatile N-nitrosamines, as well as the relative percent contribution of each processed meat product category to the total volatile N-nitrosamine exposure for the U.S. population. H.S. Lee, CFSAN/OFAS/DFI, U.S. FDA, College Park, Maryland, hyoung.lee@fda.hhs.gov

AGFD 90 CONTROL ID: 3430072
Analysis of α-dicarbonyl compounds and 4-methylimidazole in coffee with various roasting and brewing conditions In this study, we analyzed α-dicarbonyl compounds (α-DC), including glyoxal (GO), methylglyoxal (MGO) and diacetyl (DA), and 4-methylimidazole (4-MI) formed in coffee manufactured under various roasting and brewing conditions. Green coffee beans (Coffea arabica from Brazil and Ethiopia, Coffea robusta from India and Vietnam) were roasted at 235 °C for 13 min, at 240 °C for 15 min and at 245 °C for 17 min. In 72 espresso coffee samples, the total α-DC was ranged from 10.27 μg/mL to 90.41 μg/mL and the level of 4-MI was ranged from 11.68 ng/mL to 135.92 ng/mL. Total α-DC mean value in Coffea arabica (60.35 μg/mL) was higher than in Coffea robusta (32.06 μg/mL). The level of 4-MI mean value in Coffea robusta (67.54 μg/mL) was higher than in Coffea arabica (60.01 μg/mL). As the roasting temperature and time increases, MGO, DA and 4-MI increase and GO decreases significantly ($p<0.05$). In espresso method, smaller particle size of coffee bean showed significantly high concentration of α-DC and 4-MI ($p<0.05$). Cold brew method showed the highest concentration of α-DC and 4-MI in larger particle size of coffee bean ($p<0.05$). It can be useful for manufacturing coffee with various conditions to reduce α-DC and 4-MI. K.G. Lee, S. Hyung, S. Kim, Dongguk Univ., Jung Gu Seoul, Korea(The Republic of) kwglee@dongguk.edu

AGFD 91 CONTROL ID: 3430086
Volatile compounds, antioxidant, anti-wrinkle and skin whitening effect of various beans extracts In this study, volatile compounds of various beans (black bean, mung bean, soybean) were analyzed according to particle size and extraction temperature by two analytical methods. And the extracts were examined for antioxidant activities, anti-wrinkle effects and skin-whitening using various in vitro assays. A total of 54 bean extracts had 10 major volatile compounds respectively. Among them, the major volatile compounds were hexanal, 2-methyl-1- butanol, 1-hexanol, 1-octen-3-ol and benzaldehyde. The hot water extract of black bean was exhibited the inhibitory activity of malonaldehyde formation by 86.40% at the 500 μg/mL level. The same extract also exhibited the highest phenolic content and flavonoid content by 48.4085 mg GAE/g extract and 36.3846 mg QCE/g extract, respectively. The extract of black bean using distillation under reduced pressure was had the inhibitory activity of elastase and DOPA auto-oxidation by 47.15% and 67.74%, respectively. These results suggest that extracts of beans could have beneficial effect on various physiological activities. K.G. Lee, E. Han, H. Kim, B. Yoo, Dongguk Univ., Jung Gu Seoul, Korea(The Republic of) kwglee@dongguk.edu

AGFD 92 WITHDRAWN

AGFD 93 CONTROL ID: 3423477
Methyl anthranilate: A novel quorum sensing inhibitor and anti-biofilm agent against Aeromonas sobria Quorum sensing (QS), bacterial cell-to-cell communication, is a gene regulatory mechanism that regulates virulence potential and biofilm formation in many pathogens. Aeromonas sobria, a common aquaculture pathogen, was isolated and identified by our laboratory from the deteriorated turbot, and its potential for virulence factors and biofilm production was regulated by QS system. In view of the interference with QS system, this study was aimed to investigate the effect of methyl anthranilate at sub-Minimum Inhibitory Concentrations (sub MICs) on QS-regulated phenotypes in A. sobria. The results suggested that 0.5

μL/mL of methyl anthranilate evidently reduced biofilm formation (51.44%), swinging motility (74.86%), swarming motility (71.63%), protease activity (43.08%), and acyl- homoserine lactone (AHL) production. Furthermore, the real-time quantitative PCR (RT-qPCR) and in silico analysis showed that methyl anthranilate might inhibit QS system in A. sobria by interfering with the biosynthesis of AHL, as well as competitively binding with receptor protein. Therefore, our data indicated the feasibility of methyl anthranilate as a promising QS inhibitor and anti-biofilm agent for improving food safety. T. Li, Key Laboratory of BioTech. and Bioresources Utilization, Dalian Minzu Univ., Liaoning, China X. Sun, B. He, Y. Mei, D. Wang, J. Li, Bohai Univ., Jinzhou, China H. Chen, Beijing Tech. and Business Univ., Beijing tingting780612@163.com

AGFD 94 CONTROL ID: 3428632

Improving pea protein functional properties through acylation and guar gum conjugation There has been an increasing demand for more diverse and functional plant proteins for various food uses. This study aims to improve pea protein functional properties through acylation or/and conjugation with guar gum and investigate the physicochemical characteristics of modified proteins. Pea protein/guar gum conjugates were prepared by incubating the mixture at a mass ratio of 20: 1 and 30: 1 at 60 °C for 24 hours, respectively. Acylated pea proteins were prepared by reacting with acetic anhydride (AA) or succinic anhydride (SA) at 0.3 or 0.6 g of AA or SA per g protein, respectively. Acylated-guar gum-conjugated pea proteins were also prepared to investigate their synergistic effects. Both conjugated and acylated pea proteins possessed greatly improved oil holding capacity with up to 2.20 and 2.09 g oil/g protein compared with the control pea protein (1.03 g), respectively; and acylated pea protein also had greater water holding capacity up to 7.01 g water /g protein compared with the control (3.57 g). Emulsion capacity and stability were improved by up to 112% and 140%, respectively, for the modified proteins. Suspensions prepared with 7% acetylated pea protein formed firm gels. In addition, sequential acylation and conjugation of pea proteins demonstrated beneficial synergistic effects on water absorption capacity and emulsifying properties. The acylated and conjugated pea proteins possessed superior functional properties that could be used as novel food ingredients and alternatives to some animal proteins for plant-based meat and dairy products. Y. Shen, Y. Li, Kansas State Univ., Manhattan yantings@ksu.edu

AGFD 95 CONTROL ID: 3431788

Transient colonization of exogenous Lactobacillus rhamnosus GG (LGG) in the human intestine and its effect on microbial ecosystem, an in vitro study Lactobacillus rhamnosus GG (LGG) is one of the most popular probiotics used in foods, functional foods and supplements. The efficacy and functionality of LGG as a probiotic strongly depends on the dose taken and residence time in the gastrointestinal tract (GIT). In this study, we evaluated the dynamics of LGG growth in vitro in three human gut microbial communities established from the fecal samples of three different donors. This was accomplished by combining results of qPCR quantification, Next-Gen DNA sequencing, and chemical analysis using GC/MS and LC/MS. Although the bacterial community was able to maintain homeostasis during LGG's transient colonization, the probiotics promoted or suppressed the growth of specific bacteria and altered the metabolic profile, and that was donor dependent. The results of this research provide information on the interactions between LGG and the mature gut microbial community, which can be used to design novel approaches for the application of this probiotic L. Liu, J. Firrman, K. Mahalak, USDA ARS ERRC, Wyndmoor,

AGFD 96 CONTROL ID: 3428530

Inkjet-printed colorimetric gradient indicators for monitoring fish freshness The use of colorimetric indicators in intelligent food packaging is a promising technique to showcase the quality changes during storage. In this study, gradient-shaped colorimetric indicators were developed via employing a commercial piezoelectric inkjet printer, for monitoring the freshness of stored fish fillets (catfish, haddock and ocean perch) over 7 days at refrigeration temperature. By refilling the printer's cartridges with our formulated inks containing sulfonephthalein dyes, the colorimetric indicators were printed onto photo papers, which were attached as intelligent packaging labels inside the fish package. Inks' printability was investigated by determining the density, surface tension and dynamic viscosity, demonstrating our formulated inks were printable fluid. To monitor fish quality changes, the color response of the indicators on each day of fish storage was recorded by a digital camera. At the meantime, chemical analyses on the pH, total volatile basic nitrogen (TVBN), trimethylamine (TMA) content and dimethylamine (DMA) content of stored fish fillets were conducted on a daily basis. Results showed a gradual color change from day 2 to day 7, with increasing levels of TVBN, TMA and DMA. The color profile in between different storage time can be discriminated by implementing principal component analysis. A partial least squares regression model was constructed for using the color response to predict the relevant chemical composition changes. The application of inkjet-printed colorimetric indicators aligns with industrial packaging operations, revealing great promise for intelligent packaging of fish and fishery products in the future. X. Luo, L. Lim, Dept of Food Sci., Univ. of Guelph, Ontario, Canada xluo02@uoguelph.ca

AGFD 97 CONTROL ID: 3433026

Analysis of the ability of capsaicin to modulate the human gut microbiota in vitro A recent prospective cohort human study showed an inverse correlation between spicy food consumption and mortality, independent of other risk factors. An explanation for this result could be the impact of capsaicin, a bioactive compound in chili peppers, on the colonic microbial community. Previous in vivo studies have indicated that consumption of capsaicin may cause an increase in short chain fatty acid production by the gut microbiota, predominantly butyric acid, which is of interest due to its anti-inflammatory properties and its role in the maintenance of the intestinal barrier. To further elucidate these changes observed in vivo, we analyzed the impact of capsaicin on the colonic human gut microbial community, cultured in vitro over fourteen days, to obtain a better understanding on how capsaicin impacts the gut microbial community without host interactions. This allowed us to observe potential bacteriostatic effects, as well as other changes in the bacterial community and the production of its metabolites, including butyric acid. The results of this study contribute to the body of knowledge on how capsaicin may be advantageous for human health. K. Mahalak, J. Bobokalonov, DFF, USDA, Wyndmoor, Pennsylvania, J. Firrman, USDA, Wyndmoor, Pennsylvania, L. Liu, USDA ARS ERRC, Wyndmoor, Pennsylvania, karley.mahalak@usda.gov

AGFD 98 CONTROL ID: 3426338

Comparison of sour and sweet whey for the biotechnological production of aroma compounds using Galactomyces geotrichum mold Fermentation processes have been employed in the production of foods, such as beer, wine, bread, cheese, vinegar or soy sauce for thousands of years. It is well known that during fermentation, natural biochemical processes occur generating new aromas and tastes through microbial metabolism or enzymatic activity, respectively. The generation of aroma compounds from odorless precursors during microbial food fermentation is still a key issue in flavor research, because these odorants are considered as

natural. The aim of this research was comparison of sweet and sour whey for the biotechnological production of natural aromatic compositions with pleasant honey caramel flavor. In this project mold species of Galactomyces geotrichum wer used for the biotransformations. Our recent studies showed that G. geotrichum is able to biosynthesize phenylacetaldehyde, 2-phenylethanol and phenylacetic acid and create aroma compositions with pleasant honey, rosy, caramel flavor. When L-phenylalanine is converted via Ehrlich pathway usually those three compounds are present as a mixture and the ratio of aldehyde to alcohol is 1:10. However, because the odor threshold (OT) of phenylacetaldehyde is 60 times lower than OT of 2-phenyl ethanol, it is encouraged to optimize the Ehrlich pathway into producing less alcohol and more aldehyde. This way more powerful aromatization is obtained. In this project we will show results of the optimization of Ehrlich pathway into producing more phenylacetaldehyde than 2-phenylethanol with the use of sweet and sour whey. Additionally proper identification of key odorants will be shown. For that purpose sensomic approach has been used with employment of gas chromatography olfactometry and calculation of odor activity value. M.A. Majcher, K. Szudera-Konczal, K. Myszka, P. Kubiak, H. Jelen, Food Sci. and Nutrition, Poznan Univ. of Life Sciences, Poznan, Wybierz stan, Poland malgorzata.majcher@up.poznan.pl

AGFD 99 CONTROL ID: 3411294

Efficiency of seeds' germination in pre-sowing irradiation by UV-light of different spectral composition One of the main tasks of the agricultural complex is to increase the quantity and quality of crop production. Great interest in stimulating growth and increasing the resistance of plants to external factors and increasing the productivity of agricultural crops is the pre-sowing processing of seeds of crops by UV radiation. The influence of UV- light with three different spectral regions C (200–280 nm), B (280–320 nm) and A (320–400 nm) of irradiation on the biological processes in seeds has been investigated. In series of laboratory experiments it has been shown that UV irradiation positively affects vigor and germination capacity of seeds (wheat, barley, rapeseed and carrots). Particularly, it has been demonstrated that UV-light with a dose of 120 J/sqm increases the vigor and germination capacity by 23–31 % and by 14–25 % (depending on the chosen spectral region), correspondingly, compared to control samples. M. Marenych, T. Sakhno, Poltava State Agrarian Academy, Poltava, Ukraine A. Semenov, Univ. of Economics and Trade, Poltava, Ukraine N. Barashkov, Micro-Tracers, Inc, San Francisco, California, marenych@ukr.net

AGFD 100 CONTROL ID: 3440520

Identification of vitamin K binding protein by magnetic beads labeled derivative to search a novel activity Vitamin K is classified into three homologs depending on the side chain structure with 2-methyl-1,4- naphthoquinone as the basic skeleton. Vitamin K plays important roles in blood coagulation and bone formation after vitamin K binds the specific proteins such as γ-glutamyl carboxylase (GGCX) and steroid and xenobiotic receptor (SXR). The novel activity of vitamin K is recently clarified to induce neural differentiation of neural stem cells. We focused on the vitamin K binding protein to identify a new physiological activity of vitamin K. In this situation vitamin K exerts the physiological activity to bind the specific proteins, we investigated vitamin K binding protein by magnetic beads labeled MK-4 to identify a new physiological activity. The human hepatoblastoma cell (HepG2) or mouse small intestinal epithelial cell (IEC) were extracted as whole cell lysate. MK-4 binding proteins were purified by avidin-biotin complex assay. These samples were resolved by SDS-PAGE and excised from the silver stained gel. These proteins were analyzed by MALDI-TOF/TOF MS. MK-4 binding protein was identified as 17β-hydroxysteroid dehydrogenase 4 (17β-HSD4) previously reported to bind MK-4 in HepG2. We also identified for the first time that MK-4 binding proteins were identified in IEC. Further, we evaluate whether the proteins have an unknown activity of vitamin K. The present study may help to the development of new drugs for the treatment of diseases related to vitamin K. In addition, it is possible that the present methodology may help to identify a tissue-specific target protein for drug discovery. M. Kobayashi, Systems Engineering and Science, Shibaura Inst. of Tech., Saitama City, Saitama prefecture, Japan F. Ayako, Suzuka Univ., Saimata, Japan M. Kamao, Kobe Pharmaceutical Univ., Kobe, Japan Y. Suhara, Dept. of Bioscience and Engineering, Shibaura Inst. of Tech., Saitama, Japan H. Yoshihisa, Dept. of Bioscience and Engineering, Shibaura Inst. of Tech., Saitama, Japan mf19030@shibaura-it.ac.jp

AGFD 101 CONTROL ID: 3412380

Cocoa mucilage as raw material for the production of cyclodextrins Cyclodextrins are water soluble macromolecules widely used in food, agricultural, environmental, textile, pharmaceutical and cosmetic industries. They have a concave structure with a non polar cavity and a polar exterior that confers their encapsulation properties. Cocoa shells and mucilage correspond to 92% by mass of the cocoa fruit and those components are lost during cocoa production. Mucilage contains mainly water, saccharose, glucose and fructose but also contains linear and branched oligosaccharides analogs to starch. In order to take advantage of this agricultural waste; cocoa mucilage was studied as substrate for the production of cyclodextrins by the action of the cyclodextrin glucosyl transferase (CGTase Amano, Japan). The pH, temperature, enzyme and substrate concentration were evaluated in order to find the optimal conditions. Cyclodextrins were successfully obtained and their formation occurred by the action of the CGTase on the oligosaccharides present in cocoa mucilage M.F. Mercado, J.R. Pinzon, Escuela de Química, Universidad Industrial de Santander, Bucaramanga, Columbia maria.mercado@correo.uis.edu.co

AGFD 102 CONTROL ID: 3431290

Quantitation of selected tastants from mushroom hydrolysates Innovative approaches to developing healthy foods with great flavor is of utmost importance in encouraging consumer adoption of nutritious diets. Lately, interest has grown substantially in the development of flavors that increase both consumer appeal and preference for low sodium foods. In this study the thermal treatment of enzymatically hydrolyzed mushroom protein (eHMP), prepared from the button mushroom, Agaricus bisporus, resulted in a reaction flavor eliciting a high intensity of savory taste attributes. When the reaction flavor was added to chicken broth and sensorially evaluated by a consumer screening panel, the reaction flavor increased the “salty” and “umami” taste attributes of the broth as well as the “overall flavor” intensity. To gain primary insights into the tastants present in eHMP, the objectives of this study were to 1) quantitate the sugars, amino acids, and 5’-nucleosides, before and after enzymatic hydrolysis and thermal treatment, and 2) determine dose-over-threshold (DoT) factors for the selected tastants. Twenty amino acids were quantitated, of which glutamic acid, aspartic acid, and alanine were present above taste threshold, and thus perceived sensorially. Five 5’-nucleotides were quantitated. Cytidine-5'- monophosphate, uridine-5'-monophosphate, and guanosine-5'-monophosphate were all present above threshold. Lastly, seven sugars were quantitated, with mannose, xylose, and glucose above taste threshold. A taste model using the sugars, amino acids, and 5’-nucleotides with DoT >1 was prepared in a saline solution. The taste model was shown to enhance the saltiness and umami intensity of the solution, but less so than the mushroom hydrolysate, suggesting that other unidentified tastants are present in the hydrolysate furthering the increase in flavor intensity. Taste-guided fractionation of eHMP is currently underway to determine the other tastants present in eHMP. This presentation will

highlight the results of the sensory evaluations, the quantitation of selected tastants before and after hydrolysis, and future directions of the project. A. Moore, Univ. of Tennessee, Knoxville, J.P. Munafo, Food Sci., Univ. of Tennessee, amoor140@vols.utk.edu

AGFD 103 CONTROL ID: 3429858
Anti-inflammatory properties of blackberry phenolic and volatile compounds Background: Berries are known for many health benefits including anti-inflammatory properties that lower risks of chronic diseases. These properties have been linked to high concentrations of phenolic compounds, especially anthocyanins. However, the present study hypothesized that volatiles could be involved in the berries' bioactive properties. Objectives: The objectives of this research were to 1) profile the phenolic and volatile composition of three blackberry varieties obtained from the UA fruit breeding program, and 2) evaluate the anti-inflammatory capacities of the blackberry phenolic and volatile fractions on inflamed RAW264.7 cells. Method: Phenolic and volatile profiles were evaluated using chromatographic techniques. The anti-inflammatory properties were assessed in vitro using the nitric oxide (NO) assay on LPS-inflamed RAW264.7 macrophage murine cells after a preventive treatment of either a 10-fold, 20-fold or 40-fold diluted phenolic extract, or a 2-fold, 4-fold or 8- fold diluted volatile extract. Results: A2528T, A2587T and Natchez genotypes had total phenolic contents of 4807, 4115, 4435 mg/g, respectively and total volatile contents of 2418, 5574 and 3882 ng/g, respectively. The cells exposed to a 10-fold diluted phenolic extract and a 2-fold diluted volatile extract from all three selected genotypes showed significantly lower production of NO than the positive control. A2528T, A2587T and Natchez genotypes provoked a 42%, 24% and 20% inhibition of NO production, respectively within the 10-fold diluted phenolic extracts, and 23%, 32% and 22% inhibition of NO production, respectively within the 2-fold diluted volatile extract. Conclusion: A blackberry volatile extract showed comparably ability to lower an inflammatory biomarker as a phenolic extract. Our results suggest that the anti-inflammatory activity of blackberries is not only due to phenolic compounds, but also to aromatic volatile compounds. These preliminary results indicate further research is needed to identify specific bioactive volatile compounds in blackberries and determine potential synergistic effects among volatile compounds P. Morin, L. Howard, C. Brownmiller, S. Lee, Food Sci., Univ. of Arkansas, Fayetteville, J.R. Tipton, Univ of Arkansas, Fayetteville, pauline.morin29@gmail.com

AGFD 104 CONTROL ID: 3425777
Effect of steam roasting on bioactive compounds in cocoa beans Cocoa beans are rich in polyphenolic compounds such as flavan-3-ols, flavonoids (12-18% dry weight basis). Consumption of cocoa products has been associated with many health benefits including decrease in blood pressure and the risk of cardiovascular disease (Miller et al., 2009), inhibition of inflammation ((Lambert et al., 2012), (Bitzer et al., 2015), modulation of insulin resistance (Yamashita et al., 2012), (Dorenkott et al., 2014)) and nutrient digestion (Racine et al., 2019). Roasting is a crucial step during processing of cocoa beans for development of desirable flavors in the final chocolate product. Current methods of roasting use hot air as the heating medium at a temperature of 120-150 C for 10-50 min. Dry roasting can contribute to an overall decrease in the concentration of polyphenols in cocoa beans due to thermal and oxidative degradation. Steam roasting could be employed to mitigate these losses, by partially replacing the oxygen in the heating medium with water vapor. The high heat transfer rate achieved using steam could also reduce overall processing times. The aim of this study was to evaluate the effects of steam roasting on the retention of bioactive compounds and the flavor profile of cocoa beans. Cocoa beans were analyzed for Total Polyphenol Content (TPC) using the Folin-Ciocalteu assay, anti-inflammatory potential using the Phospholipase A2 assay and anti-cancer activity using stimulated gastrointestinal cancer cells. Results from the Folin assay indicated that steam roasting at 120 C for 30 min resulted in significantly higher ($p<0.05$) retention of polyphenols (148.3 mg/g fat free cocoa extract) compared to conventional roasting (110.6 mg/g fat free cocoa extract). The Phospholipase activity inhibition (% enzyme activity inhibited) of the raw (unroasted), conventionally roasted and steam roasted cocoa extracts were 37.37%, 39.76% and 32.03% respectively at 1000 µg/mL. S. Navare, R. Anantheswaran, Food Sci., Penn State Univ., Univ. Park , State College, J. Lambert, Penn State Univ., Univ. Park, sawali.navare@gmail.com

AGFD 105 CONTROL ID: 3424452
Evaluation of the antioxidant activities of Celosia trigyna (LINN) extracts Plants in recent times have been investigated for their rich content of potent natural antioxidants. Worthy of note is the contribution of phenolic compounds to the antioxidant activities of plant extracts. Celosia trigyna are a known ancient vegetable unfortunately unpopular in modern age. In this study, antioxidant composition and activities of Celosia trigyna leave was evaluated in crude methanol extract and its different fractions; Hexane, Chloroform, Ethyl acetate and Methanol. Also, total Antioxidant capacity (TAC) using phosphomolybdeum method and antiradical scavenging activity using 2,2- Diphenyl -1- Picrylhydrazyl (DPPH) and Hydrogen Peroxide (H2O2) methods were used for antioxidant evaluation. Results revealed that the leaves of C. trigyna had the highest values of TP (0.162mg, Rutin equivalent per lg methanol fraction) while the lowest value of TP (0.092mg ± 0.001 GAEg -1) was recorded in the chloroform fraction. The Total Antioxidant Capacity (TAC) was highest (0.192 ± 0.003mg GAEg -1 in ethylacetate fraction of C. trigyna leave extract. Interestingly the C. trigyna methanol fraction exhibited the highest percentage inhibition for both the H2O2 and DPPH scavenging activities of 89.22% and 88.24% respectively at concentration 0.6mg/ml. Altogether, all the fractions including the C. trigyna crude methanol extract showed strong scavenging activity on DPPH as the concentration increases while the scavenging activity of the leaves extract and fractions were high at 0.6mg/ml concentration. Based on these results, methanol and ethyl acetate media resulted in high yield antioxidants. Celosia trigyna can be a good of natural antioxidants required in foods and pharmaceutical industries. O. Ogunjinmi, Physical Sciences (Industrial Chemistry Unit), First Technical Univ., Ibadan, Oyo State, Nigeria oluwasayoesther@yahoo.com

AGFD 106 CONTROL ID: 3419977
Mechanism-based toxicity screening of natural compounds based on high-throughput approaches Natural products have been developed as therapeutic agents for various disease including cancer in the drug discovery area. However, the potential toxicity of natural products could be a big huddle to develop the drug candidates. To overcome this limitation, the development of high-contents screening method to give the information about toxic mechanism are needed. Here, we suggest the pathway-sensing method to evaluate the cellular stress for the natural compounds using imaging analysis. Several transcriptional factors including AP-1, P53, Nrf2, and NFkb which are regulated during cellular stress response including cell proliferation, apoptosis, oxidative stress, and inflammation. To screen the cellular stress response, we constructed the established HepG2 cell lines to express the luminescence and GFP when only this transcriptional factors are activated using the transcription response element. Using pathway-sensing hepatocytes, we screened the toxic effects for the wide ranges of twenty natural compounds including flavonoid, polycyclic, di-/ter-period, and quinoid and quantitative changes were examined by imaging analysis. Several natural compounds including apigenin, the potential hepatotoxic compounds

cause the cytotoxic effect mediated by AP-1, and P53 pathways and we can classify the mode of action for the natural compounds using this system. Our results suggest that the pathway-sensing hepatocytes is suitable for screening the hepatotoxicity and could give critical information about molecular mechanisms to initiate the cellular stress. This approaches can be used to build up the adverse outcome pathways (AOP) to unravel the key events associated with liver injury for natural compounds S. Park, M. Choi, S. Kim, H. Han, J. Ahn, J. Ahn, J. Oh, Korea Inst. of Toxicology, Daejeon, Korea(The Republic of) plum@kitox.re.kr

AGFD 107 WITHDRAWN

AGFD 108 CONTROL ID: 3413824
Characterization and classification of biochars with NIR hyperspectral imaging Biochar is a solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment and can be used as a soil amendment for both carbon sequestration and soil health benefits. Understanding of enzymatic activation in accordance with biochars is important, because it may vary with biochars produced from pyrolyzing swine manure and poultry litter, and by co-pyrolyzing these livestock residuals with agricultural spent mulch plastic film wastes. In this presentation, we will report spectral characteristics of biochars that were measured by near-infrared (NIR) hyperspectral imaging. Ten different biochar samples including chicken litter biochar, chicken litter with plastic biochar, swine manure biochar, swine manure with plastic biochar collected from burrow walls and undisturbed of soils were contained in 24 wells sample holder. Hyperspectral reflectance images were collected by line-scan mode between 600 and 1700 nm within 60 sec and saved as hypercube format for further spectral image analysis. The regions of interest (ROI) were selected by a growth algorithm based on reflectance of each biochar. From spectral characteristics of four different biochars, reflectance intensities from burrow walls and undisturbed of swine manure biochar were higher than other samples. We found spectral differences between chicken litter biochars with and without plastic. In addition, chicken litter biochar could be separated from undisturbed and burrow walls samples regardless containing plastic. Similarly, both swine manure and swine manure with plastic biochars were distinguishable from undisturbed and burrow walls. Thus, NIR hyperspectral imaging Tech. has the potential for rapid classification of different biochars and sampling point of soils. B. Park, USDA, ARS, Athens, Georgia, K. Ro, A. Szogi, USDA-ARS, Florence, South Carolina, J. Sanchez-Hernandez, Univ. of Castilla-La Mancha, Toledo, Spain S. Chang, USDA Ars SRRC, New Orleans, Louisiana, bosoon.park@ars.usda.gov

AGFD 109 CONTROL ID: 3439169
Emodin, a constituent of polygoni multiflori radix, induces endoplasmic reticulum stress, Aatophagy, and apoptosis in HepG2 cells Polygoni Multiflori Radix (PMR) has been used as a traditional medicine in Asia, but the recent studies reported that hepatotoxicity could be caused by intaking PMR, especially emodin, a component of PMR. In this study, we evaluated the cytotoxicity of emodin via relative oxygen species (ROS)-mediated endoplasmic reticulum (ER) stress, autophagy and apoptosis in HepG2 cells. The cytotoxicity was evaluated in HepG2 cells treated by a 70% ethanol extract of PMR and emodin for 24 hr. The content of the emodin in the 70% ethanol extract of PMR was measured by using LC-MS/MS. Total glutathione (GSH) and ROS were evaluated, and the expression levels of markers related to ER stress were all examined and measured by RT-qPCR and western blotting. The expression levels of autophagy markers and apoptosis markers were measured by using western blotting. Then, flow cytometry was used to quantify apoptosis. Emodin showed cytotoxicity and morphological changes in a dose-dependent manner. GSH was decreased and ROS was increased in a dose-dependent manner as well. The expression of BiP, CHOP, ATF6α, IRE1, and XPB1, which are related to ER stress, were increased compared with those of the control. Expressions of autophagy-related markers such as LC3II/I and Becn1, and apoptosis related markers such as Bax/Bcl2 and caspase-3 were increased in a dose-dependent manner. Flow cytometry showed a significant increase in apoptosis when the cells were treated by emodin. These findings suggest that emodin can induce hepatotoxicity by ER stress that is caused by ROS generation, and also by autophagy and apoptosis. S. Park, G. Cho, J. Lim, H. Chun, Chung Ang Univ., Anseong, Korea(The Republic of) H. Choi, Food Toxicology Laboratory, Chung-Ang Univ., Anseong, Korea(The Republic of) sirius6100@naver.com

AGFD 110 CONTROL ID: 3432575
Guaraná peel is rich in carotenoids with antioxidant potential Guaraná (Paullinia cupana) is a fruit native to the Amazonian region of Brazil, whose seeds are commonly used as a flavor and caffeine source in beverages and dietary supplements. The deep-orange peels are currently discarded during production of guaraná-based products generating significant waste. To evaluate the suitability of guaraná peels as either a natural colorant, or a source of antioxidants, we aimed to: identify and characterize the chemical source of pigmentation in guaraná peels, and develop a scheme for the pigment extraction. The major carotenoids in guaraná are lutein and β-carotene, and their identities were determined using ultra high performance liquid chromatography (UHPLC) coupled with diode array detection (DAD) and a quadrupole time of flight mass spectrometer (QTOF-MS). To optimize carotenoid extraction from guaraná peel, ethyl acetate, hexane, ethanol, and the mixtures, ethyl acetate:ethanol (1:1, v/v), and hexane:ethanol (1:1, v/v) were used as solvents. The extraction was carried out at 25 and 50 °C, considering the ratio of 1:10 (w/v) peel:solvent. Total carotenoids content was quantified using UV-visible spectrophotometry, after 2, 4, 6, 8 and 24 hours. Carotenoid recovery increased significantly ($p<0,05$) with temperature at 50 °C, compared to 25 °C, and approached a quasi-saturated condition after 4 hours of extraction, regardless of the solvent used. Under these conditions, carotenoid content obtained by extraction with ethanol:hexane (107.34±1.48 μg/g dw) showed the highest recovery. Although the solvent mixture has shown a superior result in terms of carotenoid content, ethanolic extract (94.41±0.13 μg/g dw) was chosen as solvent for an additional study to further application, as it is generally recognized as safe (GRAS). The study of the antioxidant activities of the ethanolic extract showed great results for ABTS (60.08±1.65 μMol Trolox eq./g) and ORAC (76.09±2.93 μMol Trolox eq./g) assays, indicating the potential of guaraná peel as a source of valuable compounds. L.S. Pinho, J. Cooperstone, O. Campanella, Dept of Food Sci. and Tech., Ohio State Univ., Columbus, L.S. Pinho, M. Thomazini, C.D. Rodrigues, C.S. Favaro- Trindade, Departamento de Engenharia de Alimentos, Universidade de São Paulo, Pirassununga, Brazil J. Cooperstone, Dept of Horticulture and Crop Science, Ohio State Univ., Columbus, spinholorena@gmail.com

AGFD 111 CONTROL ID: 3430290
Chemical synthesis of azetidinone, naturally occurring β-lactam antibiotics Novel approaches to the chemical synthesis of β-lactam, azetidinone. Naturally occurring antibiotics have attracted several studies because of their biological studies. H. Honda, NPU, Fremont, California, D. Ren, Pharmacy, China Pharmaceutical Univ., Nanjing, Jiangsu, Y. Lo, Bioengineering, Stanford Univ., Stanford, California, G. Ren, School of Economics, Shanghai Univ., China |E.J. Parish, Auburn Univ, Auburn, Alabama rendc@ahjc999.com

AGFD 112 CONTROL ID: 3427862
Eco-friendly strategy for mitigating microplastic pollution in agricultural soils using earthworms Microplastic pollution in agricultural soils is an emerging environmental and health issue. Application of biosolids, irrigation with reclaimed wastewater, and plastic mulching Tech. are the major sources of microplastic pollution in agroecosystems. Accumulating evidence suggests that microplastics interact with soil physicochemical properties and biological processes, thus negatively affecting plant growth. Moreover, microplastics may be the carriers of environmental contaminants (e.g., pesticides), acting as secondary sources of soil pollution. Recent studies suggest that earthworms, particularly anecic and endogeic species, may facilitate plastic biodegradation directly and indirectly via their strong impact on soil microbial properties and the resulting intense soil bioturbation. The objective of this study is to introduce potential earthworm-based strategies for reducing microplastic-effects in soil functioning. We introduce the current state of knowledge on microplastic-earthworm interaction and describe the behavior- and gastrointestinal-associated mechanisms whereby earthworms may contribute to polymer biodegradation. K. Ro, USDA-ARS, Florence, South Carolina, J. Sanchez-Hernandez, Inst. of Environmental Science, Univ. fo Castilla-La Mancha, Toledo, Spain kyoung.ro@ars.usda.gov

AGFD 113 CONTROL ID: 3431380
Untapped potential of earthworms in plastic pollution of agricultural soils Agricultural soils receive plastic debris by multiple pathways, being the fertilization with biosolids and municipal-derived composts, crop irrigation with reclaimed wastewater, and mulching film Tech. the major routes for soil plastic pollution. Consequently, a wide variety of fragment sizes (from nanoplastics [1-100 nm] and microplastics [1-1000 mm] to mesoplastics [1-10 mm]) and shapes (spheres, fibers, films and irregular fragments) comprise the cocktail of plastic debris frequently found in agricultural soils, which is a challenge for both analytical chemistry and ecotoxicology. Over the past two years, compelling evidences suggest that accumulation of microplastics and mesoplastics in soil, and the products of their degradation (nanoplastics and chemical additives), may cause adverse effects on soil fauna and plants. Among soil organisms, earthworms are frequently used in plastic ecotoxicology because of their direct interaction with plastics (ingestion of micro/nanoplastics, transport of micro/mesoplastic in soil), and their strong impact on soil physicochemical and biological properties, ultimately leading to improve plant growth and health. Taking advantage of these earthworm-mediated effects, we propose two strategies for managing plastic residues in the agroecosystem. The first option involves the inoculation of plastic- contaminated soils with earthworms (in-situ biological strategy), with the scope of creating microbial and enzymatic- rich microhabitats aimed to facilitate plastic biodegradation. The second option (ex-situ chemical strategy) consists of producing upgraded biochar (i.e., the carbonaceous material generated by pyrolysis of biomass) from agro-residues blended with plastic debris, which is added to soil in the presence of earthworms to improve the biochemical properties of soil. The increase of soil enzyme activities is due to the interplay between the improved capacity of biochar to retain exoenzymes and soil microbial activity induced by earthworms. With the intention of motivating further debate on bioremediation of plastic-contaminated agricultural soils, this presentation will discuss the main advantages and challenges around these two earthworm-assisted strategies for managing soil plastic pollution. J. Sanchez-Hernandez, Inst. of Environmental Sciences (ICAM), Univ. of Castilla-La Mancha, Toledo, Spain juancarlos.sanchez@uclm.es

AGFD 114 CONTROL ID: 3440469
Transcriptional regulatory mechanism of MK-4 converting enzyme UBIAD1 by PARP-1 Vitamin K which is contained in green and yellow vegetables and fermented foods is classified into various homologues based on the difference in the side chain structure. Vitamin K has been reported to be converted to menaquinone-4 (MK-4), which has the highest physiological activity such as bone formation and blood coagulation, by UbiA prenyltransferase domain containing protein 1 (UBIAD1). UBIAD1 is also a major regulator of HMG CoA reductase and controls cholesterol synthesis. Therefore, UBIAD1 plays critical roles in various cells, and its expression is thought to be specifically regulated. However, the expression regulation mechanism of UBIAD1 has little reported. Elucidating the expression regulation mechanism of UBIAD1 will lead to reveal a physiological roles for UBIAD1 or MK-4, and may be applicable to diseases such as osteoporosis and abnormality in cholesterol metabolism. We previously identified poly [ADP-ribose] polymerase 1 (PARP-1) as a factor that bound to upstream region of the UBIAD1. First, we evaluated the UBIAD1 expression level and the MK-4 converting activity in PARP-1 overexpressing cells. PARP-1 is reported to be activated by protein kinase C (PKC). Then, we next evaluated the UBIAD1 expression level and the MK-4 converting activity in PKC activator phorbol 12-myristate 13-acetate (PMA) treated cells. To evaluation of the UBIAD1 expression level, we measured transcriptional activity of the UBIAD1 promoter by luciferase assay, the UBIAD1 mRNA expression level by real-time PCR and the expression level of UBIAD1 protein by Western blot analysis. The MK-4 converting activity by UBIAD1 was measured by UPLC-APCI-MS/MS. Our results showed that PARP-1 accelerated UBIAD1 promoter activity. The UBIAD1 mRNA expression level was also increased by activation of UBIAD1 promoter. Furthermore, the elevated expression of UBIAD1 by PARP-1 facilitated MK-4 converting activity. Our results suggested that PARP-1 regulates the UBIAD1 expression specifically. These findings provide evidence that PARP-1 is a factor for regulating UBIAD1 expression and is expected to lead to the development of studies for UBIAD1 which plays important roles such as MK-4 conversion and cholesterol metabolism S. Sano, M. Imai, M. Kamao, Shibaura Inst. of Tech., Tokyo, Japan Y. Suhara, Dept. of Bioscience and Engineering, Shibaura Inst. of Tech., Saitama, Japan H. Yoshihisa, Dept. of Bioscience and Engineering, Shibaura Inst. of Tech., Saitama, Japan mf19036@shibaura-it.ac.jp

AGFD 115 CONTROL ID: 3437537
Total phenolic contents and free radical scavenging capacity of sunflower seed flour Sunflower seed flour is a byproduct of sunflower seed oil production. This byproduct comes from the hulls and fiber that are left behind from the sunflower oil extraction. Sunflower seed flour is commonly used for ruminant feed. However, recent trend shows that sunflower seed flour has gain its popularity as sustainable food for human consumption due to its nutraceutical benefits. Sunflower seed flour has been widely used to enrich the nutritional composition of food products. In this study, sunflower seed flour was extracted with 50% acetone and evaluated for its potential health beneficial properties such as total phenolic contents (TPC) and free radical scavenging capacity. The sunflower seed flour extract result showed a total phenolic contents of 20.8 gallic acid equivalent (GAE) mg/g of dry seed flour. In ABTS cation radical scavenging capacity, the sunflower seed flour extract had 104 μmol Trolox equivalent (TE)/g, respectively. These results suggest potential value-added utilization of sunflower seed flour in improving human health. B. Santoso, H. Childs, L. Yu, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park, U.E. Choe, Nutrition and Food Sci., Univ. of Maryland, College Park, bearnadettesantoso@gmail.com

AGFD 116 CONTROL ID: 3432572
Evaluation of the effects of different oak chips on dark and light beer Oak wood's contribution to the high-quality beverages is well documented as it interacts with them at the molecular level imparting different characteristic flavors. The desirability of infusing these flavors to beer is becoming a recent trend. Therefore, a study was conducted to evaluate the effects of distinct oak chips on the flavor profile of dark and light beers. Two different types of oak chips i.e. French and American oak were used for the maturation process of beers. Physiochemical analysis of the matured beers was performed to test for volatile compounds such as aldehydes, esters and higher alcohols by GC-MS and GC-FID. Lower molecular weight compounds were analyzed using HPLC. Insignificant changes to the physical and chemical properties of both the beers suggested that the quality was not affected by the oak chips. An overall increase in oak-derived compounds was observed indicating an interaction between the beers and oak occurred thereby resulting in the change in flavor composition for both the beer styles. D. Sarkar, K. Vander, D. Steele, Research and Development, Gusmer Enterprises. Inc, Fresno, California, D. Sarkar, Purdue Univ., West Lafayette, Indiana, dsarkar@gusmerenterprises.com

AGFD 117 CONTROL ID: 3432599
Evaluation of color-related phenolics, volatile composition, and sensory profile using oak chips in low- alcoholic beer The effects of the treatment of two different varieties of oak chips (American and French) in low-alcoholic beer were analyzed. The study was mainly focused on the changes of color-related compounds such as anthocyanins and tannins, and of volatile and sensory profiles. An overall characterization of the low-alcoholic beer was also performed. With reference to the phenolic profile, different phenolic acids (gallic, vanillic, syringic and ellagic acids), phenolic aldehydes (vanillin, syringaldehyde, coniferaldehyde and sinapaldehyde) and furanic derivatives (furfural, 5- methylfurfural and 5-hydroxymethylfurfural) were quantified in commercial American and French oak chips in low- alcoholic beer. Comparison study was performed with chips of different sizes and different toast degree. The oak profiling of the low-alcoholic beer using American and French oak chips was different due to their different initial phenolic composition. The extraction and quantification of phenolic acids, phenolic aldehydes and furanic derivatives were achieved by high-performance liquid chromatography (HPLC). The identification of those compounds was also confirmed by LC-MS. D. Sarkar, K. Vander, D. Steele, Research and Development, Gusmer Enterprises. Inc, Fresno, California, D. Sarkar, Purdue Univ., West Lafayette, Indiana dsarkar@gusmerenterprises.com

AGFD 118 CONTROL ID: 3410627
Infusion of jabuticaba peel extract in probiotic cells by passive and vacuum mechanisms Synergistic interaction between polyphenolic compounds (PC) and probiotics may improve the proliferation of probiotics and the absorption of PC and their metabolites in the gut. In this context, encapsulation of jabuticaba peel extract (JPE) using cells-based carriers, such as Lactobacillus cells, was evaluated as a strategy to simultaneously deliver PC and probiotics. Jabuticaba peel was selected as it has high levels of PC and it is a by-products of juice processing industry. This research focused on the recovery of total polyphenolic compounds (TPC) from jabuticaba peel and their infusion in live probiotics cells using passive and vacuum infusion methods. The recovery of TPC was performed using solutions with different concentration of ethanol (0%, 25% and 50% v/v) at 40 °C for 2 h. The measured TPC in JPE was between 36 to 52 mg GAE/g. Vacuum infusion using JPE in 25% of ethanol solution provided the maximum loading of PC (8 mg GAE/g of cells) in probiotic cells in less than 5 minutes without significantly influencing cell viability. Vacuum infusion using JPE dissolved in water provided the loading of PC below 2 mg GAE/g of cells. The presence of ethanol in the encapsulating mixture improved loading by increasing the solubility of PC as well as their partitioning in cells during vacuum infusion. The loading of PC using passive infusion ranged between 1.5 to 4.5 mg GAE/g of cells after 24 hours of incubation. This value was 2 – 4-fold lower than that obtained via vacuum infusion. Probiotic cells after infusion of JPE were viable, counts ranged from 7.8 to 11 log CFU/g. Release of encapsulated compounds from bacterial cells were measured in simulated gastrointestinal fluids. Lactobacillus cells released from 20% to 40% of PC. Overall, vacuum infusion is a promising technique for the encapsulation of plant extract in probiotic cells and their delivery to the gut. This research provides a novel platform to evaluate the synergistic interactions between probiotic and PC. M.P. Silva, C.S. Favaro-Trindade, Departamento de Engenharia de Alimentos, Univ. de São Paulo, Pirassununga, Brazil M.P. Silva, R. Rai, N. Nitin, Food Sci. and Tech., Univ. of California, Davis marluci.silva@usp.br

AGFD 119 CONTROL ID: 3437403
Cranberry product composition and its effect on the growth of gut bacteria Cranberry (Vaccinium macrocarpon), and other related berries, have been shown to shift the composition of the gut microbiome towards a more favorable population correlated to better overall health. The potential health benefits of cranberries can be attributed to a variety of secondary metabolites, including proanthocyanidins (PACs), flavonoids, triterpenoids, and organic acids. Previous studies have demonstrated that such polyphenolic compounds are able to inhibit adhesion and infection by pathogenic gut bacteria of several genera, while leaving probiotic species such as those of Lactobacillus unaltered, or even promoting their growth. The specific mechanisms behind this phenomenon are largely unknown. Commercial cranberry supplements can provide a low-sugar alternative to juices and sweetened fruit products, however the phytochemical content varies widely. Selected commercial cranberry supplements and a standard whole cranberry powder were analyzed for secondary metabolite profile, using 1H qNMR with Bruker AssureNMR software, HPLC-DAD and the DMAC assay for the determination of PAC content. Principal component analysis of 1H NMR spectra showed overlap between several supplements and whole cranberry powder, whereas others varied widely from the standard. Many supplements were missing bioactive compounds such as PACs, anthocyanins, triterpenoids or organic acids, and none of the supplements analyzed contained all of the compounds of interest. Several probiotic and opportunistic pathogenic bacterial species commonly found in the human gut microbiome were chosen for evaluation to monitor effects of extracts from these cranberry products with varied composition on bacterial survival and growth, using the disk diffusion susceptibility test followed by growth rate analyses. Study results may provide important insight regarding the correlation between phytonutrient composition in cranberry products and the growth of bacteria found in the gut microbiome. J.R. Turbitt, B. Benson, M. Silby, V. Bucci, Chemistry, Univ. of Massachusetts Dartmouth, Lincoln, Rhode Island, C.C. Neto, Chemistry and Biochemistry, Univ. of Massachusetts Dartmouth, Attleboro, Massachusetts, jturbitt@umassd.edu

AGFD 120 CONTROL ID: 3413281
Identifying key odor compounds in bourbon using solvent-free aroma dilution analysis and a novel software for interpreting GC-O data Stir Bar Sorptive Extraction (SBSE) coupled with gas chromatography-mass spectrometry (GC/MS-O) allows for separation and identification of aroma compounds in complex sample matrices with minimal sample preparation time. Aroma Dilution Analysis (ADA) is a solvent-free approach of Aroma Extract Dilution

Analysis (AEDA) which employs a GC inlet system to split the carrier gas flow to a desired ratio. The approach of ADA has been applied to direct immersion SBSE of bourbon samples for determination of flavor dilution (FD) factors and identification of key odorant compounds. The gas chromatography system with a thermal desorption unit (TDU) and cooled injection system (CIS) allowed two independent split ratios, with the overall split ratio ratios corresponding to the dilution factors. The developed method allowed the determination of FD factors in a range from 1-201. Data generated by ADA was evaluated by a novel software that allows for the handling of GC-O intensity data along with the GC/MS data for identification of key odorant compounds in bourbon. L. Vernarelli, J.R. Stuff, J. Whitecavage, Applications, GERSTEL, Inc, Abingdon, Maryland, lvernarelli@gmail.com

AGFD 121 CONTROL ID: 3431358
Investigation of the absorption mechanism of smoke taint markers on to winegrapes The increase in the frequency of wildfires on the West Coast of the USA is seen as a significant risk for the winegrape and wine industry. Smoke-related compounds can accumulate in winegrapes, which can result in smoke- impacted wines. Among hundreds of volatile compounds reported in wild smoke, volatile phenols and their corresponding precursors are widely agreed as the main markers of smoke taint. However, understandings of the absorption mechanism of smoke-taint markers on to grapes are still limited, making it challenging to propose winemaking strategies to mitigate or prevent smoke impact. Another challenge is the measurement of smoke-taint markers in the air generating by wildfires, and how that relates to the amount absorbed by grapes. In this present study, different analytical strategies were applied to trace the transfer kinetics of 10 volatile phenols (VFs) from air to grape, including most of the reported smoke-taint markers. A full evaporation HS-SPME-GC-MS method was proposed to determine their concentrations in the air phase. Then a well-sealed system containing known concentrations of VFs in the vapor phase was designed to investigate the absorption efficiency of grape clusters. Experimental factors were optimized to reach sufficient sensitivity and reproducibility, including the SPME extraction conditions, the equilibrium of VFs in the vapor phase and the exposure time. After VFs exposure, grape skins and berries were extracted to determine the concentrations of all the selected markers by a proposed LLE-GC-MS method. Also, the glucoside-precursors of VFs were analyzed by a well-developed SPE-UHPLC-qTOF method. Isotopic standards were used as indicators during the whole process. The results show the transfer potential of smoke-taint markers from air to grapes, expanding our knowledge of the formation of smoke-taint flavor. This controlled system is the first step in understanding the absorption process that will lead to developing preventative strategies during and after wildfire events Y. Wen, C. Medina Plaza, A. Oberholster, A.L. Waterhouse, Viticulture and Enology, Univ. of California, Davis, yanwe@ucdavis.edu

AGFD 122 CONTROL ID: 3434329
Inhibitory effects of titanium dioxide nanoparticles on beneficial gut bacteria Titanium dioxide (TiO2, E171) are widely used in many food, personal care and other consumer products. Previous studies reported that the presence of nanoscale TiO2 in E171 could disturb the homeostasis of gut microbiota. The aim of this study was to determine the impact of titanium dioxide nanoparticles (TiO2 NPs, 30 nm) on strains of beneficial gut bacteria. Four bacterial strains, i.e. Lactobacillus. reuteri, Lactobacillus. Gasseri, Bifidobacterium. animalis, and Bifidobacterium. longum were subjected to the treatment of TiO2 NPs under anaerobic conditions, mimicking the environment in the large intestine. TiO2 NPs showed significant inhibitory effects on the growth of all four strains at the concentration of 200 μg/mL. Based on the results from confocal microscope and flow cytometry, the growth inhibitory effects were associated with cell membrane damage to the bacteria strains. L. reuteri, one of the predominant lactobacillus strains, that was most sensitive to TiO2 NPs treatment. This study substantiated the need for more assessment of the toxicity of metal oxide NPs on beneficial gut bacteria Y. Wu, Univ. of Massachusetts Amherst, H. Du, Dept. of Food Sci., Univ. of Massachusetts Amherst, D. McClements, UMASS Dept of Food Sci.s, Amherst, Massachusetts, H. Xiao, Dept. of Food Sci., Univ. of Massachusetts, Amherst, yanyanwu@umass.edu

AGFD 123 CONTROL ID: 3408156
Total synthesis of aaptamine and their 3 alkylamino derivatives and antibacterial activity A simple and efficient synthetic route for preparing the benzonaphthyridine framework is reported. Only seven steps are needed for the assembly of antibacterial 3-alkylamino aaptamine from inexpensive isoquinoline by this route with about 20% overall yield. The two key steps are a novel palladium-catalyzed reductive cyclization with Mo(CO)6 as reductant to form aaptamine and demethyloxyaaptamine and a hydrogen-bond-mediated oxidative alkylamination to account for the complete regioselectivity. F. Yang, Dept. of Pharmacy, Ren Ji Hospital, School of Medicine, Shanghai Jiao Tong Univ., Oxford, Mississippi bill1985@126.com

AGFD 124 CONTROL ID: 3421560
Role of vitamin K in the brain - Measurement of vitamin K levels in human brain and the mechanism of vitamin K induced neuronal differentiation - Importance of your research: Vitamin K is found in green and yellow vegetables and fermented foods. Vitamin K2 (MK-4) has been reported to have the strongest bioactivity and has been applied in clinical practice. We have found that MK-4 is present at very high levels in mouse brain tissue, but the role of MK-4 in the brain is not fully understood. In this study, (1) The amount of vitamin K in human brain tissue was quantified using clinical samples, and it was found that the amount of vitamin K in the brain was significantly increased after administration of the vitamin K preparation. (2) We investigated the molecular mechanism of vitamin K-induced differentiation into neurons and found important two receptors and one nuclear regulatory factor. Problem your work attempts to solve: In this study, we attempted to solve two problems: (1) Precision quantification of vitamin K levels in human brain tissue using clinical samples, and (2) Molecular mechanisms of vitamin K-induced differentiation into neurons. Approaches or methods used: (1) Vitamin K were extracted from the obtained brain tissues and quantified by LC-APCI MS/MS. (2) MK-4 was added to neural stem cells isolated from 14.5-day-old mouse fetal cerebrums, and transcriptome analysis was performed on differentiated neurons to search for genes with comprehensive variation. Overview, not details, of results: (1) Precise quantification of vitamin K levels in human brain tissue showed that o the amount of vitamin K in the brain was increased more than 10-fold after administration of the vitamin K preparation. Brain MK-4 levels were lower in patients with degenerative brain diseases. (2) Transcriptome analysis revealed that two receptors (calcium and glutamate receptor) and one epigenomic nuclear regulator play important roles in MK-4-induced neural differentiation. This study revealed that vitamin K plays an important role in the brain, suggesting that it may contribute to the prevention and treatment of degenerative brain diseases. H. Yoshihisa, Y. Takagi, Y. Suhara, Graduate School of Engineering and Science, Shibaura Inst. of Tech., Saitama, Japan H. Yoshihisa, College of Medicine, Univ. of Cincinnati, Ohio, F. Ayako, Faculty of Pharmaceutical Sciences, Suzuka Univ. of Medical Science, Suzuka, Japan K. Maya, T. Okano, Dept. of Hygienic science, Kobe Pharmaceutical Univ., Kobe, Japan hirotay@shibaura-it.ac.jp

AGFD 125 CONTROL ID: 3437120
Chemical composition of tetraploid Gynostemma pentaphyllum gypenosides and their suppression on inflammatory response by NFκB/MAPKs/AP1 signaling pathways The chemical composition and antiinflammatory activity of gypenosides isolated from tetraploid Gynostemma pentaphyllum (GP) leaves were investigated. The gypenosides accounted for 7.43 mg/g of the tested GP sample, which were composed of four major saponins including isomers of gypenoside 1 and 2 (C47H76O18), 3 (C47H76O17), and 4 (C46H74O17). Pretreatment of gypenosides reduced mRNA expressions of the proinflammatory mediators in LPS stimulated RAW264.7 macrophage cells, such as IL6, ILβ, COX2, and TNF in a dose dependent manner. The secreted protein levels of IL6 and TNFα, and NO production were also decreased by gypenosides within the concentration range of 50 to 200 μg/ml. Moreover, the mechanism studies demonstrated that gypenosides (200 μg/ml) treatment significantly inhibited the nuclear translocation of nuclear factor κB and activator protein 1 through down regulating the phosphorylation of their upstream IκB kinase and mitogen activated protein kinases (MAPKs), especially that of cJun N terminal kinase and extracellular regulated protein kinase(JNK and ERK), but not that of the p38 MAPK. These results suggested that the gypenosides might have potential antiinflammatory effect and use for improving human health. L. Yu, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park, Maryland, Y. Zhang, B. Wang, H. Chen, Dept. of Food Sci. & Engineering, School of Agriculture and Biology, Shanghai, China yqzhang2006@sjtu.edu.cn

AGFD 126 CONTROL ID: 3411333
Optimization of enzymatic synthesis of EGC (epigallocatechin) mono-esters and their antioxidant activity as affected by the acyl chain length Objective: Antioxidants arrest oxidative processes in food, beverages, pharmaceuticals, and cellular matrices. Due to potential adverse effects of synthetic antioxidants, research on natural sources of antioxidants has intensified. EGC (epigallocatechin), one of the most widely distributed dietary flavanols, serves as an efficient natural antioxidant with numerous bioactivities such as antioxidant, anti-cancer, antithrombotic, antimicrobial, and antiviral ability, among others. However, EGC is a relatively polar molecule and may not be easily incorporated into food lipids and other lipophilic media. Therefore, investigating novel EGC derivatives via enzymatic modification and evaluation of antioxidant activity of the esterified products is of interest in this study. Materials and Methods: To achieve our objectives, we used a green enzymatic process. Various saturated fatty acids with 2 to 18 carbon atoms were used as acyl donors in order to increase the hydrophobicity of EGC. Nineteen different lipases and twelve different solvent systems were screened. Later on, the RSD (response surface design) method was used to optimize various reaction parameters. Furthermore,products prepared under the most effective conditions were then tested for their antioxidant activity using the ABTS, DPPH, FRAP and metal-chelation methodologies. Results: The highest yield of EGC (82.18%) was achieved under the optimized conditions. The EGC monoesters exhibited a lower ABTS radical scavenging ability (220.10-253.05% equivalents of Trolox) than the parent EGC molecule (349.55% equivalents of Trolox). Similar results were found for Ferric ion reduction ability (FRAP) but not in the DPPH assays. In ferrous chelation test, the monoesters were much more effective (15.87-49.64% equivalents of EDTA) than that of EGC (9.76% equivalents of EDTA). Overall, EGC esters with short-medium chain length showed the highest antioxidant ability in these chemical antioxidant assays. Conclusion: The ultrasonication enhanced the esterification yield. The EGC monoesters displayed a significantly higher chelation ability, but a lower ABTS radical and similar DPPH scavenging capacity compared to EGC itself. However, the monoesters so prepared were as effective as the traditional synthetic antioxidants (BHA, BHT, and TBHQ). Thus, acylated EGCs could serve as viable alternatives to synthetic antioxidants. However, preparation conditions may require further improvements. H. Peng, Biochemistry, Memorial Univ., St John's, Newfoundland, Canada F. Shahidi, Biochem Dept, Memorial Univ of Newfoundland, St. John's, Canada hanp@mun.ca

AGFD 127 CONTROL ID: 3428995
Antiplasticization behavior of biobased additives on the structure, properties, and wet spinning of cellulose acetate fibers Cellulose acetate (CA) receives notable attention as an environmentally friendly, biodegradable polymer from renewable, low-cost resources. CA polymers are believed to have a critical role in shaping a greener and more circular textile economy. However, the mechanical properties of CA fibers are among the lowest in terms of its tensile strength, poor wet strength, and low flexural strength. This study investigates the effect of biobased additives for antiplasticizing the mechanical performance and structure of CA fibers. At up to 5% of CA, glucaric acid (GA) and its monoammonium salt were added to CA fibers. With 1.5% GA additive, tensile modulus improved by 155%, tensile strength by 55%, and CA flexibility according to knot to straight fiber tenacity ratios improved by 107% when compared to neat CA fibers. Based on the results, green small molecule antiplasticizers do exist, but their performance improvements are observed at low percentages of loading. B. Bush, Textile Engineering, North Carolina State Univ., Raleigh E. Ford, Textile Engineering, Chemistry & Science, North Carolina State Univ., Raleigh M. Biswas, Textile Engineering, Chemistry and Science, North Carolina State Univ., Raleigh mbiswas2@ncsu.edu

AGFD 128 CONTROL ID: 3429608
Interior versus exterior silver nanoparticle-incorporated cotton fiber: comparison of silver release behaviors during washing For their antibacterial, antifungal, and antiviral properties, silver nanoparticles are widely employed in the production of odor-neutralizing and anti-infective textile products. However, recent studies have reported that these commercial products leach out a significant amount of silver nanoparticles during washing. Here, we examined the effect of morphological integration of silver nanoparticles to cotton fiber—interior versus exterior—on silver release during consecutive washings. The interior silver nanoparticles were produced by in situ synthesis within cotton fiber, whereas the exterior silver nanoparticles were produced by the pad-dry method of silver colloid onto a cotton fabric. A combination of analyses, including surface-enhanced Raman spectroscopy, inductively coupled plasma mass spectrometry with ultrafiltration, ion-selective electrode method, and UV/Vis spectroscopy, showed that the release of ionic and particulate silvers strongly depended on the mode of integration. The interior silver nanoparticles predominantly released ionic silver rather than particulate silver and released a much smaller amount of silver as compared with the exterior silver nanoparticles. This leach resistance of the interior nanoparticles was attributed to their immobilization within cotton fiber. S. Nam, M.B. Hillyer, B. Condon, USDA-ARS-SRRC, New Orleans, Louisiana, S.E. Chavez, Inst. of Material Science, Univ. of Connecticut, Vernon L. Sun, Insitiute of Material Science, Univ. of CT, Storrs, Connecticut, sunghyun.nam@ars.usda.gov

AGFD 129 CONTROL ID: 3430877
Chemometric characterization of aldehydes in oxidized oils: formation, transfer, and biological impact C2-C11 aldehydes with alkanal, alkenal, and hydroxyalkenal structures are the most abundant and reactive secondary lipid oxidation products in thermally-processed cooking oils. Chemometric profiling of aldehydes in oxidized cooking oils, including soybean, canola, corn, and olive oils, revealed the correlations between the kinetics of forming individual

aldehydes and the levels of their fatty acid precursors in cooking oils. Chemometric comparisons between frying oils and extracted lipids from French fries showed great variances in the transfers of individual aldehydes from frying oils to French fries, in which C9-C11 aldehydes had higher transfer rates than other aldehydes. Furthermore, the correlation analysis on the quality markers of six thermally oxidized soybean oils and the growth performance of pigs and broilers fed these oils showed that p-anisidine value and C9-C11 unsaturated alkenals had the best inverse correlation with the growth performance of broilers and pigs. These case studies on aldehydes in oxidized oils highlight the efficiency of chemometrics for characterizing complex chemical matrices in foods and their biological effects. C. Chen, J. Yuan, Q. Mao, Food Sci. and Nutrition, Univ. of Minnesota, St. Paul chichen@umn.edu

AGFD 130 CONTROL ID: 3430879
Relationship between the antioxidant efficiencies of catechins and their concentrations in the interfacial region of corn oil-in-water emulsions Determining antioxidants (AOs) distributions in intact emulsions is not an easy task due to the physical impossibility of separating the interfacial region from the oil and aqueous regions. In this work, we employed a well- established pseudophase kinetic model on the basis of reactions between a hydrophobic 4-hexadecylbenzenediazonium ions (16-ArN2+) and the selected polyphenols to determine the distributions of catechins, including (-)-Epigallocatechin-3-gallate (EGCG), (-)-epigallocatechin (EGC), (-)-epicatechin-3-gallate (ECG) and (-)-epicatechin (EC), in the oil-in-water emulsions composed of stripped corn oil, acidic water and Tween 20. Results indicated that at the same emulsifier volume fraction, the order of the percentage concentrations in the interfacial regions followed %EGCG<%ECG<%EGC<%EC. It seemed that the selected AOs with less hydroxyl groups or galloyl groups were more prone to locate in the interfacial regions. An increase in emulsifer concentration promoted the incorporation of AOs into the interfacial region, however, their interfacial concentrations, which were much greater than their stoichiometric concentration, decreased due to the dilution of AOs in the interface region. Antioxidant activity and antioxidant efficiency were also analyzed to get a better understanding of the influence of antioxidant distribution and antioxidant activity on the antioxidant efficiency in inhibiting lipid oxidation in corn oil-in-water emulsions. Results showed that EC with the lowest DPPH scavenging activity exhibited the highest antioxidant efficiency. On the contrary, although possessing the highest value of scavenging activity, EGCG showed the lowest antioxidant efficiency. Therefore, the efficiency of AOs in inhibiting the oxidation of lipid might mainly depend on their interfacial concentrations. This research highlights the key role of the AOs interfacial distributions in inhibiting lipid oxidation in emulsions and is helpful for developing a guideline to select the optimal antioxidant for food emulsions L. Cheng, Q. Huang, Food Sci., Rutgers Univ, New Brunswick, New Jersey lc894@scarletmail.rutgers.edu

AGFD 131 CONTROL ID: 3432681
Transfer of pesticide residue during tea brewing: Understanding the effects of pesticide's physico-chemical parameters on its transfer behavior The percent transfer of pesticide residue from tea to infusion is an important factor that should be taken into consideration for setting realistic Maximum Residue Levels (MRLs) and risk assessment, as infusion prepared from dry tea is generally consumed, rather than the dry tea. The aim of this study is to investigate the inherent regularity of pesticides' transfer behavior, and to understand the effects of pesticide's physico-chemical parameters on its transfer behavior. A series of field trials, manufacturing and brewing experiments of 42 pesticides were conducted. Results indicated that transfer potential of a pesticide is related to its physical–chemical properties but not much to its type. Regression of transfer rate (TR) prediction model was logTR = 1.242 + 0.306log(Ws) (R2 = 0.893). Thus, water solubility (Ws) can be used to predict the drinking safety of pesticides potentially introduced into tea plantation. Furthermore, as a case study on tea, this approach could also provide references for other beverage crops. X. Wang, Z. Chen, Tea Research Inst., Chinese Academy of Agricultural Sciences, Hangzhou J. Gan, Univ of California, Riverside, w.xinru@163.com

AGFD 132 WITHDRAWN

AGFD 133 CONTROL ID: 3400192
Structural and functional characterization of Stx2k, a new subtype of Shiga toxin 2 Infection with Shiga toxin-producing Escherichia coli (STEC) can manifest in a range of symptoms from mild diarrhea to potentially life-threatening hemolytic uremic syndrome. The major virulence factor of STEC, Shiga toxin (Stx), is encoded on lambdoid prophage and as such horizontal gene transfer contributes to the rapid evolution of Stx. The emergence of new subtypes challenges the efficacy of existing disease management and surveillance strategies. Recently a new subtype of Shiga toxin, Stx2k, was identified. E. coli encoding stx2k were isolated from a wide range of sources including diarrheal patients, animals, and raw meats, yet an existing immunological assay was inefficient at detecting the toxin. Because Stx2k is a new subtype, little information is available about its structure or function relative to other Shiga toxin subtypes. Therefore, we generated a non-toxic Stx2kE167Q toxoid which allowed us to determine the crystal structure at 2.29 Å resolution and generate a novel polyclonal antibody (pAb). The pAb neutralized the toxicity of purified wild type Stx2k and increased the sensitivity of detection of an immunoassay 10-fold when compared to assays using extant antibodies. Stx2k is less toxic than Stx2a in Vero cell assays but is similar to Stx2a in receptor-binding preference, thermostability, and acid tolerance. Although Stx2k does not appear to be as potent as Stx2a to Vero cells, the wide distribution and blended virulence profiles of the Stx2k-producing strains suggest that horizontal gene transfer through Stx2k-converting phages could result in the emergence of new and highly virulent pathogens. This study provides useful information and tools for early detection and control of Stx2k-producing E. coli, which could reduce public risk of infection by less-known STECs. A. Hughes, X. He, Y. Zhang, USDA, ARS, WRRC, Albany, California anna.hughes@usda.gov

AGFD 134 CONTROL ID: 3426103
Determination of sodium, potassium, and calcium in dietary vitamins and sauerkraut by ion chromatography Ion chromatography (IC) is a well-established Tech. for the routine determination of anionic and cationic analytes in a wide variety of samples in many industries, including the pharmaceutical, bioTech., environmental, agricultural, and food industries. Here we employed IC to analyze dietary vitamin and sauerkraut samples for nutritional elements such as sodium, potassium, and calcium. We used a Thermo ScientificTM DionexTM IonPacTM CS16 column for the separation of the sodium, potassium, and calcium cations. The Dionex IonPac CS16 high-capacity cation exchange column has 100% solvent compatibility and medium hydrophobicity. The high capacity of 3000 µeq/column is achieved by using a smaller particle diameter (5.5 µm), a higher density of grafted carboxylic acid cation exchange groups, and a larger column format. The high capacity of the column allows loading of high concentrations of sodium, potassium, and calcium without affecting/losing resolution. Samples were prepared in acidic solution to ensure complete dissolution of calcium compounds in the samples. The multivitamin sample required 1.5 M acetic acid while the sauerkraut sample only required 10 mM acetic acid for complete calcium dissolution. After dissolution, sample solution was filtered through a 0.2 µm filter and injected into the IC system. The samples were then analyzed using a Dionex IonPac

CS16 column at 40 °C with 30 mM methanesulfonic acid (MSA) eluent generated using a Thermo ScientificTM DionexTM EGC 500 MSA Eluent Generator Cartridge and suppressed conductivity detection. Figure 1 displays chromatograms of the multivitamin and sauerkraut samples. The nutritional elements (sodium, potassium and calcium) in multivitamin and sauerkraut samples were measured at concentrations ranging from 0.39 to 125 mg/g. The method showed good precision with RSDs <0.1% and <5% (n=9) for retention time and peak area, respectively. M. Aggrawal, Ion Chromatography-Sample preparation, Thermo Fisher Scientific, Sunnyvale, California, J. Rohrer, Thermo Fisher Scientific, Sunnyvale, California, manali.aggrawal@gmail.com

AGFD 135 CONTROL ID: 3430574

Isolation and characterization of novel allergens from Sechuan pepper Food allergy is an important health problem worldwide. The symptoms of food allergies include tingling in the mouth, swelling of lips, face, tongue and throat. Some severe food allergy may even cause death. Most known food allergens are proteins present in foods such as seeds and nuts. Sechuan pepper is widely grown in China. Allergy to sechuan pepper, a popular spice in Chinese and Asian cuisine, has not been reported. In this study, we evaluate the clinical features of 5 cases with sechuan pepper allergy and preliminarily investigated the allergen components in sechuan pepper seeds. The clinical data were collected by standard questionnaires. Skin prick tests of sechuan pepper seed and peel extracts were applied separately. Specific IgE measurement (Immuno-CAP) for both seed and peel of sechuan pepper were performed. Our results showed that allergens are mainly come from pepper seeds. We isolated these allergens by the combination of ionic exchange and gel filtration. N-terminal sequencing was used to identify these allergens. Dot blot and Western blot analysis showed that 5 of 12 individual patient sera recognize it. This will help to understand this rare food allergic disease, improve the accuracy of diagnosis, reduce missed diagnosis, better prevention and treatment, and avoid more life and health hazards in this patient. T. Jin, Division of Life Sciences and Medicine, Univ. of Science and Tech. of China, Hefei, Anhui, jint@ustc.edu.cn

AGFD 136 CONTROL ID: 3422020

Molecular characterization of the cross-reactivity between the N-terminal leader sequences of Ara h 1 and Jug r2 The vicilins from peanut and walnut are considered major allergens and are translated with N-terminal leader sequences (LS) that are cleaved to yield the mature protein. These LS were thought to be degraded and unstructured, but western blots and mass spectrometry demonstrate the presence of discrete ~7 kDa LS fragments in peanut and walnut seeds. Additionally, previous work suggested they might contain immunoreactive epitopes, and possibly be a source of cross-reactivity despite very low (<20%) overall sequence identity; this suggested the presence of structured elements. To explore a possible structural basis for cross-reactivity, the structures of the peanut LS (A1LS) and three walnut LS (J2LS-1, 2, &3) fragments was solved using solution NMR. Despite the low sequence identity, all four LS's reveal strikingly similar helix-turn-helix motifs held together by disulfide bonds between adjacent CxxxC repeats. Microarray analysis revealed linear IgE epitopes in the structured regions of A1LS, along with J2LS-1, 2, & 3 that showed reactivity to dual-sensitized, and peanut and walnut exclusive allergic patient sera. Mapping the J2LS epitopes onto the structures revealed strikingly similar physical properties to the A1LS structure, providing a structural basis for the observed cross reactivity in spite of the low sequence identity. In conclusion, the results indicate that CxxxC motifs within the Ara h 1 and Jug r 2 LS give rise to structured regions which support multiple immunodominant IgE epitopes, and appear to be important for the cross-reactivity of nut allergies despite their low sequence identity. G. Mueller, A. Foo, E.F. Derose, NIEHS, Research Triangle Park, North Carolina, J. Nesbit, B. Hurlburt, H. Cheng, S. Maleki, ARS, USDA, New Orleans, Louisiana, mueller3@niehs.nih.gov

AGFD 137 CONTROL ID: 3395496

Rethinking food allergen detection: Distinguishing cross-reactivity from true target signal in botanicals used in dietary supplements and spices with the xMAP food allergen detection assay The xMAP Food Allergen Detection Assay (xMAP FADA) is a powerful analytical tool that not only is capable of simultaneously detecting up to 15 food allergens and gluten in a variety of matrices, but also employs redundant antibodies and multiple confirmatory endpoints to verify allergen detection or indicate cross-reactivity. Due to genetic relatedness or sequence similarities, concentrated botanicals, such as those used in dietary supplements and spices, often display cross-reactivity with major plant allergens. In this research, 125 botanicals used as dietary supplements and spices were analyzed for their cross-reactivity potential. Some botanicals examined were particularly cross-reactive with several targeted food allergens, including annatto seed, black seed, celery seed, chili peppers, mesquite, noni, vitex, and lobelia. The complementary antibodies utilized in the xMAP FADA have distinct, predictable, and quantifiable relationships at given concentrations of target analytes that can be used as a confirmatory endpoint to verify detection of target antigens. Only 17.6% of samples exhibited no detectable cross-reactivity with the antibodies used in the xMAP FADA. Samples with complementary antibody ratios consistent with those of the calibration standards occurred most often with the gluten bead sets (12.8% of samples indicated the presence of gluten). Interestingly, chili peppers gave a noticeable signature of increased cross-reactivity with Brazil nut-14 and -15, cashew-18 and -19, coconut-21, hazelnut-29 and -30, and walnut-48. The highest cross-reactivity observed with any sample was of Kashmiri chili with walnut-48, as cross-reactivity reached 0.5%. Of the samples that were cross- reactive, cross-reactivity rarely surpassed 0.001%. The multiple confirmatory endpoints and built-in redundancy of the xMAP FADA allow the distinction between signal indicating true allergen detection from signal due to cross-reactivity. K. Ivens, U.S. FDA, College Park, Maryland, E.A. Garber, CFSAN HFS-716, US FDA, College Park, Maryland katherine.ivens@fda.hhs.gov

AGFD 138 CONTROL ID: 3420133

Cross-reactivity and in vitro pepsin digestibility of allergenic oilseed legumins Oilseeds such as tree nuts, peanut, soybean, and sesame are common allergenic foods that collectively affect >3% of the US population. Legumin, a member of the cupin superfamily, is a major storage protein and a recognized allergen in oilseeds. Cupins, in general, are structurally conserved and stable against enzymatic proteolysis. The objective of this study was to analyze cross-reactivity and in vitro pepsin digestibility of legumins from different oilseeds. Whole proteins were extracted from defatted almond, Brazil nut, cashew, pistachio, soybean, and sesame flours. Legumins were purified using low-pressure liquid chromatography. Purified legumins were subjected to in vitro pepsin digestion at 800 unit/mg protein, 37°C, pH 3.0 for 1, 5, 15, 60, and 120 min. Immunoreactivity and cross-reactivity of the legumins were assessed by immunoblotting using seed-specific rabbit antisera and oilseed-allergic patients' plasma IgE as detection antibodies. Despite low sequence identity (32-50%), the tested legumins were cross-reactive with each other in their native, denatured, and reduced forms. Sesame legumin exhibited the strongest cross-reactivity, while soy legumin the weakest. The basic subunit of the legumins was more cross-reactive than the acidic subunit except for almond legumin. Homology modeling revealed the greatest variation in immunodominant regions on soy legumin when compared to the other legumins. In vitro pepsin digestion under the experimental

conditions suggested that legumins were stable against low pH and pepsin digestion. Reactivity of the digests to allergic patients' IgE retained for at least 15 min during digestion, while reactivity to rabbit antisera lasted for 120 min. Considerable protein aggregation was observed throughout the digestion, and disulfide linkages remained intact. The persistence of disulfide bonds and acid-induced aggregation were likely the primary reasons for the stability of the legumins during digestion. Overall, our results suggested that legumins from taxonomically different seeds were cross-reactive and resistant to in vitro pepsin digestion C. Liu, School of Exercise and Nutritional Sciences, San Diego State Univ., California, S. Gupta, Q. Rao, S.K. Sathe, Dept. of Nutrition, Food & Exercise Sciences, Florida State Univ., Tallahassee sg11v@my.fsu.edu

AGFD 139 CONTROL ID: 3430539

Oleosin: A novel major allergen in buckwheat seed Background: Buckwheat is one of the five main allergenic foods (eggs, milk, wheat, buckwheat and peanuts), and it is essential to accurately diagnose it to prevent potentially life-threatening allergic reactions. Oleosin is an important type of allergen in some allergic foods. However, most diagnostic nut and seed extracts are defatted, and due to underrepresentation or denaturation, some patients with food allergies may have a false negative diagnostic results in oleosin in vitro. Recently, we purified and evaluated the allergenicity of buckwheat oleosin, a small family of proteins involved in the formation of buckwheat oil bodies for the first time. Methods: Mass spectrometry was used to identify the new allergen-oleosin, and the DNA sequence of oleosin was analyzed by sequencing. Dot blot, Western blot and Basophil activation test were used to detect the sensitization of the purified natural protein and recombinant protein. Dot blot analysis of cross-allergic reactions of buckwheat, hazelnuts and quinoa were performed. Results: Western blot results showed that the serum of buckwheat allergic patients responded strongly to an 18 kDa protein. The DNA sequence of tartary buckwheat oleosin was obtained. We found all of the 20 buckwheat allergic patients' sera had strong reactivity with purified buckwheat oleosin. Dot blot results showed that the serum of patients with buckwheat allergy can react with hazelnuts and quinoa. Conclusion: We have identified a novel buckwheat allergen, which belongs to oleosin, a family of proteins involved in the formation of oil bodies. Buckwheat, hazelnuts and quinoa have cross-allergic reactions F. Chen, Univ. of Science and Tech. of China, Hefei, Anhui, cf155@mail.ustc.edu.cn

AGFD 140 CONTROL ID: 3428761

Crystal structure analysis and conformational epitope mutation of triosephosphate isomerase, a mud crab allergen The triosephosphate isomerase (TIM), Scy p 8, is a crab allergen and shows cross-reactivity in the shellfish. Here, recombinant Scy p 8 was expressed, and its crystal structure was determined at a resolution of 1.8 Å. The threedimensional structure of Scy p 8 is primarily composed of a (β/α)8-barrel motif prototype. Additionally, Scy p 8 showed crossreactivity with high sequential and secondary structural identity among TIMs from shellfish species. The site-directed mutagenesis of critical amino acids of conformational epitopes was carried out, and the mutants of Trp 168 and Lys 237 to Ala reduced immunoglobulin E (IgE)-binding activity by approximately 30%, compared with wild- type TIM in an inhibition ELISA; however, it still induced basophil activation despite the interpatient variability between patients. These results can help to provide an accurate template for the analysis of the IgE binding and establish meaningful relationships between structure and allergenicity. : F. Xia, M. Li, Y. Yang, G. Liu, Jimei Univ., Xiamen, China xiafeiscu@126.com

AGFD 141 CONTROL ID: 3421801

Extracellular Ca++ is a stimulus signal aggravating the IgE-induced allergy reaction in mast cell through GPRC6A, a novel family C G-protein-coupled receptor Allergic diseases have seriously affected many people's normal lives, including food allergy, skin allergy, inhalation allergy, etc. In its mechanism, Ca++ as an intersection of many cellular signal pathways can convert the extracellular signal received from cell surface receptor into the intracellular space, which is the key to the process of the allergic reaction. It was once reported necrotic cells as one source for excess extracellular calcium can trigger inflammatory responses. Therefore, we speculate that extracellular Ca++ may be also a stimulus signal aggravating IgE - induced allergic reaction in mast cell. We sought to determine whether and how increased extracellular Ca++ has a role as a stimulus signal to amplify the allergic reaction. Firstly, in order to study the effect of increased extracellular Ca++ on the mast cell activation, we used the IgE/Ag-induced activation of rat and mouse mast cell models in vitro and the Balb/c mice model of mast cell-mediated passive systematic anaphylaxis in vivo. In vitro, the IgE/Ag-induced mast cell activation was characterized by degranulation, cytokines secretion and eicosanoids production; in vivo, mast cell-mediated passive systematic anaphylaxis was induced in Balb/c mice by intraperitoneal injection of anti-DNP IgE monoclonal antibody (mAb) and tail vein injection of DNP-HSA and was characterized by clinical allergic symptoms, vascular permeability (Evans blue extravation and increased albumin level in peritoneal lavage fluid) and increased histamine level in serum. Then, for determining the target of extracellular Ca++ on the mast cell, we used flow cytometry, RT-PCR, western blotting and immunohistochemistry to prove the functional expression of a calcium sensing receptor on the mast cell. Finally, to obtain definite proof for the involvement of calcium sensing GPRC6A in involving extracellular Ca++-aggravated allergic reaction, experiments with GPRC6A- specific antagonist NPS2143 and GPRC6A-siRNA were performed. Extracellular Ca++ is a stimulus signal for the aggravation of allergic reaction in mast cell. The regulatory of Ca++ influx will be an important strategy to prevent and treat allergic diseases. S. Han, H. Che, College of Food Sci. and Nutritional Engineering, China Agricultural Univ., Beijing S. Jiang, College of Food Sci. and Tech., Yangzhou Univ., Yangzhou, China shiwen0414@163.com

AGFD 142 CONTROL ID: 3427670

Droplet digital PCR for detection of food allergens: Development and evaluation of a method for peanut Food allergies affect millions of Americans. Peanut is one of eight major allergens cited in the Food Allergen Labeling and Consumer Protection Act (FALCPA) and is one of the most prominent in terms of both the number and severity of reactions it causes. Allergic individuals rely almost exclusively on avoidance of offending foods to prevent reactions, so sensitive and accurate detection methods are necessary to protect public health. PCR- based methods have become increasingly important for allergen detection and are especially useful for confirmation of results from traditional ELISA and other antibody-based detection methods. Previous work has shown real-time PCR to be highly sensitive and specific, as well as robust in a wide variety of complex and difficult food matrices. This work describes the extension of a previously developed triplex real-time PCR assay for peanut to a droplet digital PCR (ddPCR) format. The droplet digital PCR assay uses the same primer and probe sequences as the real time PCR assay and was adapted using a probe-mixing triplex format. Extension to ddPCR was carried out via thorough optimizations of primer and probe concentrations as well as various aspects of the thermal profile, including annealing/extension temperature, annealing/extension time, and cycle number. Performance of the real time PCR assay and the ddPCR assay for peanut will be compared. A. Eischeid Center for Food Safety and Applied Nutrition, U.S. FDA, College Park , Maryland, Anne.Eischeid@fda.hhs.gov

AGFD143 CONTROL ID: 3431857
Assessing the efficacy of cleaning programs to prevent allergen cross-contact Cleaning of shared processing equipment is essential for reducing the risk of allergen cross-contact. In general, cleaning protocols are classified as wet, dry or a combination of both methods. The choice and effectiveness of cleaning protocols for removing allergenic food soils depend on the chemical/physical properties of the food allergens, the surfaces to be cleaned and other factors. Analytical tools for evaluating the effectiveness of allergen cleaning programs including total protein analyses/swabs, immunochemical approaches (ELISA; lateral flow devices), and DNA-based detection methods. The choice of the method used depends on the purpose of the test, the food matrix, the extent and manner in which the food is processed, the cleaning protocol used, the turn-around time, portability and cost. Methods used to assess the effectiveness of cleaning procedures must be validated before they can be used with confidence. This presentation will examine the approaches, considerations and challenges associated with removing allergenic food residues from food-contact surfaces using wet and dry cleaning procedures, and will discuss the analytical methods used for determining cleaning treatment effectiveness L. Jackson, FDA, Bedford Park, Illinois, Lauren.Jackson@fda.hhs.gov

AGFD 144 CONTROL ID: 3427945
Effects of grapevine red blotch virus (GRBV) on grape development and resulting wine composition Grapevine red blotch virus (GRBV), causative agent of red blotch disease, causes a delay in grape ripening with significant decreases in sugar accumulation and color development. In this study, we investigated the impact GRBV has on gene expression and aromatic metabolite accumulation. Grapes were collected from healthy and diseased grapevines of Merlot (rootstock 1103P) and Cabernet Sauvignon (rootstock 420A and 110R) through berry ripening at pre-veraison, veraison, post-veraison, and at harvest in 2016 and 2017. RNA in grapes was isolated and then sequenced using Illumina Hiseq4000 to determine differences in gene expression. Grape volatile compounds were analyzed using HS-SPME-GC-MS. At harvest, grapes were used for winemaking using standard protocols. Volatile profiles of the wines were analyzed similarly as the grapes during ripening. Across both varieties and seasons, viral gene expression was highest at pre-veraison, and steadily decreased through ripening. In addition, for all genotypes, lower viral gene expression values were observed in 2017 than in 2016. This was correlated to fewer differences in gene expression between healthy and infected grapes in 2017 than in 2016. GRBV induced metabolic pathways in post-veraison and harvest samples that are normally associated with early fruit ripening. One of these pathways is the monoterpene synthesis pathway where normally gene expression increases after veraison and decreases towards the end of ripening. In addition, the lipoxygenase pathway, which is responsible for the synthesis of C6 alcohol and aldehyde compounds, was upregulated in GRBV-infected grapes at the end of ripening and generally correlated to significantly higher concentrations of these compounds in grapes. This pathway is known to be a very important defense mechanism in plants. Similar observations were observed in final wine composition, where wines made from diseased fruit were lower in monoterpene concentrations and higher in C6 alcohol and aldehyde concentrations than wines made from healthy fruit. A. Rumbaugh, R. Cauduro Girardello, A. Oberholster, Viticulture and Enology, Univ. of California, Davis B. Durbin-Johnson, M. Britton, Bioinformatics Core,Genome Center, Univ. of California, Davis M. Sudarshana, Departmnet of Plant Pathology at Univ. of California, Davis, USDA-ARS acrumbaugh@ucdavis.edu

AGFD 145 CONTROL ID: 3429914
Effect of sun exposure on the evolution and distribution of anthocyanins in interspecific red hybrid winegrapes Interspecific hybrid winegrapes are economically important in areas where environmental pressures inhibit traditional Vitis vinifera production. Red hybrid grapes, however, show great diversity in anthocyanin profile, and viticultural and winemaking techniques proven to optimize color in red V. vinifera wines are often ineffective for hybrid wine production. Because the chemistry of hybrid grape anthocyanins is largely unknown, the reactions they undergo during ripening, wine production, and aging are poorly understood. To clarify the effect of vine microclimate on red hybrid wine color, anthocyanin profiles were assessed for shaded and unshaded fruit from three economically significant cool-climate hybrid cultivars (Vitis spp): Marquette, Maréchal Foch, and Corot noir. Berry samples were collected throughout ripening from duplicate blocks of each cultivar grown in the New York Finger Lakes region, and skin extract anthocyanins were characterized via HPLC analysis. Light exposure and berry and air temperature were monitored in Corot noir throughout the season to represent generalized vine microclimate. In 2018, exposed fruit was about 0.72 degrees (F) warmer on average (SD=0.68) than shaded fruit during the period Sept 21 – Oct 15, and average daily temperatures for exposed vs. shaded berries ranged from 0-1.2°C warmer. Anthocyanin profile changed for all cultivars as fruit matured, with Maréchal Foch showing the greatest variation between initial and final sample collection. Shaded fruit generally showed slower and lower anthocyanin evolution, but changes in individual anthocyanins varied by cultivar. Identification and quantification of key mono- and di-glucoside anthocyanins is currently underway. This work is the first step in defining the evolution of anthocyanin profiles during interspecific hybrid grape ripening to allow cool-climate wine grape growers to optimize viticultural production methods for high- quality red hybrid wines. C. Dadmun, A. Mansfield, H. Walter-Peterson, Food Sci. & Tech., Cornell Univ., Ithaca, New York cdadmun@gmail.com

AGFD 146 CONTROL ID: 3431921
Effect of grapevine red blotch virus (GRBV) on cell wall composition and its impact on phenolic extractability Grapevine red blotch virus (GRBV) is the causal agent of red blotch (RB) disease. The disease impacts berry ripening and significantly decreases the accumulation of sugar and anthocyanins in grapes. Wines made from healthy (RB(-)) and infected (RB(+)) fruit from the same vineyard resulted in wines with significantly different ethanol percentages and decreased phenolic content. It is known that alcohol content in solution can increase phenolic extractability. However, when RB(+) must was chaptalized in order to meet the same alcohol percentage as RB(-), it did not increase phenolic extractability. Thus, extractability differences between RB(+) and RB(-) grapes may be due to other factors such as cell wall composition. The berry skin cell wall (CW) plays a very important role during the winemaking process as it can form a barrier for release of important compounds impacting aroma and color. During ripening, several changes occur in CW that has been related to phenolic extractability such as pectin degradation and loosening of the CW. In this study, the impact of ripening and RB disease on skin CW composition was investigated as well as how this relates to phenol extractability using Vitis vinifera cv. Merlot. CW material was analyzed for total soluble sugars, proteins, non-cellulosic glucose, lignin, cellulose, total polyphenolic content and lipids as well as extraction efficiency. Differences in CW material composition between samples were found for all the parameters studied, especially for protein, lignin, cellulose and polyphenolic content. Regarding phenolic content, RB(-) showed a higher concentration of phenolics. Multivariate analysis was performed to associate CW composition to phenolic extractability. Results indicate that extractability differences are potentially due to differences in

grape cell wall pectin, cellulose and lignin content which are relateAGFD 143 d to the ripening stage. Additionally, protein differences could be a result of the plant's defense mechanisms C. Medina Plaza, A. Rumbaugh, M. Sudarshana, A. Oberholster, Univ. of California, Davis, cmedinaplaza@ucdavis.edu

AGFD 147 CONTROL ID: 3431321

Investigation of atypical aromas in Cabernet Sauvignon wines caused by vine frost exposure Cabernet Sauvignon accounts for over 50% of red wine grape acreage in Washington state. It typically is the last cultivar to be harvested in the late fall, which often occurs after freezing temperatures have been recorded. Several reports from wineries across the state have suggested that Cabernet Sauvignon wines made from fruit harvested after an early frost can present rose and floral aromas. These aromas are often described as atypical by Washington state winemakers. Anecdotal evidence suggests that the inclusion of freeze damaged leaf material into the fermentation is the taint source. We have investigated these claims by studying how the addition of leaf matter into the fermentation affects the sensory and chemical character of the Cabernet Sauvignon wine. Two fermentation experiments were conducted during the 2019 vintage, for which either chilled leaf material or freeze killed leaf material were added to the must. Chilled leaves were live harvested from Cabernet Sauvignon vines in the Roza Vineyard; then chilled in a commercial refrigerator at 0°C for 7-days. The freeze killed leaves were hand collected from Cabernet Sauvignon vines in the Horse Heaven Hills. The experimental fruit was harvested from the Cold Creek vineyard at 26.8 and 27.4 Brix for the chilled and freeze killed leaf experiments respectively. Preliminary chemical and bench sensory analysis showed no indication of rose taint in fermentations with additions of chilled leaf material, but fermentations with freeze killed leaf material showed clear evidence of rose aroma. The phenolic composition of wines fermented with the addition of freeze killed material showed significant reduced concentration of anthocyanins, tannins, and iron reactive phenolics. Descriptive analysis of the wines found significant reduction in varietal characters (dark fruit, vegetal characters) and a proportional increase in floral, (aroma & aftertaste) citrus, and stone fruit attributes with the leaf additions. A significant reduction in astringency was found the highest dose rates. Using GC- SPME we have found 45 compounds that significantly increase proportionally with the dead leaf additions including terpenes and benzyl alcohols. S. Frost, D. Fox, T.S. Collins, M. Keller, J.F. Harbertson, Washington State Univ., Prosser, Washington, scottfrost@wsu.edu

AGFD 148 CONTROL ID: 3434496

Phenolics, volatile aroma and polysaccharide of Pinot noir wine in response to Abscisic acid treatment of red blotch virus-infected grapevine The relatively newly discovered Grapevine Red Blotch Virus (GRBaV) is now a common infection of red wine cultivars in North America, with spread now being detected internationally. Red Blotch is known to delay berry maturation in host plants by interfering with normal hormone and metabolite transport, resulting in berries with lower sugar, flavonoids, and anthocyanin content. In turn, wine of infected fruit experiences increased pH, lower ethanol content, and altered sensory attributes. To combat the impacts of lower yield, quality, and priced fetched for fruit from infected vines, abscisic acid (ABA) was applied to grapevine to promote grape maturation and offset the impacts of the virus. This study investigates the impact ABA application on volatile aroma, phenolics, and polysaccharides in wines made from Red Blotch infected grapes. Total monomeric anthocyanin and total phenolics were determined colorimetrically. The phenolics profile was investigated with LC-MS. Volatile profile was analyzed using a stable isotope dilution approach with solid-phase micro-extraction (SPME)-GC-MS and stir bar sorptive extraction (SBSE)- GC-MS techniques. Polysaccharides were investigated with gas chromatography/flame ionization detector (GC-FID), and Size Exclusion Liquid Chromatography (LC-SEC). Our results showed that ABA treatment led to lower levels of total monomeric anthocyanin and total phenolic content in wines. ABA treatment did not have a significant effect on most volatile aroma compounds. ABA application resulted in a wine with a higher content of high molecular weight polysaccharides, namely 192-383 KDa, and higher proportions of mannose when compared to untreated wines. Analysis of monomeric sugars found no differences across treatments, indicating that ABA may alter the structural polysaccharide composition as opposed to monomer identity or concentrations. To our knowledge, this study is the first of its kind, as it looks at the effects of exogenous ABA application on wine polysaccharide composition. M. Brau, A. Alcazar, L. Huang, P. Skinkis, J. Osborne, M.C. Qian, Oregon State Univ, Corvallis, Y.L. Qian, Crop and Soil, Oregon State

AGFD 149 CONTROL ID: 3433287

Investigation of the impact of pinot noir maturity on grape and wine composition and wine style The quality of red wine is directly related to its phenolic composition, which is impacted by grape maturity. In this study, different wine styles from the same vineyard were made using sequential harvesting, while at the same time investigating potential markers to indicate optimal ripeness for a given wine style. By using seeds and skins with different maturities to make wines with the juice substituted by a common base juice (20 Brix base juice from the same vineyard block chaptalized to 23 Brix), the basic chemical composition (matrix) of the wines is kept the same with mainly phenolic ripeness differences. These wines were compared with control wines made using standard winemaking practices. Pinot noir grapes were harvested at 23 and 25 Brix and gently pressed to remove the juice to substitute with the base juice. Protein precipitation assay, RP-HPLC-DAD, phloroglucinolysis, gel permeation chromatography and LC-MS were performed on grape extraction samples and wine samples to determine the basic chemical composition and phenolic composition. Multivariate statistics were used to relate compositional data to descriptive analysis. Higher concentrations of monomeric and polymeric phenols were found in wines made with more mature grapes, however no significant differences in monomeric anthocyanins were observed. Reconstituted wines had lower polymeric phenol concentrations compared with control wines and this difference increased when wines were made with fruit from higher maturity. From the sensory perspective, wines made from higher maturity fruit were described by mouthfeel 'hot', and 'persistence' as well as 'dark fruit' aroma. The study showed that wines made with riper fruit irrespective of must sugar content were characterized by more phenolics and ripe fruit attributes. Y. Tseng, C. Brenneman, H. Heymann, A. Oberholster, Viticulture and Enology, Univ. of California Davis E. Sherman, C. Grose, The New Zealand Inst. for Plant & Food Research Limited, Marlborough, New Zealand yuttseng@ucdavis.edu

AGFD 150 CONTROL ID: 3432912

When nutritional quality meets taste Red wines are considered the healthiest wines, as they provide antioxidants originating from the dark skins of the grapes. Predominant antioxidants are catechins and procyanidins, for which a regular dietary intake has been linked to health benefits such as a reduced risk for cardiovascular disease (CVD). However, some of these antioxidants contribute to the bitter and astringent taste of red wines and might also have health effects beyond those linked to CVD. The bitter taste of a compound is mediated by bitter taste sensing receptors (T2Rs) which were originally identified in the taste cells of the tongue. T2Rs belong to the class of G-protein-coupled receptors and have been found in many extra-oral tissues, e.g., the gastro-intestinal tract (GIT). Extra-oral T2Rs do not mediate a taste sensation, as they are not linked to

neuronal perceptive pathways. However, for ectopic T2Rs, more general chemosensory roles have been shown. Recent data from our own group demonstrated a functional role of gastric T2Rs in the regulation of gastric acid secretion. Based on the cell model used to elucidate the underlying mechanistic pathways, a screening system was developed for the identification of bitter tasting and bitter taste modulating compounds. This screening system was used to identify the most bitter tasting constituents of red wines and their specific T2R activation patterns. Bitter tasting compounds stimulated cellular mechanisms of gastric acid secretion effectively, whereas bitter-masking compounds reduced this stimulation. With this knowledge, evidence for balancing the bitter taste of a red wine with its gastric friendliness will be provided. S. Sterneder, C. Dugulin, V. Somoza, Nutritional and Physiological Chemistry, Univ. of Vienna, Austria V. Somoza, Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, Germany R. Eder, Federal College for Wine and Fruit, Klosterneuburg, Austria K. Liszt, Univ. Vienna, Austria J.P. Ley, Symrise AG, Holzminden, Germany
sonja.sterneder@univie.ac.at

AGFD 151 CONTROL ID: 3430447
Food of the gods: Chemistry of chocolate from cacao bean to chocolate bar Chocolate, made from Theobroma cacao seeds, is a food high in economic and hedonic value. Loved by virtually everyone and accruing >USD120,000m revenue annually, it is also the center of much scientific research. The unique flavors of chocolate can be traced to multiple sources, including tree genetics, post-harvest treatments, (e.g., fermentation and drying) and final processing (e.g., roasting, grinding, conching). Recently, the rise of the fine- flavor cocoa industry has re-started investigations into flavors tied to specific country-of-origin and tree genetics. Cocoa and chocolate are also high in polyphenols and secondary metabolites of interest from a nutritional and health perspective. Chocolate consumption has been associated with cardiovascular health benefits in epidemiological studies, and increasing evidence that such benefits cannot be explained by direct absorption of individual compounds, but rather point at indirect modes of action, including a potential role of the gut microbiome. The molecular biology and biochemistry of cacao metabolites and their genetic and environmental regulation is another important focus of cacao, cocoa, and chocolate chemistry research. The future of the T. cacao tree depends on cultivars that increase the livelihood of the mostly small-scale cacao farmers through increased yield, resistance against biotic and abiotic factors, and also special flavors and higher safety, including low Cadmium uptake. Along the process chain, chocolate product safety, made in small-scale and craft operations, also requires attention. With the trend to lower roasting temperatures and even raw, unroasted chocolates, the risk of food-born pathogen survival throughout the process increases. Understanding individual contributions of these factors, and their combined effects requires robust experimental designs, sophisticated analytical methods, and interdisciplinary collaborations, to ensure the safety, quality and deliciousness of chocolate. This talk provides an overview of various aspects of chocolate chemistry, from cacao tree and seed all the way to the final chocolate bar. H. Hopfer, Food Sci., The Pennsylvania State Univ., Univ. Park, S.E. Ebeler, Dept of Viticulture Enology, Univ. of California, Davis, hxh83@psu.edu

AGFD 152 WITHDRAWN

AGFD 153 CONTROL ID: 3432714
Impact of cultivar, harvest, and processing on plant metabolites vital to flavor in Theobroma caca Theobroma cacao has over 4,000 genetic accessions and is grown worldwide, along the Equator, to produce cocoa beans, which are processed into chocolate. Our research examines the effects of cultivated variety (cultivar), harvest, and processing on two metabolite groups that are essential to chocolate flavor perception: total fat content (melting and volatile release) and volatile compounds (aroma and flavor perception). Cocoa beans of 11 T. cacao cultivars across three different harvests were sourced from the Fundación Hondureña de Investigación Agrícola (FHIA) in La Lima, Honduras. Post-harvest processing (fermentation, drying) was completed under identical and highly-controlled conditions by FHIA. Fermented and dried beans were either peeled and ground into powder or roasted (20 min at 125C) and ground into cocoa liquor. Samples were analyzed by TD-NMR and HS- SPME-GC-MS, and ultimately Principle Component Analysis. In the unroasted powders, harvest and cultivar both significantly affected total fat content ($p < 0.05$), while the total fat content of the cocoa liquors did not differ significantly from that of the corresponding unroasted powders as a result of processing. The volatile composition of cocoa powders showed significant variation resulting from cultivars and harvests. Cocoa liquors showed significant cultivar and harvest variation that was also significantly different from the volatile composition of the powders, indicating that roasting and grinding may have altered the volatile composition. For both the total fat content and the volatile composition, certain cultivars showed larger harvest differences than others, indicating a different response to changes in environmental conditions due to higher phenotypic plasticity. This study systematically assessed the impact of cultivar, harvest, and processing on important flavor components in cocoa. These findings are essential to cacao breeders and agricultural extension workers who share this knowledge with over six million smallholder cacao farmers worldwide A.L. Brown, A.M. Wiedemer, G.R. Ziegler, H. Hopfer, Food Sci., The Pennsylvania State Univ., Univ. Park alb54@psu.edu

AGFD 154 CONTROL ID: 3431727
Analysis of chocolate using Raman spectroscopy We have utilized Raman microscopy to identify the lactose, sucrose and fats distributions in chocolate. Understanding the distribution of fats and sugars in chocolate allows the characterization and understanding of how changes in formulation and production methods improve the flavour, feel and stability of chocolate products. Raman spectral characterization is often problematic when used to study these distributions since chocolate, particularly milk chocolate, is often highly fluorescent and the surface geometry is complex. We have been able to show that Raman analysis of chocolate, and other food products, is made possible by recent advances in Raman instrumentation that enables the combination of high speed mapping (spectral acquisition at rates greater than 1000 spectra per second) while tracking the complex surface geometries without manual intervention. We show that Raman experimental analysis when optimized for studying the distribution of chemical ingredients in confectionary samples is a non- contact, non-destructive tool that provides sub-micrometre information. We show that Raman spectroscopy reveals both the chemical and crystal structures of materials, allowing individual ingredients/components to be identified and quantified. S. Shidler, T. Prusnick, R.W. Bormett, Renishaw Inc., West Dundee, Illinois, Y. Wong, Renishaw plc, Wotton-under-Edge, UK sarah.c.shidler@gmail.com

AGFD 155 WITHDRAWN

AGFD 156 CONTROL ID: 3429084
Linking cocoa polyphenol composition to chocolate quality with average-mass-spectra fingerprints Approaches enabling prediction of chocolate quality from cocoa composition would avoid time- and money- consuming steps to chocolate makers. Average mass spectra of cocoa-polyphenol-extracts led to fingerprints used to select the molecules that discriminate chocolate sensory groups. 16 worldwide cocoa samples were processed into chocolates which were

characterized by sensory analysis, allowing sorting of the samples into four sensory groups. The cocoa polyphenol extracts were analyzed by liquid chromatography−low-resolution mass spectrometry. Averaging each mass spectrum provided polyphenolic fingerprints, which were combined into a matrix and processed with chemometrics (PCA, PLS-DA) to select the most meaningful molecules for discrimination of the chocolate sensory groups. A larger set of 44 cocoa samples was used to validate the previous results. 29 mass signals of known and unknown molecules, mainly flavan-3-ols, were finally targeted including 2 newly described ethyl-bridged flavan-3-ols, enabling sensory-group discrimination. Average mass spectra fingerprints of cocoa-polyphenol-extracts proved to be quick and efficient to select the molecules that discriminate chocolate sensory groups.
A targeted MRM (Multiple Reaction Monitoring) mass spectrometry method was then developed and validated to routinely analyse large series of cocoa samples. N. Sommerer, N. Fayeulle, E. Meudec, A. Verbaere, J. Boulet, V. Cheynier, Polyphenol platform, INRAE, Montpellier, France N. Sommerer, N. Fayeulle, V. Cheynier, Univ Montpellier France N. Fayeulle, Montpellier SupAgro, Montpellier, France C. Hue, Valrhona, Tain l'Hermitage, France R. Boulanger, QualiSud, CIRAD, Montpellier, France V. Cheynier, INRA, Montpellier Cedex, France nicolas.sommerer@inra.fr

AGFD 157 CONTROL ID: 3416731
Analysis and updated occurrence of MCPD and glycidyl esters in infant formulas and processed foods 3-monochloro-1,2-propanediol (3-MCPD) esters, 2-monochloro-1,3-propanediol (2-MCPD) esters, and glycidyl esters are chemical contaminants that are present in refined edible vegetable oils. These contaminants, which form as a result of the high temperatures required for the deodorization step of the refining process, are considered potentially carcinogenic and/or genotoxic. Therefore, their presence in refined oils and foods containing refined oils, particularly infant formula, poses potential health concerns. Numerous research studies over the last several years have focused on the development of methods and the collection of occurrence data for MCPD and glycidyl esters in complex food matrices (including infant formula) in an effort to estimate levels of exposure. In addition, recent EU regulations for bound glycidol, along with imminent EU regulations for bound 3-MCPD, highlight the need for robust analytical methodologies and accurate, up-to-date occurrence data. Over the last 8 years, researchers at the U.S. FDA (FDA) have developed direct methodologies for the analysis of MCPD and glycidyl esters in edible oils, infant formulas, and other food products containing refined oils. This presentation will detail the results of several occurrence studies encompassing over 300 infant formula products (from the U.S. and Europe) and over 100 food products containing refined oils (from the U.S.) purchased between 2013 and 2019. 3-MCPD and glycidyl ester concentrations in infant formulas varied widely among different U.S. manufacturers, but were generally similar among the European formulas analyzed. In addition, average contaminant concentrations in various food products were generally lower than the EU's active or proposed regulations. J. Beekman, S. MacMahon, U.S. FDA, College Park, Maryland, M. Granvogl, Univ. of Hohenheim, Stuttgart, Germany jessica.beekman@fda.hhs.gov

AGFD 158 CONTROL ID: 3415481
Toxic effects and comparative proteomic analysis of 3-MCPD 1- monoleate and 3-MCPD 1-monostearate in a 90-day semi-long term toxicity study using Sprague–Dawley rat Fatty acid esters of 3-monochloropropane 1,2-diol (3-MCPD) are processing-induced food toxicants, with kidney as their major target organ. For the first time, this study treated Sprague–Dawley (SD) rats with 3-MCPD 1-monoleate at 10 and 100 mg/kg bw/day and 1-monostearate at 15 and 150 mg/kg bw/day for 13 weeks, and examined for their potential semi-long term nephrotoxicity and the molecular mechanism behind. No body weight difference was observed between groups during the study. Both 3-MCPD 1-monoleate and 1-monostearate resulted in the dose-dependent increase of serum urea creatinine, uric acid and urea nitrogen levels, and histological renal impairment. The proteomic analysis of the kidney samples showed that the 3-MCPD esters deregulated proteins involved in the pathways for ion transporting, apoptosis the metabolism of xenobiotics, and the enzymes related to endogenous biological metabolisms of carbohydrate, amino acid, nitrogen, lipid and fatty acids and the tricarboxylic acid (TCA) cycle, providing partial explanation for the nephrotoxicity of 3-MCPD esters. B. Gao, Univ. of Maryland, College Park, Maryland, Y. Zhang, Dept. of Food Sci. & Engineering, School of Agriculture and Biology, Shanghai, China L. Yu, Nutrition and Food Sci., Univ. of Maryland, College Park, College Park, Maryland, P. Yang, Shanghai Jiao Tong Univ., Shanghai, China raphaelgao1985@gmail.com

AGFD 159 CONTROL ID: 3398923
Are process-induced chemical changes responsible for the atherosclerotic effects of saturated fats? Since the 1950s, controversy has surrounded the hypothesis that saturated fats increase cardiovascular disease events compared to unsaturated fats derived mainly from vegetable oils. The mechanism is usually related to relative increase in circulating cholesterol levels when switching from unsaturated to saturated fats. It is widely believed that components of saturated fats, saturated fatty acids, have differing atherogenic effects, with stearic acid being largely neutral, and palmitic, myristic, and lauric acids being more atherogenic, with the latter all at relatively high concentration in the so-called "tropical oils": coconut, palm, and palm kernel oils. We tested the hypothesis that processing induces contaminants and decreases inherent phytonutrients using coconut oil and a novel in vitro human cell-based model. CO was dissolved with dipalmitoyl phosphatidylcholine (DPPC) surfactant, solvent evaporated, and emulsified into fat-free cell culture media. After 24 h treatment cellular cholesterol and triacylglycerol increased; HMG- CoA Reductase (HMGCR) increased and CYP7A1 (cholesterol 7α-hydroxylase) decreased with sequential processing steps, deacidification, bleaching, deodorization, while fatty acid profiles were not affected. Glycerol derived process contaminants glycidyl esters and monochloropropandiol (MCPD) increased with processing. Addition of glycidyl or MCPD to virgin CO (VCO) had similar effects to processing, while addition of phenolic antioxidants to fully refined CO reduced HMGCR and increased CYP7A1. We conclude that harsh processing creates contaminants that raise cholesterol levels in vitro, consistent with a role as a contributing atherosclerotic factor, and that saturated fatty acids are not atherogenic in this model. Implications for contemporary processing extends beyond traditional oils. Regulatory and popular confusion about "trans fats" vs trans fatty acids have led to untested assumptions about the relative healthfulness of fully hydrogenated fats compared to partially hydrogenated vegetable and fish oils that are no longer GRAS. Finally, the overwhelming chronic disease focus on CVD and cancer ignores effects on brain health. J T. Brenna, Dell Pediatric Research Inst., Univ of Texas at Austin tbrenna@utexas.edu

AGFD 160 CONTROL ID: 3419390
Determination of acrylamide in vegetable chips Acrylamide (AA) is a typical food-borne-toxicant, which is especially formed in foods with higher amounts of free asparagine (e.g., potatoes, cereals) at temperatures > 160 °C [1]. Based on an EFSA statement in 2015, AA in food is supposed to increase the risk of cancer [2]. Since 2002, the global food industry made lots of efforts to mitigate its content continuously. Amongst others, elevated amounts of AA in French fries and bread led to a new EU regulation to reduce AA contents in

foods [3]. The lecture will present results obtained during a comparative market study including several types of vegetable chips and potato chips, bought both in local supermarkets and also worldwide via online shops. Therefore, a previously published method based on LC-MS after derivatization [4] was improved and successfully applied. Results showed a much higher average AA amount in vegetable chips compared to their potato counterparts, corroborating previous findings [5]. Additionally, the new study showed that there is a need of mitigation strategies for this relatively new chips type on the one side, and a successful implementation of these strategies within the potato chips industry during the past years on the other side. M. Granvogl, E. Gottstein, C. Oellig, Food Chemistry and Analytical Chemistry, Univ. of Hohenheim, Stuttgart, michael.granvogl@tum.de

AGFD 161 CONTROL ID: 3429459
Oil oxidation and the formation of acrylamide, 5-hydroxymethylfurfural and 2-amino-1-methyl-6- phenylimidazo[4,5-b]pyridine in model reaction systems during frying More than one kind of new-formed contaminants (NFCs) can produce during food thermal processing. Carbonyl compounds are main oxidation products of oil during frying. It has been reported carbonyl compounds can react with amino compounds to form various NFCs, such as acrylamide (AA), 5-hydroxymethylfurfural (HMF). In our previous study AA, HMF and 2-amino-1-methyl-6-phenylimidazo [4, 5-b] pyridine (PhIP) were detected silmutaneously in traditional Chinese croquette. However, it is not clear wheather the carbonyl compounds contributed equally to the formation of NFCs in complex substances during heating. In this study, a glucose/asparagine/phenylalanine/creatinine (Glc/Asn/Phe/CRN) model system and a croquette frying system were both established, and a sensitive, rapid and stable UPLC-MS/MS method was used for the simultaneous analysis of AA, HMF and 2-amino-1-methyl-6-phenylimidazo [4, 5-b] pyridine (PhIP). The results showed that 29 kinds of volatile compounds formed in croquette frying system during four-day's frying, of which the 2,4-alkadienals compound accounted for 42.97 to 55.15% and the content of 2,4-decadienal (DA) was the highest. In Glc/Asn/Phe/CRN model system the consumption of four precursors became faster and the formaiton of AA, HMF and PhIP increased significantly in model systems heating when the temperature increased from 140 to 200 degree and frying time changed from 48 min to 5 min, respectively. However, the addition of DA showed the positive effects on the formation of AA while significantly restrained the formation of HMF and PhIP. Therefore, the role of oil oxidation in the formation of NFCs in fried foods seems complex due to the complex interactions between substances in foods. This study can provide basic data for the control of NFCs from the angle of application of oil during frying. F. Chen, China Agricultural Univ., Beijing chenfangch@sina.com

AGFD 162 WITHDRAWN

AGFD 163 WITHDRAWN

AGFD 164 CONTROL ID: 3433507
Simultaneous analysis method of mycotoxins using pre-treatment Injection mode with LC-MSMS The simultaneous analysis method of mycotoxins using pre-treatment injection mode with LC-MSMS from animal feed for monitoring was developed with QuEChERS preparation. After sample weighing (5g) in a 50 mL conical tube, 10% formic acid in distilled water (10 mL) and acetonitrile (10 mL) was added. After it was strongly shaken for 30 min, QuEChERS extraction salt (4 g MgSO4, 1 g NaCl) was added to the 50 mL conical tube. The mixture was vigorously shaken for 1 min and was centrifuged at 3,000 G for 10 min. The acetonitrile layers (1 mL) were purified by dSPE (50 mg C18, 50 mg PSA) and centrifuged at 10,000 G for 5 min. The purified extract was filtered with a membrane filter (pore size: 0.2 um) before analysis. For quantitative analysis, dilution, using internal standards (mycotoxin isotope), and matrix-matched calibration curves should be used to reduced matrix effect (ME). ME for analytes range using internal standards were -11.49 to 30.00% (bean) and -9.85 to 26.82 % (maize). MLOD (Method LOD) and MLOQ (Method LOQ) were calculated by S/N ratio. MLOQs were less than 0.005 mg/kg (aflatoxins), 0.02 mg/kg (ochratoxin A), 0.025 mg/kg (zearalenone) and 0.1 mg/kg (deoxynivalnol, fumonisins, T-2 toxin, HT-2 toxin). The linear correlation coefficients (r*2) were > 0.99 within the range of 0.5 ~ 25 ug/kg (aflatoxins), 2 ~ 100 ug/kg (ochratoxin A), 2.5 ~ 125 ug/kg (zearalenone) and 10 ~ 500 ug/kg (deoxynivalenol, fumonisins, T-2 toxin, HT-2 toxin). The recoveries on bean and maize were in the range of 66.6 ~ 118.8% within the validation criteria. H. Jo, Hankyong Nation Univ. Industry Academic Cooperation Foundation, Anseong, Korea(The Republic of) H. Jo, K. Hwang, J. Moon, Hankyong National Univ., Ansung, Korea(The Republic of) hyeongwook.jo@gmail.com

AGFD 165 CONTROL ID: 3429366
Identification and cross-reactivity analysis of sarcoplasmic-calcium-binding protein: A novel allergen in Crassostrea angulata Oysters are an important shellfish group known to cause food allergy, however, knowledge of their sensitization components and cross-reactivity is limited. This study aimed to identify a novel allergen in Crassostrea angulata and investigate its cross-reactivity. To this end, a 20 kDa protein was purified from oyster and confirmed to be sarcoplasmic-calcium-binding protein (SCP) by LC-MS/MS. A 537 bp open reading frame was obtained from oyster SCP total RNA, which encoded 179 amino acids, and was expressed in Escherichia coli. According to the circular dichroism results, digestion assay, and inhibition ELISA, the recombinant SCP (rSCP) exhibited similar physicochemical properties and IgG-binding activity to native SCP. rSCP displayed stronger IgE-binding activity by immunological method. Moreover, a different intensity of cross-reactivity and sequence homology were demonstrated between shellfish species. Collectively, these findings provide novel insight into shellfish allergens, which can be used to aid in the in vitro diagnosis of oyster-sensitized patients M. Liu, G. Liu, Jimei Univ., Xiamen, China T. Han, F. Xia, Jimei Univ., Xiamen, China hantianjiao519@163.com

AGFD 166 CONTROL ID: 3433002
Epitope mapping pathogenesis class-10 panallergens Rationale: Pathogenesis Class-10 (PR-10) proteins are reactive allergens in Oral Allergy Syndrome (OAS). In order to detect cross-reactive regions of the proteins we probed peptide microarrays with allergic sera to identify the linear epitopes responsible for the allergic reaction. Methods: The PR-10 proteins tested were: Ara h 8 (peanut), Bet v 1 (birch), Vig r 6 (lupine), Gly m 4 (soy), Pru av 1 (cherry), Cor a 1 (hazel), Mal d 1 (apple) and Api g 1 (celery). 15-mer peptides that were offset by 5 amino acids were printed on glass slides. Patient sera were incubated with the slides. IgE and IgG4 binding was detected with a combination of fluorescently-labelled antibodies Results: The linear epitopes were mapped to molecular models of the 3-dimensional structures of the allergens. The majority of the epitopes mapped to the surface of the proteins. In addition, some of the epitopes mapped to areas co-localized on all or most of the proteins tested. Conclusions: These results identify important epitopes for PR-10 proteins cross-reactivity and OAS. B. Hurlburt, southern regional research center, US Dept. of Agriculture, New Orleans, Louisiana barry.hurlburt@ars.usda.gov

AGFD 167 CONTROL ID: 3409473
Immunochemical methods for detecting fermented-hydrolyzed gluten in food: Challenges and recent progress Celiac disease (CD)

affects approximately 1 in 141 individuals in the United States, requiring adherence to a strict gluten-free diet. The Codex Standard, the European Commission, and the FDA all state that any foods that carry the label "gluten-free" must contain less than 20 parts per million (ppm) of gluten. Accurate quantitation of gluten in fermented-hydrolyzed foods is challenging due to the lack of appropriate reference materials and variable proteolysis. A novel multiplex-competitive ELISA method was recently developed utilizing the G12, R5, 2D4, MIoBS, and Skerritt antibody-HRP conjugates employed in nine commercial gluten ELISAs. The multiplex assay is able to reliably distinguish between different forms of fermentation / hydrolysis; thereby serving a unique role necessary for the selection of appropriate calibration standards and, ultimately, the accurate quantitation of hydrolyzed gluten. To further assess the potential utility of this unique multiplex-competitive ELISA, its performance with yogurt prepared with gluten incurred at four concentrations (0, 20, 100, and 500 µg/g) was examined. Gluten incurred in yogurt is partially proteolyzed during the fermentation process, providing a suitable matrix to assess the ability of the multiplex- competitive ELISA to differentiate foods based on the degrees of fermentation, in addition to its ability to differentiate foods based on the types/forms of fermentation. This is essential for the selection of an appropriate calibrator, as not all fermented-hydrolyzed foods are proteolyzed to the same degree during the production process, which leads to differences in protein/peptide profiles. Results indicated a unique antibody-dependent response when gluten incurred in yogurt was fermented, as well as similar gluten proteolysis among the yogurts at different gluten concentrations. To evaluate the reliability and reproducibility of the multiplex-competitive ELISA, a multi-lab/analyst evaluation using the prepared yogurt as a model food is currently underway. R. Panda, FDA, College Park, Maryland, E.A. Garber, CFSAN HFS- 716, US Food Drug Administration, College Park, Maryland, rakhi.panda@fda.hhs.gov

AGFD 168 CONTROL ID: 3431813

Allergen cross-contact due to the use of shared frying oil Approximately 3-4% of people in the U.S. suffer from food allergies. Strict avoidance of the offending food allergen is the only recourse for consumers with food allergies. However, allergens can be inadvertently introduced into food through cross-contact during processing or cooking operations. One mechanism by which cross-contact can occur is when foods are fried in oil previously used to cook or process allergen-containing foods. Several lab-scale experiments investigated transfer of allergens (peanut, tree nuts, shrimp) to frying oil and to other foods fried in reused oil. Separate experiments evaluated the effectiveness of filtering treatments for removing allergens from frying oil. Concentrations of allergens in frying oil were measured with allergen-specific ELISA kits as well as total protein (bicinchoninic acid; BCA) assays, while ELISA analyses were used to detect allergens in foods. In general, the allergen content of frying oil increased with the number of batches of allergenic food fried. However, the concentration of allergens detected in oil, particularly by ELISA, did not increase linearly, suggesting that they become less detectable during the frying process. Use of allergen-specific ELISA kits verified that allergens present in frying oil transferred to other foods. Use of filtering treatments such as a cellulose filter with or without added filtering aids, such as diatomaceous earth, reduced allergen levels in frying oil. These studies indicate that allergen cross-contact from shared frying oil can occur, and that oil filtration treatments can be effective at preventing cross-contact. New analytical methods are needed to accurately quantify the presence of allergens in frying oil and in fried food. L. Jackson, FDA, Bedford Park, Illinois Lauren.Jackson@fda.hhs.gov

AGFD 169 CONTROL ID: 3432120

Allergenic amylase/trypsin-inhibitors in wheat cultivars from 1890 to 2010 The prevalence of wheat-related disorders has been increasing in the population during the last fifty years. This increase is partially due to higher awareness and better diagnostic procedures, but the other factors remain unclear. Due to changed dietary habits and low frequencies of infections, there may have been changes in human immunity that result in higher susceptibility to allergies, autoimmune diseases and other hypersensitivities such as nonceliac gluten sensitivity (NCGS). With wheat consumption being the triggering factor for NCGS, breeding towards higher yields, better end-use quality and increased resistance against diseases and pests has been suspected as a cause for higher immunoreactivity of wheat proteins in sensitive subjects. Well known as wheat allergens, amylase/trypsin inhibitors (ATIs) have been identified as potent activators of innate immunity via the toll-like receptor 4. Through this route, ATIs may exacerbate pre-existing inflammatory reactions in the body and also cause NCGS. ATIs are part of the water- and salt-soluble protein fraction known as albumins/globulins and they are subdivided into several types, such as α-amylase inhibitors 0.19, 0.28 and 0.53, α- amylase/trypsin inhibitors CM1, CM2, CM3, CM16 and CM17, trypsin/α-amylase inhibitors CMX1, CMX2 and CMX3, α-amylase/subtilisin inhibitor, chymotrypsin inhibitor and trypsin inhibitor. To assess whether breeding may have contributed to changing the immunoreactivity of wheat, we developed a targeted liquid chromatography tandem mass spectrometry (LC-MS/MS) method to determine the 13 major ATIs based on 21 specific marker peptides. The sample set studied included the five most commonly used wheat cultivars per decade from 1890 to 2010 in Germany (grown in Gatersleben in the years 2015, 2016 and 2017). CM3 and 0.19 were the major ATI types making up 20% and 18% of the total ATI content, respectively. The ATIs CM17, CM16, 0.28 and CM2 amounted to 10-12% of total ATIs, whereas all other types were below 5% each. The ATI contents depended on the harvest year, but there was no clear change in contents from 1890 to 2010. Further work will explore the possible correlation between ATI contents and bioactivity determined on monocytes/macrophages expressing toll-like receptor 4. Based on our results, we found no evidence to support the hypothesis that old and modern wheat cultivars differ in their immunoreactivity. S. Geisslitz, K. Scherf, Dept. of Bioactive and Functional Food Chemistry, Karlsruhe Inst. of Tech. (KIT), Karlsruhe, Germany S. Geisslitz, D. Pronin, K. Scherf, Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, sabrina.geisslitz@kit.edu

AGFD 170 CONTROL ID: 3430424

Biochemical characterization of sesame allergen Ses i 1 Food allergy is an important health problem worldwide. Some severe food allergy may even cause death. Most known food allergens are proteins present in foods such as seeds and nuts. Sesame allergy is the most form of allergy except for the big-eight food sources. Sesame is grown and consumed worldwide. Geographically, allergic to sesame has been reported worldwide including Europe, mid-east, north America, South America, Australia and Asia. There is lack of study of biochemical characterization of sesame allergens, which is critical for diagnosis and better understanding of sesame allergy. In this study, we isolated a major storage protein around 15 kDa from white sesame seeds by the combination of ionic exchange and gel filtration. This protein has two separated bands (subunits) on SDS-PAGE and both subunits are linked by interchain disulfide bonds. N-terminal sequencing showed that it is sesame major allergen ses i 1, belonging to the 2S albumin family. CD spectrum showed that it has high stability and disulfide bonds be opened after adding reducing agents. We further cloned this gene to facilitate further studies. IgE blot and Western blot analysis showed that sesame allergic patients' sera recognize it, confirming that it is an important allergen for

sesame allergic patients in China. This provides important theoretical basis for research and treatment of sesame allergy L. Zhu, T. Jin, Division of Life Sciences and Medicine, Univ. of Science and Tech. of China, Hefei, Anhui, zlxia@mail.ustc.edu.cn

AGFD 171 CONTROL ID: 3433238
Plant antimicrobial proteins and food allergens Multicellular organisms produce distinctive proteins and peptides as a first line of defense against viruses, bacteria, and fungi. These antimicrobial proteins (AMP) can have broad activities, including directly killing the microorganisms. A number of plant antimicrobial proteins/peptides have been known to be food allergens. Our recent results indicated that a protein with multiple coupled-Cys-X3-Cys (cC3C) repeats in almond was the first identified food allergen of new family. We will provide a brief comparison of the physical properties and functional activity of the plant antimicrobial proteins and peptides that have also been defined as allergens. Y. Zhang, USDA, Albany, California, H. Che, College of Food Sci. and Nutritional Engineering, China Agricultural Univ., Beijing, yuzhu.zhang@ars.usda.gov

AGFD 172 CONTROL ID: 3430678
Molecular approaches for the detection, quantification and standardization of specific food allergen proteins, Rationale: Quantification of food allergens is important for risk assessment, safety monitoring and effective food allergen management. A molecular approach was used to develop a multiplex array for measuring allergens of known clinical importance (e.g. Ara h 6, Ara h 3). These are the 'active ingredients' in foods to which allergic patients react and their molecular structures are known. The aim was to develop one test for measuring food allergens that are regulated in the US, Europe and Japan. Methods: The multiplex array was developed on the Luminex xMAP system using allergen-specific monoclonal antibody pairs. Reference standards were purified allergens with purity established by mass spectrometry. Full method validations were performed to determine parameters of linearity, range, limits of quantification and detection, accuracy and precision. Food products were analyzed using a multiplex array and the results were compared with ELISA and with mass spectrometry. Results: Method validations were completed for 12 major food allergens. Standard curves for all analytes allow for quantification over a broad (4-log) dynamic range. Limits of detection were as low as 0.01ng/ml. Intra- and inter- assay accuracy and precision was within the range of 70-130% recovery (CV of <15%). The specific allergen content of food products (e.g. milk, egg, hazelnut, Bamba) and the NIST Peanut Butter Standard correlated with the food ingredients. The results for individual allergens in the array correlated with ELISA and with mass spectrometry. Conclusions: A quantitative, accurate and precise multiplex immunoassay was validated for the simultaneous detection of major food allergens. Completion of a 17-plex array will allow all allergens that are regulated by food laws in the US, Europe and Japan to be measured simultaneously in a single test. MARIA is an important tool for regulators and food processors to improve food allergen management. M. Chapman, Indoor Biotechnologies, Charlottesville, Virginia mdc@inbio.com

AGFD 173 CONTROL ID: 3433072
Thermal processing alters allergens Food allergy is on the rise and the prevalence of peanut allergy has more than tripled in the U.S. in the last 20 years. Meanwhile, little is known about why certain proteins in foods are allergenic and others are not. Some classic characteristics associated with food allergens are resistance to enzymatic digestion and heat, stimulation of T cell proliferation, IgE binding and, some times, enzymatic function. However, at the molecular level, not much is known about what happens to the allergenicity of food products after processing. We have shown that thermally processed peanut proteins can form higher order structures (oligomers), are less soluble, more resistant to digestive enzymes, and bind higher levels of IgE than raw peanut proteins. We also show that in a majority of patients, roasted peanuts resulted in a higher skin prick test (SPT) reactivity. To determine if processing-induced structural changes in allergens contribute to an increase in IgE binding by roasted peanuts, the major allergens were purified from raw and roasted peanuts and the structure and IgE binding to each allergen was compared. While the structure of the allergens purified following roasting did not show significant changes compared to the raw, the IgE binding and SPT to the roasted samples were higher. Therefore it is highly likely that the chemical modifications incurred by roasting are more important for enhanced IgE binding and immunogenicity than processing induced structural changes of the major peanut allergens. Therefore, the specific modifications that contribute to enhanced IgE binding by sera from allergic individuals were identified. Understanding the effects of processing at the molecular level and determining the differences in structure, function, IgE binding to various processed forms of foods may be useful in development of more specific and lead to improved detection, diagnostic, therapeutic tools and processes that can reduce the allergenic potency of a food. In conclusion: Allergens should be studied and compared in raw foods and in the processed form in which they are ingested. S. Maleki, Food Allergy, USDA-Agricultural Research Service-SRRC, New Orleans, Louisiana, sjmaleki@gmail.com

AGFD 174 CONTROL ID: 3425388
Understanding the complexity of interactions between phytochemicals and the network of mechanisms based on systems biology Despite the medical advances, numerous disease states can only be explained by complex, multi-molecular interactions rather than by alteration of a single gene, gene product or metabolite. Thus, in order to garner a more complete and relevant understanding of disease, one must obtain a comprehensive perspective of the biological system, thereby uncovering the interdependent and dynamic pathway, network and cellular events that undergo change as a function of disease predisposition, onset and progression. In the last 20 years, researchers have made great efforts to investigate botanical products and to analyze their components. Although many studies were conducted to understand the molecular mechanisms, it is still unclear how the multi-components of complexed phytochemicals interact with multi-targets to exert its therapeutic effects. The current state of data generation (omics) and data analytical (AI) technologies enables the generation of insights into the complexity of interactions between phytochemicals and physiology, leading to better interventions aimed at improving health. The presentation will show a few examples on understanding the complex interactions between phytochemicals and molecular targets and mechanisms of herbal ingredients for human health based on systems biology approach J. Kim, Seoul National Univ. of Science and Tech., Seoul, Korea(The Republic of) O. Kwon, Food and Nutritional Science, Ewha Womans Univ., Seoul, Korea(The Republic of) jiyeonk@seoultech.ac.kr

AGFD 175 CONTROL ID: 3422227
Set-based gene-environment interaction test using the hierarchical structural component model To solve the missing heritability problem in genome-wide association studies, gene-environment interaction studies can be one of the solutions. For identifying gene-environment interaction, many statistical methods have been proposed. However, most of these methods focus on individual markers, such as single nucleotide polymorphism (SNP), analysis. In this study, we took a different analytics strategy and proposed a set-based gene-environment interaction test using the hierarchical structural component model. The proposed method can

improve the statistical power by reducing the multiple testing burdens and take into account a combination of synergy's effects among all SNPs within the interested set. The performance of the proposed method is evaluated in simulation studies and illustrated via genome-wide gene-alcohol intake interaction analysis using the cohort data of the Korea Associated Resource (KARE) consortium. S. Choi, Hanyang Univ. (ERICA), Gyeonggi-do, Ansan-si, Korea(The Republic of) T. Park, Dept. of Statistics, Seoul National Univ., Seoul, Korea(The Republic of) choisk0413@gmail.com

AGFD 176 CONTROL ID: 3421987
Two stage clustering analysis to detect pattern change of biomarker expression between experimental conditions In interventional studies, biomarkers such as metabolites, are usually measured across serial time points. And when the interest lies in comparing expression levels between different experimental conditions, summary measures such as area under curve (AUC), have been widely used. Although the summary measure based approaches have been successful in identifying novel biomarkers, they do not reveal anything about time-dependent changing patterns of biomarkers which can demonstrate the reactivity of biomarkers to various physiological conditions. To account for such patterns, all measurements across time points need to be used, and clustering analysis with the measurements can group together biomarkers having similar changing patterns. Some such popularly used clustering methods include hierarchical- and K-means clustering. While these may provide some well-clustered results, their patterns are quite dependent on input data sets, making it difficult to obtain consistent patterns across different interventional studies. In addition, it is problematic for these methods to discriminate biomarkers with weakly active patterns that need to be grouped as static, compared to those having strongly active patterns, when their patterns are highly similar. To address these issues, we propose a new clustering method for improving identification of changing patterns. Our approach is based on a two-stage process: the first is elimination of stable markers using Euclidean distances, while the second stage assigns the remaining biomarkers to predefined patterns using 1-correlation distance measure. By simulation studies, we showed that our proposed method had superior classification performances, compared to other unsupervised clustering methods. Afterwards, we applied our method to a real biomarker data set, studying the anti-inflammatory activity of the carrot Angelica Keiskei, having measurements of three time points and two experimental conditions. Resultantly, we found a few markers with differentially changing patterns between control and treatment conditions, and interpreted the results in terms of reactivity. Such approaches could complement the existing summary measure based approaches I. Huh, S. Choi, T. Park, Seoul National Univ., Seoul, Korea(The Republic of) Y. Kim, S. Park, O. Kwon, Food and Nutritional Science, Ewha Womans Univ., Seoul, Korea(The Republic of) huhixoo@gmail.com

AGFD 177 CONTROL ID: 3429384
Pathway-based integration of metabolome and microbiome data It is clear that the human's microbiome is associated with various disease. Much work has been done to analyze microbiome data to identify microbiota related with specific disease. However, in the case of study using only microbiome data, even if we identify microbiota related to a particular disease, it is difficult to know the functional potential of the microbiome. The metabolomes produced from the microbial community are known to play a role in connecting host phenotype and microbiome function. Using both metabolomics and metagenomics has an advantage of understanding functional potentials of the microbiome and interactions with the host. However, integration of these two omics data remains a challenge, usually requiring a more advanced method. In this study, we proposed the hierarchical structural component model (HisCoM-mm) that integrates microbiome and metabolome data. In particular, we used pathway information for integrate these two omics datasets to provide insight into biological interactions between different biological layers in relation to host phenotype. We applied our model to analyze real datasets generated from specific diseases. These real datasets were used to demonstrate whether our model is able to identify the pathways known to be related with disease. This analysis shows our HisCoM-mm can identify disease related pathways from KEGG database and provide significant metabolomic and metagenomic components of pathway. T. Park, Statistics, Seoul National Univ., Seoul, Korea(The Republic of) tspark@stats.snu.ac.kr

AGFD 178 CONTROL ID: 3430942
Landscape of serum and urine microbiota based on extracellular vesicles and their implication to human health The microbiome has emerged as one of the major contributors to human health and has attracted considerable attention for several decades. This interest had allowed us to a better understanding of the role of the microbial community in the human body. However, while the role of the gut microbiome has been actively studied, few studies have been attempted on serum and urine microbiome. and even that has not been conducted on a large scale. To illustrate the characteristics of the body fluids microbiota and examine factors that associated with shifts in their microbial composition, we conducted an in-depth analysis of a large population with vast amounts of risk factors and disease data collected in Korea. Using microbe-derived extracellular vesicles microbiome data obtain from about 3000 individuals in Korea Resources Association (KARE) cohort, we found the strong relation of the fluid microbiome diversity and human intrinsic and extrinsic factors such as serum calcium levels and dietary intake. These associations were attributed to the microbes belongs to the genera Akkermensia, Streptococcus, and Rothia. In addition, we have shown that metabolic disease states such as diabetes and hyperlipidemia are significantly related to the structural changes in microbial co-occurrence patterns and networks. These observations provide the novel insight into the role of urine and serum microbiota in host and support the potential as a preventive and therapeutic intervention target S. Park, Neurosurgery, Brigham and Women's Hospital, Boston, Massachusetts, K. Kim, S. Won, Public Health, Seoul National Univ., Seoul, Korea(The Republic of) S. Lee, Dept. of Medical Consilience, Dankook Univ., Yongin, Korea(The Republic of) spark51@bwh.harvard.edu

AGFD 179 CONTROL ID: 3431972
Comparative genomic, transcriptomic and functional analyses provide new insights into diversity, distribution and evolution of natural products produced by the agriculturally important fungal genus Fusarium Fusarium is a species-rich genus of fungi that collectively cause disease on most economically important plant crops and produce numerous natural products (NPs), including some of the mycotoxins of greatest concern to food and feed safety, multiple plant hormones and pigments, and other metabolites with varied biological activities. In Fusarium, as in other fungi, genes required for synthesis of the same NP are typically located next to one another in a biosynthetic gene cluster (BGC). In the post-genomic era, advanced genome sequencing technologies and reductions in the costs of generating genome sequences have provided an opportunity to investigate the diversity, distribution and evolution of Fusarium BGCs required for synthesis of mycotoxins and other NPs. Computational and comparative analyses of 343 Fusarium genomes representing 187 Fusarium species have identified over 15,500 previously characterized and novel BGCs, revealing that Fusarium has the genetic potential to produce a far greater diversity of NPs than indicated by previous chemical analyses. The genomic analyses also revealed three basic patterns of BGC distribution: limited, wide and sporadic. Phylogenomic analyses suggest that

horizontal transfer and loss of genes have contributed to the sporadic distribution of some BGCs. A combination of transcriptomic, chemical and gene- function analyses indicated that variation in production of different analogs of the same NP family can arise through acquisition, loss, and changes in functions of genes in a BGC. Additional analyses provided evidence for the genetic bases for variation in production of some NP types as well as insights into predicting chemical structures based on gene content of BGCs, which in turn can aid in predicting biological activity. The deep sampling of genome sequences of Fusarium species has enriched our understanding of the diversity of NPs that can exist within a single fungal genus. This will in turn aid efforts to exploit the chemical diversity of fungi and contribute to development of strategies to control crop diseases and mycotoxin contamination problems caused by Fusarium and other fungi. H. Kim, S.P. McCormick, M. Busman, G. Hao, J.M. Lohmar, M.M. Vaughan, D.W. Brown, R.H. Proctor, USDA-ARS-NCAUR, Peoria, Illinois, hyeseon.kim@ars.usda.gov

AGFD 180 CONTROL ID 3388507
Use of high content cellular imaging system to compare the cytotoxic effects of differently processed xanthii fructus in chang liver cells Xanthii Fructus is a commonly used herbal medicine, but its toxicity has been frequently reported. The Traditional Chinese medicine (TCM) theory states that processing can reduce herbal toxicity; therefore, we examined whether hydroethanol extracts of Xanthii Fructus with (FSX-08) or without stir-baking (FSX-09) had different effects on cytotoxicity. The cytotoxic effects on Chang liver cells was evaluated by measuring phenotypic morphology parameters such as cell number, inner nuclear, outer nuclear (indicative of nuclear condensation), edge, valley, saddle and dark textural values (indicative of mitochondrial fragmentation) in parallel with conventional cytotoxicity assays. Treatment with FSX-08 increased all phenotypic morphology parameters, in a dose-dependent manner. By contrast, FSX-09 showed similar morphology parameters as observed in the vehicle control. We also tested the effects of 6 constituents of Xanthii Frutus on the morphological parameters. Among 6 constituents, tomentosin, xanthathin and caffeic acid appeared to increase all phenotypic morphology parameters. These results were found to be in good agreement with conventional cytotoxicity results. FSX-08 had higher quantities of tomentosin, xanthatin and caffeic acid than FSX-09, analyzed by liquid chromatography-tendem mass spectrometry. These results suggested that the cytotoxicity of the hydroethanol extracts of Xanthii Fructus are related to its constituents and support the TCM theory that stir-baking can reduce toxicity. In addition, use of morphology parameters could be utilized to evaluate cytotoxicity rapidly and mechanismatic. H. Choi, H. Chun : H. Choi, H. Chun, Food Toxicology Lab, Chung-Ang Univ., Anseong, Korea (The Republic of) hwayoung0830@gmail.com hschun@cau.ac.kr

AGFD 181 CONTROL ID: 3436868
Sulforaphene inhibited the invasion of breast cancer cells and the adipogenesis of 3T3-L1 adipocytes through tissue-specific regulation of the hedgehog signaling pathway Aberrant Hedgehog (Hh) signaling activation has been demonstrated to be associated with tumorigenesis including breast cancer, and the key mediator of Hh signaling Gli1 is considered as a molecular target for cancer prevention and therapy. In addition, Hh signaling activation was found to suppress fat accumulation and prevent obesity. For prevention of chronic diseases by dietary and natural components, it is confused whether they have to inhibit or activate the Hh signaling pathway. Here, we investigated the effect of sulforaphene, one of isothiocyanates rich in cruciferous vegetables, on different chronic disease models and determined the involvement of the Hh signaling pathway. In breast cancer cells, sulforaphene suppressed the Hh signaling by decreasing the expression and nuclear localization of Gli1, which lead to inhibition of MMPs and the cellular migration and invasion in human breast cancer cells. Interestingly however, sulforaphene was found to activate the Hh signaling by restoring Smo and Gli1 expression, which lead to suppression of the adipogenic transcription factor, PPARγ and C/EBPα and fat accumulation in 3T3-L1 adipocytes. These findings indicate that the dietary component sulforaphene regulate the Hh signaling in a tissue-specific manner, suggesting the multiple beneficial efficacy of sulforaphene through Hh signaling. H. Lee, Chung-Ang Univ., Anseong, Korea(The Republic of) hongjin@cau.ac.kr

AGFD 182 CONTROL ID: 3434551
Multiple clustering methods and databases-based microbiome association test There are multiple software programs available for operational taxonomical unit (OTU) clustering and multiple 16S rRNA gene sequence databases, and the statistical properties of statistical approaches ultimately depend on which method is used. The statistical power should be maximized when the OTU clustering results are the most accurate, but the best strategy for OTU clustering remains unclear. Multiple studies have compared the accuracy of databases by using a mock community whose microbial composition is known, and the EzTaxon database was reported to be the most accurate among the existing databases, including the Silva and Greengenes databases. But EzTaxon database is not widely used and lacks in terms of the number of OTUs they can identify. Recently, amplicon sequence variant (ASV) is proposed for constructing metagenomics dataset and it has its obvious strengths in its consistent labeling and reference independence. In this study, we developed metrics for comparing datasets based on various clustering methods and databases. Then, we proposed a novel microbiome association test based on multiple databases and clustering methods. We observed that datasets based on different databases were similar when the share the same methods of clustering (Figure 1). Also, compared to other methods, ASV's dataset properties were unique. K. Kim, S. Park, S. Won, Public Health, Seoul National Univ., Seoul, Korea(The Republic of) kangjinkim1109@gmail.com

AGFD 183 WITHDRAWN

AGFD 184 CONTROL ID: 3393887
Processing cocoa with water – new insights into aroma formation The common practice of processing cocoa beans into chocolate established in the last two centuries is a totally water-free approach. However, it was recently shown that the three-phase decanter Tech. including the extraction of cocoa beans with water resulted in dark chocolates with pleasant sensory characteristics. It was demonstrated that unroasted cocoa beans processed with water under gentle conditions (T <60°C) resulted in chocolates with high concentrations of valuable odorants such as Strecker aldehydes and pyrazines, which are normally formed at much higher temperatures. Therefore, it was postulated that these compounds are released upon water treatment of fermented and dried cocoa beans from yet unknown odorless precursors. To get a deeper insight into the formation of odorants during water treatment of cocoa beans, we compared traditionally produced chocolates and chocolates obtained by the three-phase decanter Tech., both from the same batch of cocoa, by application of the aroma extract dilution analysis and key-aroma compound quantitation by using isotopically modified odorants as internal standards. Model experiments revealed further insights into the role of water on the generation of important chocolate odorants. L. Ullrich, T. Hühn, I. Chetschik, Life Sciences and Facility Management, Zhaw, Wädenswil, Switzerland S. Neiens, M. Steinhaus, Leibniz-Inst. for Food Systems Biology at the Technical Univ. of Munich, Freising, Germany lisa.ullrich@zhaw.ch

AGFD 185 CONTROL ID: 3427606
Roasting-induced changes in cocoa beans with respect to the mood pyramid The mood pyramid of cocoa, which was previously proposed as a new concept, consists of four levels (flavan-3-ols, methylxanthines, minor compounds and orosensory properties). Roasting is a crucial process for flavor development in cocoa (level 4) but is likely to have a negative impact on the phytochemicals (level 1-3). We investigated the effect of roasting time (10 – 50 min) and temperature (110 – 160°C) on the mood-enhancing compounds corresponding to the distinct mood pyramid levels. Phytochemicals were analyzed using UPLC-HRMS, while the flavor was mapped via aroma (HS-SPME-GC-MS) and generic descriptive analysis (trained panel). Results revealed that through selection of appropriate roasting parameter values for time and temperature the studied phytochemicals could be retained without comprising the flavor. V. Lemarcq, Dept. of Food Tech., Safety and Health, Ghent Univ., Wieze, Belgium valerie.lemarcq@ugent.be

AGFD 186 CONTROL ID: 3428897
Mean degree of flavanol polymerization is a superior predictor of α-glucosidase inhibitory activity compared to flavanol or polyphenol concentrations in cocoas produced by controlled fermentation and roasting Objectives: Cocoa beans (Theobroma cacao) are a rich source of flavanols. Cocoa undergoes a series of processing steps, including fermentation and roasting, that degrade native flavanols. While it is widely accepted that preservation of native flavanols in cocoa is critical for potential bioactivity, reactions occurring during processing may generate compounds with novel activities- potentially preserving or enhancing bioactivity. Our objective was to evaluate the impact of fermentation and roasting on concentrations of cocoa flavanols and subsequent bioactivity. Methods: Unfermented cocoa beans were processed into cocoa powder through a controlled laboratory fermentation model system and roasting operation. Various fermentation and roasting parameters were selected to develop powders representing the extremes of farm-based fermentation and roasting temperatures. Uniform further processing (winnowing, grinding, pressing) produced cocoa powders for each treatment and extracts were made for analysis. Total polyphenols were quantified by the Folin-Ciocalteu assay. Flavanol polymerization was analyzed through HILIC UPLC-MS/MS and thiolysis. α-glucosidase inhibitory activity was assessed in vitro. Results: Total polyphenols and individual flavanols (monomer-decamer) were reduced 27-90% in hot fermented/hot roasted cocoa and reduced 11-54% in cool fermented/cool roasted cocoa, when compared to unprocessed powder. All treatments dose-dependently inhibited α-glucosidase compared to the acarbose control (IC50 = 133.22 µg/mL), with cool fermentation/cool roasted powder exhibiting the greatest potency (IC50 = 68.09 µg/mL). A significant negative correlation between flavanol polymerization and IC50 was observed (−0.88), indicating polymerization as a marker of enhanced α-glucosidase activity. Strong correlations were not observed for total polyphenols and flavanols. Conclusions: Cocoa powder is potentially a powerful inhibitor of α-glucosidase activity in vivo. Significant flavanol reductions by fermentation and roasting do not necessarily dictate reductions in α-glucosidase inhibition, but rather that processing can enhance cocoa bioactivity K. Racine, L.E. Griffin, A. Neilson, Plants for Human Health Inst., North Carolina State Univ., Kannapolis K. Racine, L.E. Griffin, A. Neilson, Food, Bioprocessing, and Nutrition Science, North Carolina State Univ., Raleigh H. Hopfer, Food Sci., The Pennsylvania State Univ., Univ. Park J. Lambert, Penn State Univ., Univ. Park, B.D. Wiersema, L.A. Essenmacher, A. Lee, A.C. Stewart, Dept. of Food Sci. and Tech., Virginia Tech, Blacksburg kcracine@ncsu.edu

AGFD 187 CONTROL ID: 3431652
Effect of genetics and post-harvest processing on the in vitro anti-inflammatory effects of cocoa Cocoa derived from Theobroma cacao is a popular food ingredient containing high levels of flavan-3-ols and other polyphenols. It has been shown to mitigate chronic inflammatory diseases in vivo. T. cacao is grown in disparate parts of the tropics, and three major varieties and multiple hybrids are grown. While geographic origin and variety have been reported to impact sensory properties, the effect of these factors on the health-related bioactivity of cocoa has not been well-studied. Cocoa beans also undergo extensive processing including fermentation and roasting prior to consumption. Previous studies have shown that these processing steps can adversely affect the total phenolic content of cocoa, but the effect on bioactivity has not been well-described. Here, we compared the in vitro anti-inflammatory activity of (1) cocoa extracts from 3 T. cacao clones from 2 harvests grown under common environmental conditions in Honduras and (2) a single lot of cocoa beans that were subjected to controlled fermentation and/or roasting protocols. In both experiments, cocoa beans were winnowed, ground, and defatted using hexane. The defatted cocoa mass was then extracted with 80% aqueous acetone containing 0.1% acetic acid to prepare a polyphenol-rich extract. The anti- inflammatory efficacy was evaluated by measuring inhibition of phospholipase A2 in vitro. In study 1, the three cocoa clones differed significantly in terms of PLA2 inhibitory activity; harvest year also impacted inhibitory activity. In study 2, extracts from unfermented/unroasted cocoa beans had similar inhibitory potency to extracts from lightly fermented/unroasted cocoa beans and lightly fermented/cool roasted cocoa beans (IC50~ 10 µg/mL) whereas more aggressively fermented/roasted cocoa beans were less potent (IC50~ 25 µg/mL). Additional chemical analyses are needed to explain the observed effects of cocoa genetics and post-harvest processing on in vitro anti-inflammatory activity, whereas animal model studies are needed to determine whether the observed differences in anti-inflammatory activity translate to the in vivo situation. J. Lambert, T.N. Seymore, A.L. Brown, G.R. Ziegler, Penn State Univ., Univ. Park, K. Racine, Food, Bioprocessing, and Nutrition Science, North Carolina State Univ., Raleigh, A. Neilson, Plants for Human Health Inst., North Carolina State Univ., Kannapolis, H. Hopfer, Food Sci., The Pennsylvania State Univ., Univ. Park, jdl134@psu.edu

AGFD 188 CONTROL ID: 3429736
Enhanced bioactivity of milk chocolate using extracts from food processing waste materials Dark chocolate is noted for its health benefits which have been attributed to small molecule phenolic compounds such as flavonoids. It is also noted for its increased bitter flavor and hard texture over more popular chocolate products such as milk chocolate. Other foods such as nuts, peanuts, coffee, tea, and various dark fruits contain the same or similar small molecule phenolic compounds. These compounds are also present in the processing waste material from these food products. Using peanut skins, a waste product of the peanut blanching industry as a case study, the development of a functional food ingredient was prepared. Aqueous ethanolic extracts were prepared from peanut skins and their phenolic compounds characterized. The extracts were found to consist of catechins and other procyanidins. The extracts were encapsulated with maltodextrin to create a free flowing powder. After incorporation at levels from 0.1 to 8.1% into molten milk chocolate, the matrix was molded to form individual squares. The resulting chocolate products were analyzed for chemical antioxidant activity using the DPPH assay. Sensory analysis using consumers was conducted and it was found that the consumer threshold for detection of the presences of the ingredient was above 0.9% which produced a product with DPPH activity higher than dark chocolate. When the ingredient was incorporated at a level of 0.8%, 60% of the consumers preferred the flavor of the dosed product to the untreated control. This indicates that extracts of waste peanut skin material can provide bioactivity to milk chocolate without interfering with the preferred

taste. Other waste streams from food processing that contain similar compounds would be candidates for this treatment and lead to increased utilization and economic value L.L. Oehrl, Food Sci. and Market Quality and Handling Research, USDA, ARS, Raleigh, North Carolina, B.J. Hess, Biological and Agricultural Engineering, North Carolina State Univ., Raleigh, C.M. Eickholt, Food, Bioprocessing and Nutrition Sciences, North Carolina State Univ., Raleigh, lisa.dean@ars.usda.gov

AGFD 189 CONTROL ID: 3430391
Future challenges for chocolate Chocolate is the most craved food in the US, but the future of this product will be affected by climate change and disease. Warming weather across the globe may force cacao trees to be grown at higher altitudes, which do not exist in cacao-growing areas in West Africa. Droughts and floods are becoming more extreme and also have a negative effect on the crop. Various fungi, pests, and viruses attack cacao trees, which are all in the same species (with fewer than 12 varieties). This lack of genetic diversity may cause a large die-off if another and more dangerous biological threat appears. Growers will need to develop hardier trees, integrated pest management, and other techniques so that chocolate can be enjoyed in the future at a reasonable price. M.H. Tunick, Dept. of Food & Hospitality Management, Coll. of Nursing & Health Professions, Drexel Univ., Philadelphia, Pennsylvania mht39@drexel.edu

AGFD 190 CONTROL ID: 3424040
Tempeh fermentation enhanced health-promoting potential of soybean by increasing bioavailability and efficacy of soy phenolics Background. Soy phenolics have been linked with a lower incidence of several types of cancers and can be made more bioavailable by tempeh fermentation. However, bound phenolics (BPs) have not been well studied due to them being bound to food fiber thus difficult to be extracted or fully utilized in the GI tract after oral consumption. This research aimed to determine the composition, anti-inflammatory activity, and anti-cancer activity of soy BPs before and after tempeh fermentation. Methods. Soybeans were fermented using Rhizopus oligosporus. BPs were obtained by digesting the residue leftover from acetone-water extraction using enzymes, acid, and base consecutively before ethyl acetate extraction. Soy glycosides, aglycones, and small phenolics in extracts were analyzed using high-resolution LC-MS. RAW 264.7 cells and HCT116 cells were used to determine the anti-inflammatory and anti-cancer activities, respectively. Results. In free phenolics (FPs) extracts, tempeh fermentation significantly increased the levels of all glycosides (1.3 to 6.4-fold), all aglycones (2.4 to 4.5-fold), and some small phenolics (ferulic acid: 60.4-fold and p-coumaric acid: 13.9- fold). In enzyme-hydrolyzable bound phenolics (EhBPs) extracts, tempeh fermentation eliminated glycitin and genistin while increased the levels of all glycosides (4.3 to 4.4-fold) and p-coumaric acid significantly. In acid-hydrolyzable bound phenolics (AhBPs) extracts, tempeh fermentation eliminated genistin while increased the levels of sinapic acid, p-coumaric acid, and ferulic acid (10.6-fold) significantly. In base-hydrolyzable bound phenolics (BhBPs), glycitein and genistein were decreased significantly. In cell culture experiments, tempeh fermentation significantly increased anti- inflammatory activities of EhBPs, AhBPs, and BhBPs by 6-fold, 7.1-fold, and 1.7-fold respectively as well as significantly increased anticancer activities of EhBPs, AhBPs, and BhBPs by 35.1-fold, 1.4-fold, and 2.2-fold respectively. Conclusion. Tempeh fermentation may enhance the health-promoting potential of soybeans by releasing BPs into loosely-bound phenolics (LBPs) and FPs to be in higher amounts and efficacy. A.D. Ahnan, H. Xiao, Food Sci., Univ. of Massachusetts Amherst driando.ahnan@gmail.com

AGFD 191 CONTROL ID: 3416776
Microencapsulation applications for value added textiles Microencapsulation Tech. used in the cosmetics field as well as in the pharmaceutical, agrochemical and food industries for flavors, acids, oils, vitamins, microorganisms, among others. The achievement of this Tech. is due to the correct choice of the wall material, the core release form and the encapsulation method. Research and development needed to identify and develop new wall materials and to improve the existing methods of encapsulation for the better use of microencapsulation and its potential applications. Microencapsulation have formulated for applications on woven and nonwoven textiles without substantially altering the feel or color of textile products. Formulation addictive usually consists of binder, crosslinking agents, pigments, and filler, antifoaming agents and viscosity-controlling agents. In this study, insect repellents, antimicrobial and flame retardant textile have been developed using microencapsulation technologies. Woven and nonwoven textiles treated with tritolyl phosphate flame retardant microcapsules with binder to provide different add-on values. These textiles tested for flammability tests. Thermal properties of desired products discussed using thermogravimetric analysis and microscale combustion calorimeter. Furthermore, natural essential oils and tee tree oil were treated textile for insect repellents and antimicrobial. Encapsulation of antimicrobial essential oils into a non-toxic polymer with subsequent finishing on the fabric will be the initial approach. An area of interest as well is the application of essential oils is for skin hygiene/protection and wound healing S. Chang, B. Condon, J. Smith, USDA Ars SRRC, New Orleans, Louisiana, sechin.chang@ars.usda.gov

AGFD 192 CONTROL ID: 3437531
Laccase mimicking nanozymes and their applications in food analysis and food processing Laccase mimicking nanozymes of a metal framework structure was prepared based on copper ions and adenosine phosphate. The nanozymes had the advantages of higher catalytic activity and lower price than laccase. And they also had a good stability, for example, the catalytic activity remains high level over a wide temperature range (30 - 90 C), pH range (4 - 9) and salt concentration (0 - 500 mM NaCl). The proposed nanozyme was used to remove phenol from juice and showed a better phenol removal effect than native laccase. Clarification of different juices with the nanozymes indicates that they have good application prospect in the food industry. In addition, the nanozymes were also applied for the detection of phenolic substances, alkaline phosphatase and hydrogen sulfide, etc. H. Huang, L. Lei, J. Bai, M. Li, Food Sci. and Engineering, Jilin Univ., Changchun, China H. Huang, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park, huanghui@jlu.edu.cn

AGFD 193 CONTROL ID: 3429038
Natural vanillin production from Ischnoderma resinosum fermentations The demand for natural vanillin has increased in recent years because of a growing consumer preference for products of natural origin. Even though the seed pods of vanilla plant (Vanilla planifolia) have been historically considered the major source of natural vanillin, the expensive nature of isolation and low yields have rendered the botanical source a less sustainable option than microbial fermentation. Ischnoderma resinosum (P. Karst) is a white-rot fungus commonly found in North American hardwood forests. Currently, the production of vanillin from I. resinosum has not been reported. The objectives of this study were to (1) culture the fungus in liquid broth, (2) elucidate the biosynthetic pathway for production of benzylic derivatives using isotope incubation studies coupled with gas chromatography- mass spectrometry analysis (GC-MS), and (3) utilize the knowledge of the biosynthetic pathway to produce natural vanillin via fermentation. Results from the study revealed the conversion of both benzyl alcohol and benzoic acid to benzaldehyde,

as well as benzaldehyde to 4-methoxybenzaldehyde. 4-Methoxybenzaldehyde was converted to 3,4- dimethoxybenzaldehye via subsequent hydroxylation and methylation at the 3-C position. Based on isotope incubation studies, a biosynthetic pathway for production of benzylic derivatives in I. resinosum was proposed. While the fermentations did not produce vanillin de novo, incubations with precursor (2H3) -vanillic acid produced 82.8 ± 0.01% (2H3) -vanillin and 17.2 ± 0.01% (2H3) -vanillyl alcohol via bioconversion. This presentation will discuss use of I. resinousm as a potential source of natural vanillin and highlight other potential opportunities for the sustainable production of flavor compounds of economic interest. P. Wickramasinghe, Food Sci., Univ. Of Tennessee Knoxville J.P. Munafo, Food Sci., Univ. of Tennessee, Knoxville, pwickram@vols.utk.edu

AGFD 194 CONTROL ID: 3429223
Peptide production for food allergy studies Linear IgE epitopes play essential roles in peanut and tree nut allergies. Overlapping peptides spanning the full length of the protein sequences of food allergens were used in dot blot and microarray experiments, and the dominant linear epitopes of peanut allergens Ara h 1-3 were identified. However, prevalent IgE epitopes for most known food allergens have not been mapped. One of the challenges for linear IgE epitope mapping is the production of peptides. Chemically synthesizing is currently the main method of peptide production. It is expensive, and the method has inherent challenges in scaling-up the production, and in the purification of the synthesized peptides. To overcome this problem, we have constructed a plasmid vector for expressing peptides sandwiched between an N- terminal His-tag and a truncated form of the trimeric protein. The vector was used to make overlapping peptides derived from peanut allergens Ara h 2 and 5, and all of the peptides were successfully expressed and purified. This system can be used in future researches to produce agents for component- and epitope-resolved food allergy diagnoses. It can also be used for creating single epitope reagents to study IgE cross-linking. Y. Zhang, A. Vilches, C. Li, ARS-PWA-WRRC, USDA, Albany, California, C. Li, School of Food Sci. and Tech., Jiangnan Univ., Wuxi, Jiangsu, China yuzhu.zhang@ars.usda.gov

AGFD 195 CONTROL ID: 3429704
Effect of baking on phenolic acids in bread and muffin made from blends of hairless canary seed, wheat and corn Phenolic acids are potent antioxidants present in cereal grains as the major polyphenols. They undergo changes during processing which influence their bioavailability and bioactivity. This study investigated the fate of phenolic acids during processing of bread and muffin made from blends of hairless canary seed, corn and wheat. Bread was chosen as a fermented baked food, while muffin is a non-fermented baked product. Three bread formulations made from wheat/canary seed blends, 85/15, 75/25, 50/50 (w/w) (W/C15, W/C25 and W/C50) were evaluated after dry mixing, dough formation and baking and compared with 100% wheat (W) bread control. Three muffin recipes made from 100% canary seed (C) and canary seed/corn blends (50/50 and 33/67, w/w) or C/Cn50 and C/Cn67 were evaluated after dry mixing, batter formation and baking. Bound and unbound phenolic acids were monitored in products using UPLC analysis. Eight phenolic acids were present in the bound fraction at reasonable concentrations in raw grains, while only a few phenolic acids were detected in the unbound fraction. Ferulic (FA) was the dominant phenolic acid in wheat, corn and canary seed followed by p-coumaric acid but the latter phenolic acid was extremely high in canary seed compared with wheat and corn. After baking, bound phenolic acids decreased, while the unbound phenolic acids increased especially FA. Fermentation and dough formation resulted in about 6, 5, 15 and 14% reductions in bound FA for W, W/C15, W/C25 and W/C50 bread products, respectively. Additional decreases of 15, 14, 10 and 20% occurred in bound FA for the same products after baking due to thermal degradation. But, the unbound FA increased after fermentation by about 48, 236, 251 and 307%, and by 273, 374, 421 and 495% after baking for W, W/C15, W/C25 and W/C50, respectively. Muffin-making process also resulted in bound FA reductions of 30, 30 and 26% after batter formation and 37, 34 and 34% after baking for C, C/Cn50 and C/Cn67, respectively. The unbound FA increased by about 221, 1, 1% after batter formation and 155, 1 and 1% after baking for C, C/Cn50 and C/Cn67, respectively. The results indicate tangible increases in unbound phenolic acids at different extents subject to type of formulation and baking process which may improve bioavailability. E.M. Abdelaal, I. Ralablski, M. Hernandez, Guelph Research and Development Centre , Agriculture and Agri-Food Canada, Ontario, elsayed.abdelaal@canada.ca

AGFD 196 CONTROL ID: 3431083
Synthesis and characterization of hydrophobic polyurethane-co-perfluoropolyether coatings to reduce biofouling Bacterial contamination during food processing and production continues to be a main cause of foodborne illness outbreaks. As additional regulatory guidance and efforts emerge for preventing microbial contamination of food, technologies for eliminating favorable growth conditions within processing and production facilities must also be considered. Areas with conditions most favorable for bacteria, including areas that are damp and consistently rich in organic matter, are an optimal environment for bacteria to adhere and create microfouling. In this work, we have synthesized traditional solventborne polyurethane, conventionally found in food processing and production facilities, and solventborne polyurethane containing 1%, 2%, and 3% non-fouling perfluoropolyether. Polyurethanes were coated onto food grade stainless steel to replicate application in food industry growth niches, e.g. floor drains. Polyurethane formation was confirmed by attenuated total reflectance Fourier transform infrared (ATR-FTIR) spectroscopy with the urethane band forming at 1730cm-1 and absence of free isocyanate stretching from 2275- 2250cm-1. X-ray photoelectron spectroscopy (XPS) was used to confirm perfluoropolyether polymerization with an increase in the atomic percentage of fluorine. Wettability and hydrophobicity were determined using dynamic water contact angle with significant differences in advancing water contact angle with the inclusion of perfluoropolyether blocks compared to the control polyurethane (87.4° ± 3.8, 107.3° ± 3.6, 114.9° ± 1.5, 117.2° ± 1.2). Additionally, coatings containing perfluoropolyether blocks had a water contact angle affirming hydrophobicity (>90°). This work has demonstrated the ability to control the surface functionality of a traditionally used coating material in order to reduce the ability for bacterial adhesion and subsequent microfouling found in processing facilities. A. Rudlong, J.M. Goddard, Food Sci., Cornell Univ., Ithaca, New York amr452@cornell.edu

AGFD 197 CONTROL ID: 3409135
Compositional and bioactivity characterization of the emulsion fraction recovered during bioprocessing of fish by-products Generation of functional foods and nutraceuticals from fish by-products has inherent economic and environmental advantages, in addition to the significant human health prospects. Not only are these good sources of edible proteins and fish oil, fish by-products are also reservoirs of bioactive molecules. In this study, emulsion phase generated from microbially processed fish by-products was isolated and characterized. During processing, endogenous enzymes in the fish tissues facilitated the hydrolytic release of oil, peptides and other mineral components of the fish tissue. Centrifugal separation of the by-product fermentate resulted in four chemically distinct fractions: oil, emulsion, hydrolysate and residue. Of these, the emulsion fraction in particular is poorly characterized in the literature. It is primarily a heterogenous mixture of proteins/peptides (24%) and oil

(60%), and is referred to as a lipopeptidic complex. Results of this study indicates that hydrophobic interactions are expected to have facilitated the formation of the complex, as evident from the significantly higher abundance of aromatic amino acid residues in the emulsion fraction amino acid profile (across multiple fish species). Peptide profile of the emulsion fraction was derived from LC-UV and LC-MS/MS and demonstrates a distinct set of peptides relative to that of the soluble fraction. For instance, ~76% of identified peptides were unique to the emulsion fraction. Antioxidant activity of the emulsion fraction was also found to be higher, as measured using colorimetric assays such as ferric reducing antioxidant potential assay and Fe(II) chelation assay. These findings are relevant to understanding the behavior of peptides as fish by- products undergo fermentative processing and separation. It also has relevance to novel product development from microbial processing of fish by-products such as emulsion for use in food formulations. Additionally, the results from the study contributes towards the elucidation of the various physicochemical properties of peptides that determine antioxidant activity. S. Cheri Kunnumal Rajendran, A. Doucette, Chemistry, Dalhousie Univ., Sydney, Nova Scotia, Canada S. Cheri Kunnumal Rajendran, B. Mason, Verschuren Centre for Sustainability in Energy and the Environment, Sydney, Nova Scotia, Canada subinrajck@dal.ca

AGFD 198 WITHDRAWN

AGFD 199 CONTROL ID: 3405236
Molecular and functional diversity of organelle RNA editing mediated by RNA recognition motif-containing protein ORRM4 in tomato Plant organellar RNA editing is a distinct type of post-transcriptional RNA modification and is critical for plant development. Our previous study showed RNA editing factors SlORRM4 is required for both mitochondrial function and tomato fruit ripening. However, the comprehensive atlas of RNA editing mediated by SlORRM4 are largely unknown, which will help to demonstrate the regulatory mechanism of plant RNA editing. We found SlORRM4 is dually targeted to chloroplast and mitochondria. Knockout of SlORRM4 resulted in pale green leaves and delay of fruit ripening. SlORRM4 is a critical RNA editing factor that is responsible for at least 54% and 61% RNA editing events in chloroplast and mitochondria, respectively. We combined nRIP-seq and RNA editing extent analysis of tomato fruits and classified 19 direct SlORRM4 target mitochondrial coding genes. Inspection of the functions of SlORRM4 targets suggested that SlORRM4 participates in the regulation of mitochondrial respiratory. Large-scale analysis of putative SlORRM4-interacting proteins revealed that SlRIP1b, which is another critical RNA editing factor, was involved in the editosome complex of SlORRM4. In sum, our results provide new insights towards a better comprehension of the molecular and functional diversity of plant organelle RNA editing. Y. Yang, K. Wang, J. Li, G. Zhu, S. Ren, B. Zhu, D. Fu, G. Qu, H. Zhu, Y. Luo, China Agricultural Universtiy, Beijing X. Liu, Novogene Bioinformatics Inst., Beijing, Z. Deng, Chinese Academy of Agricultural Sciences, Hangzhou yangyf0720@cau.edu.cn

AGFD 200 CONTROL ID: 3426926
Metabolic adaptation of apple and pear peel during transitions in the postharvest environment Fruit peel is a dynamic organ integral to apple and pear physiology and quality. The outermost portion of the peel, or epidermis, is not only important for fruit appearance, it is the protective barrier responsible critical processes such as excluding spoilage pathogens and regulating gas, solute, and water exchange. Apple and pear peel are also metabolic engines responsible for producing photosynthetic and respiratory energy and many other processes central to fruit quality, including pigment and aroma production. As a protective barrier, the outer epidermal cells produce, and are sometimes surrounded by, layers of the polyester cutin which is, in turn, intercalated and overlaid with a complex waxy mixture that includes nonacosane and various quantities of other alkanes, alcohols, fatty acids, triglycerides, and free and conjugated forms of ursane, oleane, and betulane triterpenes, and hydroxycinnamates. Peel tissue is dynamic and changes as fruit react to conditions in the orchard all the way through the cold chain, even producing event-specific volatile signals. Different metabolic reactions to the environment and potential positive and negative consequences to fruit surface chemistry, integrity, and quality as well as opportunities afforded using predictable metabolic changes to modify storage conditions or assess whether specific apples and pears will survive the cold chain will be discussed. D. Rudell, Tree Fruit Research Laboratory, USDA-ARS, Wenatchee, Washington, david.rudell@ars.usda.gov

AGFD 201 CONTROL ID: 3434332
Tomato lateral organ boundaries transcription factor, SlLOB1 specifically regulates the cell wall and softening component of ripening Fruit softening is a key component of the irreversible ripening program, contributing to palatability necessary for frugivore-mediated seed dispersal. The underlying textural changes are complex, and result from cell wall remodeling and changes in both cell adhesion and turgor. While a number of transcription factors (TFs) that regulate ripening have been identified, these affect most canonical ripening-related physiological processes. Here we show that a tomato fruit ripening-specific LATERAL ORGAN BOUNDRIES (LOB) TF, SlLOB1, up-regulates a suite of cell wall associated genes during ripening. SlLOB1 repression in transgenic fruit impedes softening, while over-expression confers precocious induction of cell wall gene expression and premature softening. Transcript and protein levels of the wall loosening protein EXPANSIN1 (EXP1) are strongly suppressed in LOB1 RNAi lines, while EXP1 is induced in LOB1-overexpressing transgenic leaves and fruit. In contrast to the role of ethylene and previously characterized ripening TFs, which are comprehensive facilitators of ripening phenomena, including softening, LOB1 participates in a regulatory sub-circuit specific to cell wall dynamics and softening. Y. Shi, Zhejiang Univ., Hangzhou, China shiyanna@zju.edu.cn

AGFD 202 CONTROL ID: 3430416
Capitalizing on plant genetics to enhance fresh produce safety Mounting evidence suggests that zoonotic bacterial pathogens of humans (e.g., non-typhoidal Salmonella enterica and Escherichia coli O157:H7) may have adapted to both animal and plant hosts, enabling them to survive in the food production chain. Our research has focused on understanding the molecular and genetic mechanism(s) underlying the ability of these pathogens to survive in edible leaves. For instance, we have uncovered genetic variation of lettuce in the interaction between the plant and strains of the two most common bacterial species identified in disease outbreaks. Using plants grown under controlled environment, we observed significant variation in the bacterial leaf colonization among eleven lettuce genotypes (Lactuca sativa L. and L. serriola L.) after surface- and syringe-inoculation methods. Three lettuce genotypes with contrasting bacterial persistence phenotypes also exhibited significant differences in the level of plant defense responses (i.e., reactive oxygen species burst and callose deposition) against S. enterica and E. coli O157:H7. Simultaneous and temporal analysis of the plant and bacterium transcriptomes revealed an active interaction between these organisms and a significant modulation of diverse metabolic pathways, including plant defense response. Overall, this study supports the basis for breeding (i.e., genetic variability) and creates opportunities to develop additional strategies to decrease microbial hazards in leafy greens. M. Melotto, Dept. of Plant Sciences, Univ. of California, Davis, melotto@ucdavis.edu

AGFD 203 CONTROL ID: 3430459
BrNAC092 is involved in ABA-promoted leaf senescence in Chinese flowering cabbage by activating the ABA biosynthesis and GA catabolism Leaf senescence is a complex biological process and is tightly controlled by various phytohormones, among which abscisic acid (ABA) and gibberellins (GAs) act antagonistically. NAC (for NAM, ATAF1/2, and CUC2) proteins are one of the largest plant-specific transcription factors, and play pivotal roles in senescence. However, to date, the direct regulation of hormone pathways by members of the NAC gene family and specifically in association with the ABA and GA biosynthesis pathway, especially for the leaf senescence of economically important leafy vegetables, such as Chinese flowering cabbage, is largely unclear. In the present work, we present data to support the participation of a Chinese flowering cabbage NAC transcription factor, BrNAC092, in ABA-antagonized GA accumulation in ABA-induced leaf senescence. Exogenous ABA treatment accelerated Chinese flowering cabbage leaf senescence, with decreasing maximum quantum yield (Fv/Fm) and total chlorophyll content, as well as up- regulating the expression of senescence-associated genes. Notably, ABA treatment enhanced endogenous ABA accumulation and reduced GA3 level in senescing leaves. Consistently, up-regulation of two ABA biosynthetic genes (BrNCED3 and BrABA2) and one GA catabolic gene BrGA2ox1 was observed following ABA application. Furthermore, a NAC transcription factor, BrNAC092, a homolog of Arabidopsis ANAC092, was isolated and characterized. BrNAC092 was senescence-/ABA-up regulated and localized in the nucleus acting as a transcriptional activator. Further in vitro and in vivo experiments demonstrated that BrNAC092 activated BrNCED3, BrABA2 and BrGA2ox1 transcription by targeting their promoters via the NAC-binding sequence (NACBS). Finally the function of BrNAC092 is verified by its transient and ectopic overexpression in tobacco leaves and Arabidopsis, respectively, which accelerated leaf senescence via activating the ABA biosynthesis and GA catabolism. Taken together, we proposed that BrNAC092 is a novel regulator of leaf senescence in Chinese flowering cabbage, which acts by directly regulating key biosynthetic genes of the ABA and GA pathways. These findings provide important insights into NAC- mediated ABA and GA antagonism in regulating leaf senescence, and are contributed to improve the Tech. of maintaining the shelf life and commercial value of this important leafy vegetable. Z. Fan, W. Shan, J. Kuang, W. Lu, J. Chen, College of Horticulture, South China Agricultural Univ., Guangzhou Z. Fan, College of Food Sci., Fujian Agriculture and Forestry Univ., Fuzhou, China ffanzqi@163.com

AGFD 204 CONTROL ID: 3430895
Citrus huanglongbing (HLB) and secondary infection by the fungus Lasiodiplodia theobromae (Diplodia) impact on citrus crop and juice quality Citrus huanglongbing (HLB) is caused by Candidatus Liberibacter asiaticus (CLas). HLB-diseased trees produce small, misshaped, discolored fruit, and the juice is usually less sweet and more sour and bitter, with off-flavor. We found the degree of off-flavor shows a positive correlation with CLas titer in juice. By sequencing PCR products resulted from universal primers, we also found high incidence of fungus Lasiodiplodia theobromae (Diplodia) in HLB- affected juice, but not in healthy-fruit juice. Diplodia is a pathogen causing stem-end rot (SER) of citrus fruit. It infects on-tree fruit under the calyx, and fruit decay typically occurs following harvest. Our follow up on-tree fruit studies confirmed the secondary infection of Diplodia in the calyx abscission zone (AZ-C) of HLB-affected citrus fruit, which was positively correlated with CLas titer. The incidence of SER was much higher for HLB than healthy fruit. In addition, Diplodia titers were positively correlated with decrease in fruit detachment force, suggesting the secondary Diplodia infection may also contribute to HLB-related fruit abscission. We further investigated the HLB-affected fruit that were undergoing abscission (Dd fruit, dropped upon shaking the tree) compared with those not undergoing abscission (Rd fruit, retained on the shaken tree), regarding Diplodia titer, global gene expression profile in AZ-C, level of abscission related phytohormones (Ethylene (ET), jasmonic acid (JA), and abscisic acid (ABA)), and fruit juice quality. Diplodia level in Dd was significantly higher than in Rd. Increased ET and JA, and decreased ABA were measured in Dd. RNA-sequencing results showed a gene expression profile in Dd of typical defense responses against necrotrophic fungal infection (upregulation of ET and JA and the downstream defense response genes). Dd fruit juice had more bitter limonoids and astringent flavonoids, and less fruity volatiles. The information will facilitate strategies to decrease fruit drop and decay, while avoid lowering juice quality. W. Zhao, E. Baldwin, J. Bai, A. Plotto, G. McCollum, J. Manthey, USDA, United States Horticultural Research Laboratory, Fort Pierce, Florida, M. Irey, Southern Gardens Citrus, US Sugar Corporation, Clewiston, Florida wei.zhao@usda.gov

AGFD 205 CONTROL ID: 3434331
Effects of postharvest conditions on fruit flavor quality In order to connect producers and consumers, postharvest technologies are necessary to maintain the quality of fruit. Postharvest cold storage is the most effective Tech. for extending fruit storage life. However, this handing results in reduced fruit flavor quality. Volatile, together with sugar and acids, is one of the important traits for fruit flavor quality. Flavor-related volatiles are sensitive to low temperature, and loss of volatile production greatly reduces flavor quality and consumer liking. Production of volatiles did not fully recover after transferring to shelf-life at room temperature. Application of some postharvest treatments effectively reduce volatile loss caused by cold storage. Transcripts for some key volatile synthesis enzymes are reduced in response to postharvest cold storage. Those reduction of transcripts are accompanied by major changes in the methylation status of promoter regions. Our analysis provides insight into the mechanisms of fruit flavor loss caused by postharvest cold storage. B. Zhang, C. Kunsong, Horticulture Dept., Zhejiang Univ., Hangzhou, China bozhang@zju.edu.cn

AGFD 206 CONTROL ID: 3432189
New postharvest technologies to control decay and retain fruit quality of fresh fruits Postharvest decay caused primarily by fungal pathogens results in significant losses of fresh fruits during storage and transit and in the market. Controlling postharvest decay and maintaining fruit quality is important to consumers' acceptance and the profitability of the fresh fruit industry. Natamycin has been commonly used in the food industry as an additive to reduce the growth of yeasts and molds on the surface of cheese and other non-sterile food products. Natamycin has recently been registered as a biofungicide for postharvest use on certain fresh fruits and is exempt from residue tolerance in the United States. In this presentation, the postharvest use of natamycin for control of fungal decay on fresh fruits is presented. In addition, the use of antimicrobial packaging, including sulfur dioxide- emitting packaging pads, liners, sheets, or bags with or without modified atmosphere capability, to control postharvest fruit decay and maintain fruit quality of fresh fruits is also presented. Challenges and prospects of these new postharvest technologies for fresh fruits will also be discussed. C. Xiao, S. Saito, D. obenland, US Dept. of Agriculture - Agricultural Research Service (USDA-ARS), San Joaquin Valley Agricultural Sciences Center, Parlier, California Chang-Lin.Xiao@ars.usda.gov

AGFD 207 CONTROL ID: 3434552
Microbiota responses to dietary fiber structures are both highly individual and generalizable The human gut microbiota is known both to be highly malleable to dietary changes and idiosyncratic in structure across individuals. Furthermore, the consumption of

fermentable dietary fibers is thought to among the strongest dietary drivers of gut microbiome structure and function. Our previous research suggests that gut microbiota respond divergently to differing fiber physical and chemical structures. Together, these aspects suggest the hypothesis that interactions of the gut microbiome with differing fiber structures will be strongly individual in nature. To test this hypothesis, we cultivated human fecal microbiota from individual donors as inocula in media containing common types of soluble dietary fiber oligosaccharides and polysaccharides in foods (inulins, resistant dextrins, and arabinoxylans) varying in fine structure (molecular weight, degree of polymerization, sugar composition, and linkage profiles). We measured community structure via 16S amplicon sequencing and metabolite outputs (e.g. short-chain fatty acids) over sequential cultures. Though community metabolic responses were strongly individual across donors, our data clearly revealed structure-dependent growth responses of certain operational taxonomic units (OTUs; computational analogs of species) across individuals. Furthermore, complex carbohydrates maintained stable diversity over sequential passages; carbohydrates with greater complexity supported greater microbial diversity in the face of high dilution pressure. To determine relationships between carbohydrate structure and organism's genome content, we sequenced metagenomes from final cultures and reconstructed member species' genomes. These genome reconstructions uncovered polysaccharide structure-dependent differences in gene content that hypothetically drives which microbes are successful on different carbohydrate structures and lays a foundation for understanding microbial division of labor in degradation of complex polysaccharides. S. Lindemann, Purdue Univ., West Lafayette, Indiana lindems@purdue.edu

AGFD 208 CONTROL ID: 3430645
Natural anthocyanins from berry fruits prevent diabetes through regulating gut microbiota Emerging evidence indicates that consumption of anthocyanin-rich food contributes to the prevention of type-2 diabetes (T2D) and its complications. However, the underlying anti-diabetic mechanisms of natural anthocyanins remain unclear. In the present study, we first investigated the protective effect of wild raspberry extract produced before and after in vitro gastrointestinal digestion against oxidative stress. We found that wild raspberry extract produced after digestion (RD) showed a better protective effect against oxidative stress than that produced before digestion (RE). LC–MS analysis revealed that wild raspberry underwent gastrointestinal digestion significantly increased the contents of pelargonidin-3-O-glucoside (Pg3G), which might be responsible for improved antioxidant activity. Therefore, we next isolated Pg3G by a combination of high-speed countercurrent chromatography (HSCCC) and HPLC techniques. To investigate the antihyperglycemic mechanism of Pg3G, global hepatic gene expression and gut microbiota structure were analyzed. We found that Pg3G administration ameliorated glucose intolerance and insulin resistance in db/db diabetic mice. Pg3G led to improvement of serum lipid profiles and attenuation of hepatic dysfunction. In addition, RNA sequence analysis showed that Pg3G treatment contributed to 301 genes upregulated and 269 genes downregulated. GO, KEGG and GSEA analysis indicated that Pg3G led to differential gene expressions (DEGs) enriched in glucose metabolism, lipid metabolism and inflammatory signaling pathway. RT-PCR validation of selected genes exhibited a positive correlation between RNA sequence and RT-PCR results. Furthermore, our results showed that Pg3G modified the gut microbiota composition as indicated by an increased abundance of Prevotella and elevated Bacteroidetes/Firmicutes ratio. Pg3G also ameliorated the leaky gut in db/db mice. Taken together, this study demonstrated that Pg3G attenuated T2D by regulating the hepatic genes involved in glucose metabolism and lipid metabolism and modulating gut microbiota, which implicates the potential for nutritional intervention of T2D W. Chen, H. Su, T. Bao, Zhejiang Univ., Hang Zhou, China zjuchenwei@zju.edu.cn

AGFD 209 CONTROL ID: 3431115
Codium fragile extract increases muscle weight and exercise endurance by upregulating protein synthesis and ERRγ in adult mice Skeletal muscle is crucial to maintain metabolic homeostasis and prevent chronic disease as well as posture maintenance and mobility. Codium fragile (CF) has been reported to show immune enhancing, anti- inflammatory, anti-obesity, and anti-osteoarthritis effects. However, the effect of CF on skeletal muscle mass and function remains to be elucidated. 20-week-old C57BL/6 mice were fed a diet containing 0.1% or 0.2% CF extract for 10 weeks. In mice fed the CF extract, the total running distance, total running time, and maximum speed of the treadmill increased. The soleus and quadriceps muscle weights and the cross-sectional area of soleus muscle fibers were increased by CF extract. CF enhances protein synthesis and myogenic differentiation through mTORC1 pathway in C2C12 cells. CF also promotes the formation of oxidative muscle fiber such as myosin heavy chain 1 (MHC1) and MHC2A, increases the protein expression of estrogen-related receptor γ (ERRγ) that control oxidative fiber formation, oxidative metabolism, and exercise capacity. QTOF-MS/MS analysis identified that CF extract contains canthaxanthin and signaling molecules controlled by CF extract was regulated by cantaxanthin, suggesting canthaxanthin is the main bioactive substance of CF. Collectively, the CF extract increases muscle weight and exercise endurance by upregulating protein synthesis and oxidative muscle fiber formation, and these events were regulated by ERRγ. Therefore, CF is a potential candidate material for functional foods to prevent sarcopenia or sport nutrition to improve athletic performance. Y. Jang, J. Ahn, J. Ahn, T. Ha, C. Jung, H. Seo, M. Kim, Korea Food Research Inst., Wanjugun, Korea(The Republic of) jyj616@kfri.re.kr

AGFD 210 CONTROL ID: 3433457
Exploration of healthy and stressed gut microbiota metabolism via in vitro fermentation From a military perspective, the gut microbiome serves as an ideal tool to enhance Soldier gut and immune health and to improve survivability and performance. Our work employs in vitro tools as a means to elucidate the systematic processes of colonic bacterial metabolism of dietary inputs under both native and stressed conditions. This talk will focus on the use of in vitro fermentation to investigate metabolism of the prebiotic potential of cranberry proanthocyanidins (PAC) within a healthy microbiome as well as the utilization of fermentable fiber as a function of stress-induced dysbiosis on gut metabolism. Understanding of gut microbiota metabolism dynamics could direct future dietary supplementation strategies to build resiliency against military-relevant stressors and offset negative impacts of gut dysbiosis. T. Branck, U S Army NSRDEC, Natick, Massachusetts, L.A. Doherty, I. Pantoja-Feliciano, K. Racicot, S. Arcidiacono, J.P. Karl, J.W. Soares, U S Army CCDC Soldier Center, Natick, Massachusetts, laurel.a.doherty.civ@mail.mil

AGFD 211 CONTROL ID: 3423774
Cereboost, an American ainseng, promotes microbial colonic SCFA production which potentially relates to its acute and chronic improvements of attention, memory and mood Cereboost, a water-soluble, American ginseng extract (when consumed at 200mg/day) has been shown to improve short-term memory and attention/alertness in healthy young and middle-aged individuals (Scholey et al., 2010; Ossoukhova et al., 2015), potentially mediated by an increase in brain acetylcholine levels (Kyungha et al., 2016). Here, using a double-blind, placebo-controlled clinical trial, we aimed to confirm the effects of Cereboost on cognition and mood (i)

in the first 6 hours post-intervention (acute), (ii) after 2 weeks daily supplementation (chronic), while (iii) also assessing whether 2 weeks daily supplementation altered the response to a single acute dose (acute- on-chronic). The potential chronic modulation of the gut microbiome was concurrently investigated using the Simulator of the Human Microbial Ecosystem (SHIME ™). This in vitro model was used to evaluate effects of repeated administration of Cereboost on the luminal and mucosal human gut microbiota along the simulated proximal and distal colon, revealing changes in gastro-intestinal regions that are inaccessible in vivo. First, consistent with previous findings, it was confirmed that Cereboost improved working memory and attention acutely, with more pronounced improvements during acute-on-chronic testing. Chronic Cereboost intake similarly improved cognition but also improved mental fatigue and self-assurance aspects of mood. Further, the parallel in vitro study provided insight into the potential mechanism of action underlying cognitive improvement, as Cereboost was shown to significantly increase acetate, propionate and butyrate levels in both colon regions. Increased distal acetate and propionate production could be linked with distal stimulations of the mucin-degrading Akkermansia muciniphila. Moreover, distal lactate levels increased, which could be linked with elevated luminal, and especially mucosal, Lactobacilli levels. The increase in SCFA could be implicated in gut–brain signaling pathways including immune (neuroinflammatory response, mood), endocrine (learning and memory), vagal/neural (learning and memory) and humoral pathways (stress, neuroprotection) (Dalile et al., 2019). In conclusion, while this study confirmed the promising effects of Cereboost on cognitive functions and suggest a possible link with the gut microbiome, further studies will be required to unravel the underlying mechanisms that are involved. P. van den Abbeele, C. Duysburgh, M. Marzorati, Prodigest, Ghent, Belgium L. Bell, C. Williams, School of Psychology and Clinical Language Sciences, Univ. of Reading, UK M. Marzorati, Center of Microbial Ecology and Tech., Ghent Univ., Ghent, Belgium P. Fanca-Berthon, R. Le Cozannet, Naturex, Avignon, France pieter.vandenabbeele@prodigest.eu

AGFD 212 CONTROL ID: 3424010

Gastric digestion simulator for visualizing and analyzing in vitro digestibility of foods Food scientists and technologists have a great deal of interest in adequate control of food digestibility in the human digestive tract. The stomach is one of the major human digestive organs, and gastric digestion is strongly affected by both physical and chemical digestion processes. In vitro gastric digestion models have played important roles owing to superior applicability to various conditions, better reproducibility of experimental data, and basically no ethical restrictions. Our research group developed a gastric digestion simulator (GDS) that simplifies the geometry and function in the human antrum. The original, batch-type GDS (b-GDS) equips with quantitatively simulated gastric peristalsis and enables direct observation of the digestion behaviors of food particles in the gastric contents. A recently developed continuous-type GDS (c-GDS) is capable of secretion of simulated gastric fluid and emptying of gastric digesta in a programmable manner (Fig. 1). This study provides a brief overview of the researches performed using GDS. The history and development of b-GDS and c-GDS are first introduced. We next present in vitro digestibility of representative foods (e.g., Tofu and cooked rices) and food models (e.g., hydrogels) using the b-GDS. The use of b-GDS and c-GDS has provided useful information about complex food digestion behaviors in the stomach, such as the disintegration of food particles driven by physical and chemical processes. Detailed information about the disintegration of solid foods and the release of nutrients from food particles has also been obtained from the GDS studies. Further improvement of our GDS could potentially make it a useful tool for designing novel functional/care foods for which digestibility and release of nutrients and bioactives are well controlled. I. Kobayashi, Food Research Inst., NARO, Tsukuba, Japan H. Kozu, S. Ichikawa, Faculty of Life and Environmental Sciences, Univ. of Tsukuba, Japan Z. Wang, Inst. of Inst. of Vegetable and Floriculture Science, NARO, Tsu, Japan Z. Wang, Graduate School of Life and Environmental Sciences, Univ. of Tsukuba, isaok@affrc.go.jp

AGFD 213 CONTROL ID: 3417227

Volatile sulfur compounds in wine: Recent findings and future challenges Volatile sulfur compounds (VSCs) comprise of a large family of aroma molecules commonly found in fermented foods and beverages. In wine, VSCs are mostly considered as off-flavours, but play a critical role in the products overall quality, which can lead to either consumer acceptance or rejection. Dimethylsulfide (DMS) arguably represents the species that better captures the complexity of sulfur (bio)chemistry in grape and wine. Yeast (Saccharomyces cerevisiae) plays a key role in altering the final concentration of VSCs. Labelled-isotope tracing experiments using C13, N15, S34 - labelled sulfur-containing putative precursors, followed by mass spectrometry analysis, has been recently shown to be very effective to study the pathways leading to the formation of these molecules. Most recently the attention of the research community has been re-focussed on the most volatile and most deeply studied VSC: hydrogen sulfide. The intrinsic volatility and reactivity of this molecule, together with its recently discovered signalling role, highlighted the possibility that this molecule had still “a lot tell”. From this research new polysulfurylated molecules were identified in wine, begging the question as to what impact they might have on wine quality. Our recent finding that Saccharomyces cerevisiae can produce these polysulfanes has shed new light on the impact of fermentation and Tech. on the level of polysulfanes. Ultimately, this talk aims to provide an overview on the recent research on sulfur chemistry applied to grape and wine matrices, and on the impact of fermentation (as yeast plays a key role in the formation of these species), to finish with an insight on the future challenges and questions on these molecules and their fate. B. Fedrizzi, The Univ. of Auckland, Auckland, New Zealand b.fedrizzi@auckland.ac.nz

AGFD 214 CONTROL ID: 3417047

Transglycosylation products unique to sake are formed by a fungal α-glucosidase during multiple parallel fermentation in sake-brewing Unlike either beer or wine, sake, a Japanese rice wine, is brewed using the “multiple parallel fermentation” process, wherein enzymes secreted by the fungus Aspergillus oryzae carry out the process of saccharification and the yeast Saccharomyces cerevisiae ferments alcohol simultaneously. This characteristic fermentation process is important in the formation of components that are unique in sake. For instance, α-ethyl glucoside (α-EG), which is the condensation product of ethanol and glucose, is a unique component that is formed during sake brewing. It is believed that α-EG is formed by the transglycosylation reaction, which is catalyzed by α-glucosidase of A. oryzae. However, the precise enzyme responsible for the transglycosylation reaction during sake brewing has not been identified yet. Therefore, we focused on the major α-glucosidase, AgdA, in A. oryzae to identify the responsible enzyme. We constructed a gene-knockout strain of agdA and brewed sake using this strain. The resultant sake contained less amount of α-EG, which indicated that α-EG is formed by the transglycosylation reaction by AgdA. Furthermore, the amount of two compounds with molecular masses similar to that of ethyl maltose decreased due to agdA gene knockout. For the identification of these compounds, we investigated the enzymatic synthesis of both compounds. AgdA was prepared using the culture broth of an agdA-overexpressing A. oryzae strain, which was also constructed in this study. Two compounds were synthesized in vitro from maltose and ethanol using purified AgdA. We then performed nuclear magnetic resonance analysis and

identified the two compounds as ethyl α-maltoside and ethyl α-isomaltoside, respectively, which are novel compounds in sake as well as in the natural environment. Further quantitative analysis of 111 commercially available types of sake revealed that these novel compounds were widely present at concentrations of several hundred mg/L, which suggested that both were compounds of the common glycosides found in sake. M. Tokuoka, Y. Kojima, C. Honda, I. Kobayashi, S. Matsumura, I. Wagatsuma, M. Takehisa, H. Shindo, M. Hosaka, Dept. of Fermentation Science, Tokyo Univ. of Agriculture, Setagaya-ku, Japan R. Katsuta, T. Nukada, Faculty of Applied Biosciences, Tokyo Univ. of Agriculture, Japan m3tokuok@nodai.ac.jp

AGFD 215 CONTROL ID: 3430601
Nutrients characteristics of the leaf, stem and root of Eclipta prostrata (L) Eclipta prostrata (L) is one of the plant samples used locally in the south western part of Nigeria in preparation of herbs for treatment of some ailments, diseases and hormonal disorder. The sample was purchased, and authenticated with a view to evaluate its nutritional composition by determining the proximate composition, mineral content, and amino acid profile using standard analytical method. The proximate analysis revealed; the moisture content for the root to be the highest followed by the stem, while the leaf has the least value. The ash content and protein values respectively were (7.54±0.00)g/100g, 12.48±0.03g/100g for the root and the highest followed by the stem (7.54±0.23)g/100g; (11.36±0.47)g/100g and the leaf had the least values; (5.55±0.00)g/100g, 4.38±0.61) g/100g respectively. More crude fat and crude fibre were found in the root followed by the stem. The leaf had the highest value of nitrogen free extractive; (70.15±0.71)g/100g while the root had the least (56.51±0.26)g/100g. The dietary mineral revealed highest concentration of Na, K, Ca, Mg, Zn and Fe in the root than other parts. Other minerals that were detected in the three parts of the plants samples in trace amount are: Cu, Mn, P, and Cd. Lead was not detected in the samples but the stem showed trace amount of selenium of concentration, 0.05±0.16mg/100g. The amino acid profile revealed significant proportion of both essential and non-essential amino acid. The amino acid values were higher in the stem than the leaf and the root of the plant samples. The consumption and pharmaceutical use of the whole part of the plant is therefore encouraged. The plants could serve as raw material to produce essential supplements needed by man O.O. Onawumi, A. Sodamade, Dept. of Pure and Applied Chemistry, Ladoke Akintola Univ. of Tech., Ogbomoso, Oyo, Nigeria A. Sodamade, Depatment of Chemistry, Emmanuel Alayande College of Education, Oyo, Oyo, Nigeria O.A. Onawumi, Bioscience, Forestry Research Inst. of Nigeria, Ibadan, Oyo, P.B. Ayoola, Science Laboratory Tech., Ladoke Akintola Univ. of Tech., Ogbomoso, Oyo, Nigeria estherdr@rocketmail.com

AGFD 216 CONTROL ID: 3405143
Suberin look at time travel: Metabolite profiling of wound tissue extracts, polymeric barriers, and depolymerization products of potato tubers During various stages of cultivation and distribution of Solanum tuberosum, commonly known as the potato, the crop is at risk of mechanical damage. However, after wounding the tuber undergoes a healing process and develops a physical barrier consisting of the cell wall-embedded suberin biopolymer, which offers protection from water, heat loss, and pathogenic attack. Several models have been proposed for the suberin macromolecular assembly, but a definitive structure has remained elusive. Most structural hypotheses are based on top-down approaches derived from depolymerization treatments that suffer from incomplete breakdown and low yield. In the current study, we began with a bottom-up approach, monitoring development of the wound-healing metabolites at various time points in order to complement the widely used top-down methods. LC-MS and GC-MS metabolite profiling were conducted for polar and nonpolar extracts from wound tissues in four potato cultivars with differing skin morphologies (Norkotah Russet, Atlantic, Chipeta, and Yukon Gold) at 0, 1, 2, 3 and 7 days post wounding. In parallel, we carried out solid-state C13 NMR (ssNMR) compositional analysis of the suberin-enriched polymeric material. The biopolymer composite was then subjected to depolymerization treatment with subsequent LC-MS and GC-MS analyses. Combining the information obtained from metabolite profiling of the wound tissue extracts, ssNMR, and depolymerization, it was possible to obtain a holistic structural view of the suberization process during wound healing in potatoes K. Dastmalchi, M. Perez Rodriguez, A. Kligman, R.E. Stark, Chemistry, City College of New York B. Yoo, Chemistry, Hunter Collge, New York, drk1dast@yahoo.com

AGFD 217 CONTROL ID: 3411684
Effects of potato processing and frying on oxidized fatty acid concentrations Potatoes and French Fries are a major stipulate in Western diets. Potatoes undergo multiple processing steps (blanching and par-frying) to form frozen French fries, which are subjected to frying in oil. Quite often, the oil is used multiple times before being discarded. The effects of potato processing and frying on lipid oxidation have not been thoroughly investigated. In the present study, we tested the effects of blanching, par-frying and repeated frying cycles on the concentration of primary fatty acid oxidation products known as oxylipins. Blanching, which involves heating potatoes in water for 15 minutes, had distinct effects on potato oxylipin concentrations compared to par or deep frying. Specifically, epoxy and diol metabolites of linoleic acid (LA, 18:2n-6) were decreased by blanching, whereas alpha-linolenic acid (ALA, 18:3n-3) hydroxylated metabolites were increased. Par-frying reduced these compounds whereas deep frying increased most of them in potato significantly. Repeated frying cycles (total of 3) increase the concentration of LA-derived hydroxy, ketone and epoxide compounds and ALA derived hydroxy compounds in soybean oil without altering diols. French fries heated in this oil showed significant decreases or increases in these compounds, as well as a marked increase in diols. It is concluded that distinct oxylipin profiles are observed when potatoes are subjected different processing conditions. Knowing the specific effects of processing on oxylipin profile may help assess risks associated with exposure to LA- and ALA-derived oxylipins through potatoes and potentially, other processed foods. Z. Zhang, M. Hennebelle, S. Emami, A. Taha, Food Sci. and Tech., Univeristy of California Davis, yntzhang@ucdavis.edu

AGFD 218 CONTROL ID: 3432688
Quality and purity evaluations of avocado oil sold in the US The demand for avocado oil has increased significantly as consumers resonate with its potential health benefits, however, due to the lack of enforceable standards, consumers are unprotected from fraud (i.e., economic motivated adulteration). This study analyzed avocado oils currently on the market in the US to evaluate their quality (e.g., free fatty acidity, peroxide value, UV absorbances, vitamin E) and purity (e.g., fatty acids, sterols, triacylglycerols). Our results showed that the majority of commercial samples were oxidized before reaching the expiration date listed on the bottle. In addition, adulteration with soybean oil at levels near 100% was confirmed in two “extra virgin” and one “refined” sample. These findings demonstrate there is an urgent need to develop standards for avocado oil not only to ensure the consumers receive high quality and authentic products but to establish a level playing field to support the continuing growth of global avocado oil industry. H. Green, S. Wang, Food Sci. and Tech., Univ. of California Davis, hsgreen@ucdavis.edu

AGFD 219 CONTROL ID: 3432693
Targeted next-generation sequencing using plant ITS2 for authenticating honey origins Adulteration and mis-labeling of honey to mask its true origin have become a global issue. Pollen microscopy (melissopalynology), the current gold standard for identifying the geographical origins of honey, is time- consuming and requires expert personnel. Additionally, pollen microscopy fails to identify honey samples that have been filtered to remove the original pollen and/or spiked with pollen from a remunerative plant to profit from sale of the honey. Using pollen DNA barcoding and clustering analysis, we are assembling country-specific plant DNA barcode sequences obtained from next-generation sequencing (NGS) of plant genomic DNA isolated from diverse honey samples. We have targeted the nuclear ribosomal ITS2 region of plant genomic DNA, which is known to facilitate species-level discrimination of plants. By using a targeted deep-sequencing approach we also are exploiting the presence of trace plants, which are known to be limited to a geographical region, to authenticate the true origins of commercial honey samples. D. Chavan, R.C. Willson, Dept. of Biology and Biochemistry , Univ. of Houston, Texas, J.R. Adolacion, M. Crum, B.V. Vu, K. Kourentzi, R.C. Willson, Dept. of Chemical and Biomolecular Engineering, Univ. of Houston, Texas, J.R. Adolacion, Dept. of Chemical Engineering, Univ. of the Philippines, Diliman, Quezon City, A. Sabo, Human Genome Sequencing Center, Baylor College of Medicine, Houston, Texas, R.C. Willson, Escuela de Medicina y Ciencias de la Salud ITESM, Monterrey, Mexico dchavan@uh.edu

AGFD 220 WITHDRAWN

AGFD 221 CONTROL ID: 3434333
SlGRAS4 mediates a novel regulatory pathway promoting chilling tolerance in tomato Tomato (Solanum lycopersicum L.) plants are cold-sensitive, and the fruit are susceptible to postharvest chilling injury when stored at low temperature. However, the mechanisms underlying cold stress responses in tomato are poorly understood. We demonstrate that SlGRAS4, encoding a transcription factor induced by low temperature, promotes chilling tolerance in tomato leaves and fruit. The fruit of overexpressing SlGRAS4 showed much lower CI index and better quality than WT and RNAi lines. Combined genome wide ChIP-seq and RNA-seq approaches identified among cold stress-associated genes those being direct targets of SlGRAS4 and protein studies revealed that SlGRAS4 forms a homodimer to self-activate its own promoter. SlGRAS4 can also directly bind tomato SlCBF promoters to activate their transcription without inducing any growth retardation. The study identifies the SlGRAS4 regulon as a new cold response pathway conferring cold stress tolerance in tomato independently of the ICE1-CBF pathway. This provides new track for breeding strategies aiming to improve chilling tolerance of cultivated tomatoes and to preserve sensory qualities of tomato fruit often deteriorated by storage at low temperatures. Z. Li, School of Life Sciences, Chongqing Univ., Shapingba, Chongqing , China zhengguoli@cqu.edu.cn

AGFD 222 CONTROL ID: 3430498
Tomato ethylene response factor SlERF.F12 represses fruit ripening epigenetically by recruiting the co- repressor TPL2 and histone deacetylase HDA1/3 Ethylene Response Factors (ERFs) are downstream transcription regulators in the ethylene signaling pathway that are predicted to play critical roles in ethylene-controlled climacteric fruit ripening processes. Although both activator and repressor ERFs are recognized, to date little is known about the molecular mechanism underlying their action in ripening. Here, we demonstrate that SlERF.F12, an EAR-motif containing ERF.F subfamily member, represses fruit ripening by recruiting co-repressors TPL2 and histone deacetylases HDA1/3 to repress the transcription of ripening-related genes in tomato. SlERF.F12 transcripts decrease during normal ripening and their role in repression was studied by experimentally up- and down-regulating their levels in tomato fruit. Repression of the transcription of ripening related genes was shown to be dependent on the SlERF.F12 C-terminal EAR motif, which is required for interaction with the co-repressor TPL2. Furthermore, SlERF.F12 was found to recruit TPL2 and two ripening-related histone deacetylases SlHDA1 and SlHDA3 to form a complex in vivo that represses transcription of ripening-related genes by reducing the histone H3k27ac levels in their promoter regions. This study provides new insights into the molecular mechanism underlying the repression by ERFs in fruit ripening and also broadens our knowledge of the regulatory network controlling climacteric fruit ripening. M. Liu, College of Life Sciences , Sichuan Univ., Chengdu, China mcliu@scu.edu.cn

AGFD 223 CONTROL ID: 3430472
Food safety technologies in the era of the COVID-19 pandemic The COVID-19 pandemic is challenging the ability of food producers to safely get their products into the hands of people who need it. There are increasing concerns about the transmission of COVID-19 through the food supply, specifically fresh produce, and points of contact within the produce production continuum. Currently, it is very difficult to study COVID-19 directly in a lab because it requires a BSL-3 facility. Therefore, researchers heavily rely upon surrogates, animal models, and predictive microbiology to glean insights into the efficacy of potential interventions. This talk will focus on the chemical and physical properties that constitute a suitable surrogate for predictive viral behavior in the food supply. We will draw on insights gained from successful interventions against established foodborne pathogens, such as human norovirus and hepatitis A. Current innovations in food safety are occurring at a rapid rate allowing for novel technologies to emerge. Novel nonthermal technologies, cold plasma, gaseous ozone, and gaseous chlorine dioxide, will have an impact on the changing landscape of food safety. These technologies hold promise for the decontamination of fresh produce because of the lower demand for water, the reduction of chemical input, and unique surface chemistries. Different foods have varying susceptibility to viral particular because of their intrinsic surface properties. Contact angle and surface wettability play a major role in viral adhesion to foods and food contact surfaces. We will discuss these considerations in the context of emerging nonthermal technologies for the removal of viral particles and the prevention of adhesion. The knowledge from this talk can be applied to a variety of food processes and distribution systems. The impact of novel applications of nonthermal and increased understanding of viral particle behavior will improve the safety of our food systems. A. Lacombe, V.C. Wu, USDA, Albany, California alison.lacombe@usda.gov

AGFD 224 CONTROL ID: 3422103
Evaluation of the antimicrobial effects of vitamin K3 and vitamin B2 Introduction: The photo sensitizing of vitamin K3 (VK3) and vitamin B2 (VB2) under dark, UV-A, and simulated sunlight and their antimicrobial efficacy against common foodborne pathogens attracted increasing attention from food microbiologist and were investigated in this study. Methods: Series concentrations of VK3 from 9.8 to 2500 mg/ml or VB2 from 25 to 200 mg/ml were tested against Listeria monocytogenes (LM), Escherichia coli O157:H7 (O157), and Salmonella Enteritidis PT30 (SE) in 96-well plates. One set of plates was incubated in dark at 37 °C for 24 h. The other sets of plates were exposed to UV-A (320- 400 nm) or simulated sunlight (300-400 nm) for 15 or 30 min followed by 24 hours of incubation in the dark at 37 °C. The production of reactive oxygen species (ROS) and singlet oxygen of VK3 post-light exposure was evaluated by using p-nitrosodimyethlaniline (p-NDA) and p-NDA with L-

histidine. Scanning electron microscopy (SEM) was used to examine the impact of treatments on the morphology and integrity of pathogens cells. Results: The minimal bactericidal concentration (MBC) of VK3 against LM, O157, and SE in darkness was 625.0, 156.3, and 625.0 mg/ml, respectively. Unfortunately, no antimicrobial efficacy of VB2 were observed under dark. When treatments were carried out under light, the MBC values of VK3 (VK3 + light) were reduced in strain, light source, and exposure time dependent manners. The synergistic effect can be attributed to the production of hydroxyl radical and singlet oxygen of VK3 under light exposure. Based on SEM examination, VK3 + light treatments damaged the cell wall integrity of LM and SE and altered the morphology of O157, including filament formation and fewer fimbriae/flagella. Conclusion: The results of this study demonstrated the promising synergistic antimicrobial effects of VK3 + light treatments and can be used as a surface antimicrobial treatment. : L. Sheng, L. Wang, Food Sci. and Tech., Univ. of California Davis Z. Zhang, G. Sun, Textiles and Clothing, Univ. of California, Davis lssheng@ucdavis.edu

AGFD 225 CONTROL ID: 3428673
Chlorine rechargeable halamine biocidal alginate hydrogel beads for highly efficient sanitization of fresh produce There is a critical need for novel and efficient means of sanitizing fresh produce. Current fresh produce washing systems mainly rely on mechanical forces and low concentration of active chlorine in water to aid removal and inactivation of microorganisms and dirts attached on surfaces of fresh produce. Folded and pocket areas of fresh produce such as romaine lettuce reduce the sanitizing efficiency and could be a reason of frequent outbreaks of bacteria contaminations. Technologies that can improve cleaning efficiency of sanitizing process were desired and proposed by scientists, and among them use of antibacterial particles in washing processes is one option. Here, we present a scalable methodology for preparation of chlorine rechargeable halamine biocidal hydrogel beads using polyacrylamide and natural polysaccharide alginate blends through an emulsion polymerization. The resulting hydrogel beads exhibited robust mechanical strength, rechargeable chlorination capability, and 99.99% contact-killing bactericidal efficiency, which enable the hydrogel beads effectively sanitize fresh produce in washing process. Thus, the biocidal beads represent a promising material for improving sanitizing efficiency and safety of fresh produce. G. Sun, Biological and Agricultural Engineering, Univ. of California, Davis, gysun@ucdavis.edu

AGFD 226 CONTROL ID: 3430841
Stabilization and controlled release of ethyl formate for in-packaging fumigation of fresh produce The existing fumigants for quarantine purposes are toxic and/or undesirable to the environment such as methyl bromide which is being phased out by governmental agencies. Ethyl formate (EF) is a naturally-occurring volatile compound with GRAS status. It is a potent insecticide and antimicrobial agent, promising as an alternative to synthetic counterparts. Our research is focusing on developing a controlled release Tech. for EF to address its high vapor pressure and chemical stability issues. To this end, an EF precursor of was developed via reacting adipic acid dihydrazide with triethyl orthoformate, to produce, diethyl N,N'-adipoyldiformohydrazonate as confirmed by FTIR and NMR spectroscopies. The EF precursor is non-volatile and remained stable under dry condition but could be hydrolyzed readily during the application to trigger the release of EF vapor. The EF release was evaluated by citric acid-catalyzed hydrolysis using a gas chromatograph. Approximately 98% of EF was released from the precursor after 2 h at 25C, where 0.41±0.08 mg of EF was released per mg of the precursor. The mortality of adult spotted-wing drosophila on blueberries was evaluated when they were exposed to the EF vapor released from the precursor. Different degrees of mortality were observed for the insect depending on the EF concentrations. After 2 h, 70% mortality was achieved for 1 mg EF vapor, while 100% mortality was achieved for 3 mg EF vapor released from the precursor. Furthermore, EF precursor was encapsulated in ethylcellulose/poly(ethylene oxide) electrospun nonwovens. Precursor-loaded nonwovens were able to inactivate the microbial growth and extend the shelf-life of strawberries for up to 10 days when treated with 2 mg EF vapor as compared to 6 days for untreated samples. The solid-state fumigation Tech. holds strong promise in active packaging applications to control insect pests and inhibit the growth of microorganisms in fresh produce. A. Jabeen, C.D. Scott-Dupree, School of Environmental Sciences, Univ. of Guelph, Ontario, Canada A. Zaitoon, L. Lim, Dept of Food Sci., Univ. of Guelph, Ontario, Canada azaitoon@uoguelph.ca

AGFD 227 CONTROL ID: 3431598
Application of gaseous ozone as in-package and fumigation treatments to enhance microbial safety and maintain quality of tomato fruit It is difficult to inactivate human pathogens on fresh fruits and vegetables due to protected features on the surface of fresh produce such as crevices, stomata, scars, etc. Ozone is a strong oxidizer that leaves no residuals on foods. However, the effectiveness of ozone, when used as an aqueous sanitizer, is often limited against foodborne pathogens on fresh produce, partially due to its reactivity toward organic material in water. In recent years, we have applied ozone as a gaseous treatment to reduce populations of bacteria on tomatoes. Gaseous ozone may have advantages over aqueous ozone as it tends to diffuse into protective sites where pathogens often resides while avoiding the chance of reaction with organic materials in water. Ozone was produced either via dielectric barrier discharge cold plasma as an in-package treatment or corona discharge as a fumigation treatment. The in-package system generated over 1,000 ppm ozone inside sealed packages and reduced populations of Listeria innocua by 4 log CFU/fruit, and of Escherichia coli O157:H7 and Salmonella by 2-3 logs CFU/fruit on the stem scar area of tomato after less than 3 min of treatments. Fumigation with dry ozone (<10% relative humidity, 3,200 ppm) for 2 and 4hr reduced Salmonella populations by approximately 2 log CFU/fruit on stem scar area of tomatoes. However, the dry ozone negatively impacted sensory quality, firmness and nutrition quality of the fruit. When the relative humidity was increased to ~90% during ozone treatment, not only the efficacy increased significantly, but also the damage to fruit quality was minimized. The results suggested that gaseous ozone, with proper conditions, can be used to mitigate the risk of pathogen contamination with little influence on fruit quality X. Fan, Eastern Regional Research Service, ARS, USDA, Wyndmoor, Pennsylvania xuetong.fan@ars.usda.gov

AGFD 228 CONTROL ID: 3431684
Reducing foodborne bacterial biofilms on biotic and abiotic surfaces with an engineered enzyme Biofilm formation is a major cause of post-harvest microbial persistence on fresh produce, processing, and packaging surfaces, as the biofilm matrix has been shown to provide pathogens and other bacteria with protection from common disinfection approaches. The potential of an enzyme-based food processing aide has been investigated as a green, targeted supplement to common disinfection practices for preventing bacterial adhesion and removing mature biofilms. Crystal violet staining of biofilms formed in multi-well polystyrene plates has been used to demonstrate the efficacy of enzymatic biofilm prevention and removal on E. coli O157:H7, E. coli 25922, Salmonella Typhimurium, and Listeria monocytogenes. In the presence of 0.1 mg/mL enzyme, biofilm development was significantly inhibited for all bacteria, with a maximum of 41 ± 7% reduction for E. coli O157:H7. Effectiveness of mature biofilm removal varied by bacteria

species type, with a maximum of 35 ± 12% reduction for E. coli O157:H7. A microfluidic flow cell was used to directly observe and quantify the impact of enzyme rinses on E. coli O157:H7 cells adhered to spinach leaf surfaces. In the flow cell, enzyme rinses resulted in significantly greater cell removal than water, representing a reversal of initial phases of biofilm formation. Initial biochemical characterization of the enzyme indicates a key role in surface- and extracellular polysaccharide degradation, suggesting multiple potential mechanisms of biofilm disruption. Transmission electron microscopy (TEM) of treated and untreated cells reveal major modification to surface polysaccharide structures, consistent with the predicted role as a polysaccharide-degrading enzyme. Additionally, changes in cell surface hydrophobicity were measured using the microbial adhesion to hydrocarbons (MATH) test and provide further evidence of changes to the cell surface. These results present a strong case for further development and optimization of enzyme activity to be applied as a novel food processing and packaging aid to minimize food safety risks associated with bacterial pathogens. B. Berger, Chemical Engineering, Univ. of Virginia, Charlottesville, S. Walker, Drexel Univ., Philadelphia, Pennsylvania, H. Mayton, Chemical Engineering, Univ. of Virginia, Charlottesville, hollymayton@gmail.com

AGFD 229 CONTROL ID: 3433259

Use of lytic bacteriophages as an antimicrobial intervention to improve produce safety In recent years, there are more and more foodborne outbreaks associated with the consumption of the produce products contaminated with enteric pathogens, such as Shiga toxin-producing Escherichia coli and Salmonella, in the United States. Produce is usually consumed raw, and it can be easily contaminated at any point from farm to table where pathogens are present. Due to the open setting of the farming system, crops are susceptible to the contamination introduced from the external sources, and the presence of physical contaminants, such as dirt, may also adversely affect the effectiveness of the intervention used at either preharvest or postharvest environments. Additionally, to enhance the antimicrobial activity, the overuse of antibiotics could highly result in the development of antibiotic resistance on those pathogens. Bacteriophages (or phages) are highly diverse and abundant entities in the biosphere, being approximately ten times more prevalent than bacteria. Due to the nature of lytic phages, they are considered as an alternative to antibiotics to control bacterial pathogens. Additionally, the biological features of the lytic phages are different based on various sources of isolation; thus, these naturally occurring antimicrobial agents could be applied to diverse conditions alone or in a hurdle setting. Phage intervention has the potential for microbial decontamination of fresh produce because lytic phages exhibit specificity and co-evolution with their bacterial hosts, and they are eco-friendly. Most importantly, phage-based intervention could significantly decrease the frequency of antibiotic-resistance development. This talk will discuss the current status and role of lytic phages as an antimicrobial intervention to improve produce safety and focus on the application of phage-based Tech. to mitigate the potential contamination in the produce preharvest environment. Y. Liao, V.C. Wu, USDA, Albany, California, yen-te.liao@usda.gov

AGFD 230 CONTROL ID: 3432025

Influence of leafy green surface chemical composition on E. coli O157:H7 attachment and growth Some leafy greens are more susceptible to foodborne pathogens than others, and it is suspected that the chemical composition of their surfaces affects the bacterial attachment and growth. In this study, the effects of leaf surface chemicals on bacterial attachment and growth are analyzed for Carmel spinach, romaine lettuce, and collard leaves using artificial models made of polydimethylsiloxane (PDMS) that mimic leafy greens' surface topology and surface chemical composition. The surface chemical profiles of the leafy green samples were obtained using gas chromatography. The chemicals were classified into groups according to their impact on microbial attachment and growth, e.g. surface hydrophobicity, pH, aw nutrients, and natural antimicrobial agents. A growth model will be generated to describe the bacterial growth on leafy greens affected by surface chemical compounds. Results of this study will provide insights into the roles played by natural surface chemicals in leafy greens microbial safety. This growth model will be able to predict the shelf life of fresh produce with known surface chemical properties. M. Dong, H. Feng, Univ. of Illinois, Urbana mengyid2@illinois.edu

AGFD 231 CONTROL ID: 3431968

Evaluation risks to consumers from exposure to pesticide residues on fresh food commodities for the California pesticide residue monitoring program To limit public exposure to illegal pesticide residues in food, the California Dept. of Pesticide Regulation (DPR) operates the California Pesticide Residue Monitoring Program (CPRMP) to monitor pesticides in raw agricultural commodities and assesses the health risks. Commodities are sampled at any point in the channels of trade. CPRMP enforces pesticide tolerances established by the US EPA, which are the highest residue levels of a pesticide legally permitted on a specific commodity. Two types of violations are monitored, investigated, and enforced: 1) "over tolerance" (OT), which occur when residue levels are greater than the tolerance limit; and 2) "no tolerance established" (NTE), which occur when a tolerance has not been set for a pesticide on a specific commodity. Risk evaluations are conducted by first estimating pesticide exposure through diet and comparing with acute oral reference doses (aRfDs), or the maximum acceptable oral doses established by DPR, US EPA, or other regulatory organizations. Exposures greater than the aRfD indicate potential acute health risks to consumers, and trigger more stringent enforcement actions than those undertaken when a health risk is not indicated. In this work, we present the diversity of cases encountered in CPRMP. Finally, we provide an overview of the 2018 CPRMP data. In 2018, 3,666 samples were collected from 600 different businesses; 192 (5.2%) of those samples contained illegal residues. A total of 29 samples (0.8%) posed potential risks, all of which contained illegal organophosphates or carbamate residues. P. Dodmane, M. Leung, L. Scanlan, Q. Dong, A. Kalashnikova, M.C. Geier, K. Truong, B.M. Brown, C. Lewis, A. Rubin, P. Lohstroh, S. Koshlukova, M. Armstrong, S. DuTeaux, K.C. Morrison, California Dept. of Pesticide Regulation, Sacramento, California, puttappa.dodmane@cdpr.ca.gov

AGFD 232 CONTROL ID: 3439011

Extension responses to food safety concerns for the food industry and consumers related to the COVID-19 pandemic A major concern that has emerged with SARS CoV-2 is the persistence of this virus on diverse surfaces and the ability to cross-contaminate and subsequently infect individuals as a result of persistence on these surfaces. This is of significant concern in a food processing environment where contact between food contact surfaces and workers can lead to an outbreak of disease. We have seen rapid spread of COVID-19 already in meat processing plants in the US. Similar to meat processing plants, risks exists in other key areas of food processing including packing houses for fresh produce as well as in the retail environment. In order to protect worker safety during the pandemic it is imperative to educate the industry on effective chemistries to utilize on non-food contact and food-contact surfaces to control SARS-CoV-2. Most EPA N list chemicals listed as effective against SARS-CoV-2 have been tested for efficacy against the more stable food- and waterborne viruses including norovirus, hepatitis A virus, and rotavirus. Previously we have shown the mechanisms of inactivation of norovirus by chlorine, surfactants, and

organic acids. This research and information gleaned from regulatory guidance documents has enabled us to provide in depth and targeted information to the produce industry on how to enhance sanitation during the COVID-19 pandemic. Extension education efforts have shifted from traditional food safety training for growers to more tuned information related to COVID-19 transmission and control. Consumers also have questions on the safety of produce related to SARS-CoV- 2. We conducted a nationwide survey and found that consumers purchasing of produce decreased by 30% due to the COVID-19 pandemic. Recent reports indicate a 30% increase in calls to poison control centers since the March 2020 and a case study showed that misuse of chemicals to wash produce resulted in an emergency room visit. Education with this stakeholder group on the appropriate use of chemicals in the home has been a key emphasis of ongoing extension education efforts during the pandemic. E. DiCaprio, UC Davis, California, eldicaprio@ucdavis.edu

AGFD 233 CONTROL ID: 3433068
Leveraging metabolomics to investigate the chemical space of the human gut microbiome It has become increasingly evident that microbial communities are responsible for a wide range of processes critical to human health and wellbeing. Diet is a key driver of microbial structure and function in the gut, outweighing even the host genotype. Thus, targeted dietary interventions are a promising avenue for modulation of the gut microbiome, rendering beneficial effects on host health and fitness. Microbes interact with each other and the host physiology via metabolites and other small molecules. Through use of advanced metabolomic analysis platforms, the complex interplay between the microbiota, host and diet can be characterized. This talk will describe the application of mass-spectrometry based metabolomics tools across multiple studies to understand the effects of dietary constituents, such as micronutrients, macronutrients and food additives, on microbiome function and host physiology. Through the combined use of advanced multi-dimensional analytical platforms and in silico computational library building approaches, we are investigating the immense chemical space of the human gut microbiome. S. Couvillion, K. Bloodsworth, S. Colby, R. Renslow, B. Thrall, T. Metz, Biological Sciences Division, Pacific Northwest National Laboratory, Richland, Washington, P. Demokritou, Center for NanoTech. and Nanotoxicology Dept. of Environmental Health, T.H. Chan School of Public Health Harvard Univ., Boston, Massachusetts, L.A. Doherty, J.W. Soares, US Army NSRDEC, Natick, Massachusetts sneha.couvillion@pnnl.gov

AGFD 234 CONTROL ID: 3433625
Window into the microbiome: Saliva and its association with depression, diet, and human genetics There is emerging evidence that the microbiome plays essential roles in human health. We sought to determine whether the saliva microbiome may provide a new window into human health, through its association with compliance to the Mediterranean diet, genetic risk for depression or suicide, and depression phenotypes. 205 UF students provided a saliva sample and on REDCap completed two surveys: PHQ-9 and KIDMED. DNA was extracted from the saliva using Isohelix Extraction and purified using Qiagen or Zymo. The V4 variable region of 16S rRNA gene was amplified, samples were pooled with barcodes, including 40ng of DNA per sample, and subjected to 2x300v3 Illumina MiSeq. Human DNA was subjected to the Axiom Precision Medicine Research Array. Data was processed using Qiime, DADA2, PIME, PERMANOVA, and Kruskal Wallis. Significant differences in overall saliva microbiome were found for several behaviors, including diet and sleep. Differences were identified in suicidality over the same period. Bacteria characteristic of differences in diet compliance or depression levels were further classified using PIME (Fig. 1 for diet). Differences in relative abundance were also identified. For instance, when controlling for a low compliance diet, Prevotellaceae were higher in those who endorsed feelings of depression ($p=0.05$) as well as in those who endorsed feelings of anhedonia ($p=0.1$). Moreover, differences in the saliva microbiome were found at the phylum, family and genus level on the basis of genetic variance at rs7296262, which has been associated with risk of suicide attempts. Together these data provide evidence for the saliva microbiome as a marker for mental health, mediated by specific wellness behaviors as well as human genetics. A.P. Ahrens, E.W. Triplett, Microbiology and Cell Science, Univ. of Florida, Gainesville, a.ahrens@ufl.edu

AGFD 235 CONTROL ID: 3430544
Cucurbitacin B transformed from cucurbitacin B 2-O-β-D- glucoside via gut microbiota for the suppression on hepatic lipid accumulation Cucurbitacin B (CuB) and its glycoside (cucuribitacin B 2-O-β-D-glucoside, CuBg) are the crucial triterpenoid phytochemicals found in Cucurbitaceae familly vegetables that exhibit diverse health effects, such as cucumber, luffa, pumkin and melon. Previous evidences demonstrated CuB possessed abundant biological functions including anti-inflammation, anti-infection and anti-cancer. And CuBg could be converted into CuB by bacterial fermentation in biotransformation process. However, whether CuB and CuBg have other beneficial roles, such as the suppression on lipid over-accumulation, as well as the transformation of CuBg into CuB via gut microbiota were still unknown. In this work, we used HepG2 cells treated by oleic acid and palmitic acid to justify the suppression of CuB and CuBg on lipid deposition, respectively. Then we used in vitro gastrointestinal digestion system with heathy human fecal slurry to evaluate the conversion between CuB and CuBg. Oil O Red straining and lipid determination showed both CuB and CuBg could alleviate hepatic toxicity and inhibit lipid deposition. Then qRT-PCR assays demonstrated CuB treatment significantly down-regulated the transcriptional expression of critical lipogenesis biomarker (peroxisome proliferator-activated receptor γ, PPARγ) relative to CuBg treatment. Furthermore, we found the digestion ratio of CuB and CuBg increased with the time extension in vitro fermentation. Compared with only CuB fermentation, CuB needed more digestion time when CuB was co-fermented with CuBg. Taken together, we supposed CuBg could be transformed into CuB via gut microbiota for the suppression on hepatic lipid accumulation. L. Zhang, Z. Fang, F. Chen, College of Food Sci. and Nutritional Engineering, China Agricultural Univ., Beijing L. Zhang, K. Ma, Beijing Zhendong Guangming Pharmaceutical Research Inst. Co., Ltd., Beijing, China luzhangcau@hotmail.com

AGFD 236 CONTROL ID: 3431113
Oxidized vegetable oil exaggerates colitis and colitis-associated colon tumorigenesis 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 highly 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 corn or soybean oil, even with low concentrations of lipid oxidation products (within the recommended industrial limit of oxidative status of fresh vegetable oil), exaggerates dextran sodium sulfate (DSS)- and IL-10 knockout-induced colitis, and exacerbates azoxymethane (AOM)/DSS-induced 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. G. Zhang, Dept. of Food Sci., Univ. of Massachusetts Amherst, gdzhang.umass@gmail.com

AGFD 237 WITHDRAWN

AGFD 238 CONTROL ID: 3431172
Phytochemicals in Arcrium lappa reduce stress-hormone induced oxidative stress by inhibiting monoamine oxidases in mice Chronic stress can lead to depression following elevated stress hormones such as glucocorticoid, which is accompanied by increase of the level of reactive oxygen species (ROS) in brain. Increased ROS in brain can cause loss of the dendritic atrophy and spine loss in neurons followed by memory loss. Dicaffeoylquic acids (DCQA) are naturally occurring polyphenolic compounds in Arcrium lappa (AL) which have an anti-oxidative effect. The aim of this study is to investigate whether phytochemicals from AL extract have effects on stress hormone-induced depressive mice as an antioxidant. Stress hormone-induced depressive behavior in mice was confirmed by tail suspension and forced swim test (TST and FST). This treatment lead to memory loss in the mice confirmed by passive avoidance test (PAT), but oral administration of AL recovered memory loss by dose dependent manners in the mice as well as depressive behaviors. Electrophysiological measurement of glutamatergic response in the hippocampal slices of the mice and cultured neurons was revealed that reduced excitatory response by stress hormone was protected by co-treatment of AL and chlorogenic acid (CGA). HPLC analysis showed AL contained several DCQAs as major component. Among them, 3,4- DCQA and 3,5-DCQA have an inhibitory effect of ROS production via inhibit the activity of monoamine oxidases (MAOs) and protective effects on stress hormone-induced morphological changes in cultured neurons. These results suggested that DCQAs from AL inhibit ROS production and prevent memory deficiency in stress hormone-induced depressive mice, which could be considered as a potential natural antidepressant. J. Lee, Korea Food Research Inst., Jeonju, Korea(The Republic of) jklee@kfri.re.kr

AGFD 239 CONTROL ID: 3431548
Gary List: Inspirational leader in agricultural and food chemistry and our community Dr. Gary List is a distinguished scientist and inventor known for discoveries that led to more healthy and nutritious edible fats and oils for American consumers, and increased usage of soybean products. The impact of Dr. List's endeavors goes beyond his research, and he has been an active advocate for the careers of many scientists at the National Center for Agricultural Utilization Research, researchers in the ACS Illinois Heartland section, and members of several professional societies. Dr. List has mentored several colleagues over his career, helping advance the fields of bioproduct utilization, food safety, and sustainability. M. Appell, USDA-ARS, Dunlap, Illinois, michael.appell@gmail.com

AGFD 240 CONTROL ID: 3433488
Use of vegetable oils in industrial lubricants Vegetable oils are promising candidates as base fluid for eco-friendly lubricants because of their excellent lubricity, biodegradability and low evaporation loss. Their use, however, is restricted due to low thermo-oxidative stability and poor cold flow behavior. This paper presents a systematic approach to improve the oxidation and cold flow behavior of vegetable oil derivatives (chemical modification and additive Tech.). Vegetable oil based lubricants formulated using the above approach exhibit superior oxidative stability, improved low temperature properties such as pour points and better wear properties compared to some of the commercially available industrial oils. The above Tech. has been patented (U.S. Patent 6,583,302) and currently is being used in the hydraulic fluid industry along with other industrial applications. S. Erhan, Easter Regional Research Center, Wyndmoor, Pennsylvania, B. Sharma, Illinois Sustainable Tech. Center, Univ. of Illinois, Urbana-Champaign, sevim.erhan@usda.gov

AGFD 241 CONTROL ID: 3430347
Transference of lipid processing technologies to the cannabis-hemp platform My collaboration with Awardee Gary List took primarily between the years of 1985-2002 at the National Center for Agricultural Center Research in Peoria, IL. resulting in 20 publications, 2 books, and 4 review articles. This proved invaluable to the speaker at that time and in the future, partially in connection with his professionally activities in extraction and processing technologies utilizing critical fluids, physicochemical characterization of lipid materials, and analytical method development. This presentation will report on how this research is being currently applied in the fields of cannabis or hemp processing – both for seed oil and flower biomass containing predominately cannabinoid and terpene constituents. A comparison will be made between the unit operations utilized in vegetable extraction and post-extraction refining, and those employed in the extraction and purification of cannabis-hemp- derived extracts. These will include on how winterization, vacuum distillation, and adsorbent application is applied in both fields; in the former case to purify extracted vegetable oils extracted using both liquid solvents or sub- and super-critical fluids; in the latter case to produce full-spectrum "oil" concentrates, distillates, and isolates containing highly- purified cannabinoids. Hansen Solubility Parameter (HSP) theory was applied in all of the above cases to rationalize and optimize these unit processes, including the selection of solvents, fractionation conditions, and miscibility criteria - useful in the formulation of final products. In the case of analytical methodologies, there is a mutual overlap in the applicable techniques (HPLC, GC, GC-MS, LC-(MS)3, etc.); but an increased application of these analysis techniques will probably be required in the area of cannabis-hemp extractives. Data mining of the lipid property literature has also proven valuable in modeling the above unit processes. This presentation will conclude with a few examples on how extractives from both industries are combined to produce marketable products for the food and cannabis industries. J.W. King, CFS, Fayetteville, Arkansas kingjw100@hotmail.com

AGFD 242 CONTROL ID: 3430407
Chemistry of lipids in cheese Milk fat has the most complex structure and composition of all lipids found in food. The composition of the lipids in milk is well known, and the triacylglyceride and fatty acid profiles are not altered when the milk is processed into cheese. Except for fluid milk, cheese is commercially the most important dairy product in the US. For years, dieticians have encouraged consumers to use low-fat dairy products, including lite cheese, to reduce saturated fat intake. However, mammary glands produce saturated and unsaturated fat, and natural selection would presumably cause the latter to be predominant if the former were harmful. Moreover, milk fat carries bioactive compounds such as conjugated linoleic acid, phospholipids, and vitamins, and is structured differently than other lipids. This presentation will describe the chemistry of cheese lipids and relate it to aspects of health. M.H. Tunick, Dept. of Food & Hospitality Management, Coll. of Nursing & Health Professions, Drexel Univ., Philadelphia, Pennsylvania mht39@drexel.edu

AGFD 243 CONTROL ID: 3436665
Chemistry behind edible oil processing safety: 3-MCPD fatty acid esters Fatty acid esters of 3-monochloropropane 1,2-diol (3-MCPD esters) are a new group of chemical toxicants which may be formed during edible oil processing. 3-MCPD esters have been detected in

many food categories, including bread and infant formula. 3-MCPD esters have also been detected in human breast milk, suggesting that they have become a food safety concern. This presentation discusses the chemical mechanisms for their formation and their toxicities. L. Yu, Dept. of Nutrition and Food Sci., Univ. of Maryland, College Park, lyu5@umd.edu

AGFD 244 CONTROL ID: 3435144
Health, nutrition, dietary fats: Never ending challenges to the food industry Coronary heart disease (CHD) is the leading cause of death both in the US and worldwide. Nearly 650000 cases occur annually and 325000 are fatal. Unfortunately dietary fats including saturated,trans fatty acids,and cholesterol have linked to CHD ,some cancers and a host of other diseases and affictions. Although relationships between dietary fats and CHD are controversial the fact remains that the food industry faces a never ending series of challenges to, provide healthy,nutritious,and functional foods. The medical profession,popular press articles,trade groups,consumer advocates,and last but not least government regulations have all challenged the food industry over a considerable period. This presentation will focus the effects of major government interventions in the food industry including dietary guidelines for Americans (1980-present) and the Nutrition Education Labeling Act (NELA) .of 1990. Early dietary guidelines for fats and oils stressed avoiding saturated fats and cholesterol as well as consuming a low fat diet.In response fat was cut and replaced with sugar and refined carbohydrates. Saturated fats were replaced with hydrogenated oils and Trans fatty acids.Thus the first major challenge was met albeat with the unintended consequencene of rising obesity. NELA began by requiring total fat,calories,saturated fat, cholesterol and,mono and polyunsaturated acid listed on nutrition panels However by 1999 trans fats were added to the list and became law in 2006.Obviously reformulation to meet the less than 0.5 Trans fatty acids /serving for compliance posed numerous technical challenges at a considerable cost. Questions to be answered include have these regulations improved health? and if so were the costs justified.? This presentation will attempt to shed light on these complex issues. G.R. List, List Consulting, Secor, Illinois grlist@telstar-online.net

AGFD 245 CONTROL ID: 3432796
Sensing challenges in monitoring hygienic hazards in critical production areas Industrial food production demands critical consideration and care in relation to biological, physical and chemical hazards, which must be monitored and managed along the whole food supply chain in order to ensure food quality and safety and consumer health. Sensor systems offer a means to monitor biological and chemical hazards of a diverse nature, including microorganisms, natural biological toxins, chemical or processing contaminants, as well as traces of cleaning and sterilising agents. Inline tracking and alert of the incidences of related hazard markers allow for the implementation and execution of suitable (automated) control mechanisms. Supporting the prevention of ingress, growth and accumulation of these hazards is especially critical during food production when residual microorganism multiply rapidly, requiring more frequent and/or intense sanitation events. This multitude of challenges requires a high diversity of system approaches, especially for inline measurements, which additionally need to be fast and inexpensive. Broadband detectors, such as photoionization detector or semiconductor sensor systems require additional measures for selective detection. Pre-separation by selective filters, sampling, or even chromatographic methods are possible approaches. For semiconductor sensors, dynamic operation modes and sensor arrays combined with multi-signal processing can be used for the selective detection of certain organic and inorganic gases. For ultimate selectivity, sensors based on odor binding proteins can complement the detector toolbox. To enable an efficient generation of new system approaches, the effort of system development needs to be reduced by effective models of the individual system components in order to allow the simulation of new systems by strongly reducing the development costs and thereby enabling widespread implementation for monitoring purposes along the production line. T. Sauerwald, J. Beauchamp, E. Ortner, Fraunhofer IVV, Freising, Germany A. Buettner, Fraunhofer IVV, Freising, Germany M. Mauermann, Fraunhofer IVV, Dresden, Germany andrea.buettner@ivv.fraunhofer.de

AGFD 246 CONTROL ID: 3429916
Sensory properties, volatiles, and non-volatiles using quantitative descriptive analysis and flavor instrumental analysis of ten strawberries grown in Texas Strawberry (Fragaria × ananassa Duch. ex Rozier) is one of the most widely consumed fruits in the U.S. Most of the strawberries grown in the U.S. are cultivated in Florida and California. Little information could be found on fruit quality of strawberries grown in Texas, which is currently around 250 acres annually. In order to increase the annual acreage in Texas, it is essential to understand the flavor quality of strawberries grown in this region. The objective of this study was to evaluate the quantifiable flavor differences among 10 strawberries grown in Texas using descriptive sensory analysis (QDA) and flavor instrumental analysis. QDA was conducted by 10 well-trained panelists who rated the taste and smell of each strawberry cultivar on a 10-point line scale. Volatiles in the 10 strawberries were isolated using solid-phase microextraction (SPME) and identified using gas chromatography-mass spectrometry (GC- MS). The sugar:acid ratios were determined according to the titratable acidity and °Brix, while color was assessed using UV-Spectroscopy. The QDA results indicated that seven strawberries (Monterrey, Ruby June, Albion, Camarosa, Camino Real, Chandler and Sweet Charlie) have a high association with positive sensory attributes such as strawberry flavor, sweetness, jammy, fruity, buttery, fresh, and creamy notes, while San Andreas, Fronteras, and Festival were negatively associated with bitterness, astringency, sourness, and the lack of sweetness. Camarosa and Albion had the highest concentration of anthocyanin (red color), 52.7mg/L and 41.8mg/L respectively. The highest sugar:acid ratio was exhibited by Monterrey (16.9), while Albion (13.5) and Camarosa (12.2) showed more balanced ratios. Chandler followed by Camarosa and Monterrey had the greatest overall concentration of volatiles. Sweet Charlie, Albion, and Monterrey had the key combination of a complex and higher concentration of the major volatiles such as aldehydes, esters, lactones, and furanones. The results suggest that Camarosa, Albion, Monterrey, Chandler, and Sweet Charlie are varieties with preferred taste, which can be beneficial to growers of locally grown strawberries in Texas. X. Du, G. Scott, C. Williams, Nutrition and Food Sci., Texas Woman's Univ., Denton, R. Wallace, Horticultural Sciences, Texas A&M AgriLife Research & Extension Center, Lubbock xdu@twu.edu

AGFD 247 CONTROL ID: 3429874
Odorants from the American matsutake mushroom (Tricholoma magnivelare) The American Matsutake (Tricholoma magnivelare) is an edible mushroom native to the temperate forests of the United States. The mushroom has a convex cap with cream colored flesh and an aroma described as earthy and floral with spicy cinnamon undertones. The wild mushroom is commercially harvested and exported to Asia as a popular culinary substitute for the pine mushroom (Tricholoma matsutake). While the aroma of T. matsutake has been well explored, the aroma chemistry of T. magnivelare has not been comprehensively evaluated. In the present work, T. magnivelare was subjected to solvent-assisted flavor evaporation (SAFE) distillation and an aroma extract dilution analysis (AEDA). In total, thirty-six odorants were identified with 10 having flavor dilution (FD) factors ≥ 64. The odorants with the highest FD of 1024

were 1-octen-3-one and ethyl (E)-3-phenylprop-2-enoate, both described as having mushroom and cinnamon characters. The next highest FD odorants (FD 256) included linalool, (2E,4E)-2,4- nona-2,4-dienal, and ethyl-3-phenylpropanoate. These odorants had floral-citrus, fatty, and cinnamon attributes, respectively. Additional identified odorants included hexanal (FD 64), (E)-oct-2-enal (FD 64), 3- (methylsulfanyl)propanal (FD 64), methyl-3-phenylpropanoate (FD 64), methyl (E)-3-phenylprop-2-enoate (FD 64), 1- octen-3-ol (FD 16), and 4-methoxybenzaldehyde (FD 1). This report expands on what is generally known about the aroma chemistry of the American Matsutake. These results encourage further quantitative and omission studies to determine the odorants responsible for the unique aroma of the mushroom. This presentation will discuss the aroma chemistry underlying the odor of T. magnivelare. A. Murray, A. Moore, J.P. Munafo, Food Sci., Univ. of Tennessee, Knoxville, afmurray@utk.edu

AGFD 248 CONTROL ID: 3432869

Emerging role of taste receptors as metabolic sensors Taste receptors were originally named for their expression in taste cells of the tongue and their role in the sensation of taste. These receptors belong to the class of G-protein-coupled receptors (GPCRs) and have recently been identified in many extra-oral tissues, e.g., lungs, gastro-intestinal tract (GIT), testes, adipose tissue and brain. These extra-oral taste receptors do not mediate a taste sensation, as they are not linked to neuronal perceptive pathways. However, for ectopic bitter and sweet taste sensing receptors, more general chemosensory roles have been shown. Bitter taste sensing receptors recognizing bitter tasting compounds, e.g., caffeine or bitter acids from beer, are expressed in the GIT and play a role in food intake and satiety. Sweet taste sensing receptors also recognize sugars and d-amino acids, and are expressed in the intestines, where they modulate incretin hormone responses which regulate blood glucose homeostasis. Receptors of the transient receptor potential (TRP) channels superfamily do not belong to the class of GPCRs, although they are also expressed in many tissues. TRP channels are a superfamily of about 28 non-selective cation channels divided into 7 subfamilies including TRP vanilloid (TRPV), and TRP ankyrin (TRPA). TRPV1 channels are activated by pungent food constituents and are involved in thermoregulation, lipid metabolism and energy intake. This review will provide evidence from clinical trials and mechanistic cell culture studies to critically discuss the role of bitter and sweet taste sensing receptors, and TRPV channels as metabolic sensors with impact on food intake and body weight maintenance. V. Somoza, Nutritional and Physiological Chemistry, Univ. of Vienna, Austria V. Somoza, Leibniz Inst. for Food Systems Biology at the Technical Univ. of Munich, veronika.somoza@univie.ac.at

AGFD 249 CONTROL ID: 3405486

Metabolomics for horticulturists: Employing ambient mass spectrometry to assess inherent postharvest pepper quality characteristics Horticulturists are interested in evaluating how cultivar, environment, or production system inputs could affect human health-related compounds or other postharvest quality characteristics such as aroma. While platforms such as gas chromatography-mass spectrometry (GC-MS) coupled with solid phase micro extraction (SPME) have been used to profile the aroma-contributing metabolites (ACM) in food crops, sample preparation and long acquisition times coupled with the need for technical lab expertise, and high cost per sample present practical barriers preventing horticulturists from routinely utilizing this type of Tech.. Ambient mass spectrometry (AMS), which can detect metabolites in minimally processed samples under ambient conditions has emerged as a promising new platform for assessing inherent quality characteristics in postharvest plant products such as pepper pods. Our objective was to evaluate two AMS platforms, direct analysis in real time-mass spectrometry (DART-MS) and rapid evaporative ionization-mass spectrometry (REIMS) coupled with chemometric analysis, to assess quality characteristics in 40 pepper (Capsicum annuum L.) cultivars. DART-MS exhibited the ability to discriminate between red and green pepper pod colors based on the metabolite profiles with a predictive accuracy of 75%. In addition, market class could be predicted based on metabolite profiles with a prediction accuracy of 74% using REIMS. Furthermore, DART-MS analysis resulted in the detection of important human health compounds including p-coumaric acid, vitamin C, and capsaicin, which demonstrates its potential usefulness as a tool for horticulturists interested in evaluating inherent postharvest quality characteristics. T.J. Mason, H.M. Bettenhausen, J.M. Chaparro, J.E. Prenni, M.E. Uchanski, Dept. of Horticulture and Landscape Architecture, Colorado State Univ., Fort Collins tyler.mason@colostate.edu

AGFD 250 CONTROL ID 3386246

Online mass spectrometry as a tool for the development and performance validation of sensor systems for food and agriculture application Sensor systems hold incredible promise in manifold food and agricultural applications in light of their compact size, inexpensive construction, and easy use. The deployment of such systems in field applications to detection volatile organic compounds (VOCs) can be of great benefit to monitor specific processes of both a qualitative (e.g., the presence of specific compounds/mixtures) and quantitative (e.g., exceedances of threshold levels) nature in an industrial setting (e.g., food production or farming practices). A prerequisite of many industrial applications, however, is knowledge on the nature of the volatiles that elicit signals in the sensor devices, regardless of whether they are selective sensors that react to single compounds or cross-reactive sensors that deliver non- selective signal patterns from multiple components. Much knowledge on volatile markers relevant to food or agriculture applications has been gained from benchtop chemical analytical tools, especially gas chromatography- mass spectrometry (GC-MS), which offers unequivocal compound identification. An alternative approach to analysing VOCs is soft chemical ionisation mass spectrometry (SCIMS), which offer online detection down to ultra-trace concentrations in the gas-phase, meaning that measurements can be made continuously and nondestructively. These features make SCIMS-based systems ideal tools to explore dynamic processes to which sensor signals react. Rather than competing, SCIMS and sensor systems can be implemented complementarily, whereby the former can be employed to validate the latter and aid in understanding the nature of gas-phase volatile emissions to enable the development of bespoke sensor systems for specific applications. This talk will introduce SCIMS, foremost the technique of proton transfer reaction mass spectrometry (PTR-MS), as a tool for the dynamic analysis of VOCs in relation to process monitoring in food production or biogenic emissions in agriculture practices, with a view to utilising results for sensor system implementation. J. Beauchamp, Sensory Analytics, Fraunhofer IVV, Freising, Germany jonathan.beauchamp@ivv.fraunhofer.de

AGFD 251 CONTROL ID: 3436918

Towards biomimetic smell sensors: New tools and applications Three of our five senses, namely, seeing, hearing, and touching, have been commercialized in small powerful sensors and are ubiquitous in our everyday life (smartphone etc). Odor and taste, due to their fundamentally different detection mechanism, represent an extreme challenge for the technical implementation. In contrast to readily available devices that mimic mechano- or photoreceptors, which enable powerful optical and tactile sensors, artificial chemoreceptors are needed for the realization of smell and taste. These chemoreceptors are capable of translating a chemical-biological signal into an electronic one and are a prerequisite for odor and taste

sensors. In this presentation we will highlight our research efforts using three different biomimetic approaches: A) low-cost polymer-based sensors that mimic our combinatorial code for IoT applications, B) protein engineering of natural odorant binding proteins to increase and tune specificity C) tethered lipid membranes to mimic the cell membrane and allow for hosting olfactory receptors. Finally, we also present our novel combined SPR/EG-FET sensor platform. By combining surface plasmon resonance (SPR) and electrolyte gated field-effect transistor (EG-FET) methods in a single analytical device we introduce a novel tool for surface investigations, enabling simultaneous measurements of the surface mass and charge density changes in real-time. This is realized by using a gold sensor surface that simultaneously serves as gate-electrode of the EG-FET and as SPR active interface. These simultaneous label-free and real-time measurements allow new insights into complex processes at the solid liquid interface, which are beyond the scope of each individual tool. The aim of our research is to produce, characterize, compare and benchmark biomimetic smell sensors using various sensing principles to create a better understanding of the olfactory process. P. Aspermair, C. Reiner-Rozman, B. Pichler, M. Gora, U. Ramach, K. Kump, P. Fruhmann, J. Andersson, P. Pelosi, W. Knoll, J. Bintinger, 1Austrian Inst. of Tech., Tulin, Austria patrik.aspermair@ait.ac.at

AGFD 252 CONTROL ID: 3436916

Monitoring soiling removal in food processing lines Cleaning of closed production lines is a crucial process in the food industry. Inline fittings such as pipes, valves or pumps are often cleaned by oversized CIP procedures, which are designed according to the worst-case scenario because there is a lack of sensors to monitor the cleaning progress. To overcome this issue, a novel sensor system was developed at Fraunhofer IVV based on the inverted piezo electrical effect. The sensor uses quartz crystals to detect soiling layers on the surface of the machinery. Therefore, a network analyser induces an AC voltage into the quartz, and in return measures the resulting resonance parameters, such as frequency and attenuation. The resonance of the quartz differs with its mass. Hence, any adhering soiling layer influences the measured signal. To implement this sensor principle in a CIP process it has to meet specific requirements. The main issue is that quartz crystals are very thin and vulnerable because they need to oscillate freely. Therefore, a concept to equalize the pressure on both sides of the quartz was developed and tested. This allows the use of the sensor system also for applications with high operating pressure during production without breaking. First tests with the sensor were performed in a flow channel test rig. The quartz was thereby coated with a model soiling and afterwards cleaned in the channel. As a reference, an established optical sensor monitored the cleaning process. Starch, custard and tomato paste were used as model soiling. The tests showed that the sensor is able to detect the soiling removal from its surface and that the signal fits with the optical sensor data. Furthermore, it was possible to observe an influence of the operating parameters, such as fluid temperature or cleaning agent on the sensor signal, which needs to be compensated by calibration and smart data processing. M. Mauermann, R. Murcek, A. Boye, Fraunhofer Inst. for Process Engineering and Packaging IVV, Freising, Germany marc.mauermann@ivv-dd.fraunhofer.de

AGFD 253 CONTROL ID: 3431356

Development of foods for the elderly people in Korea As aging progresses rapidly, the health problems of the elderly are emerging as social problems. The health of the elderly is accompanied by a decrease in physical function, dysfunction and loss of function and pathological changes according to the degree of aging. The three major eating disorders of the elderly can be divided into three categories: mastication problem, dysphagia, and digestive disorders. Various physical control techniques can be used to overcome the three eating disorders of the elderly. Through this property control Tech., it is possible to maintain the shape of the food as well as to adjust the hardness, and to maintain the enjoyment of food intake according to the level of deterioration in function of the elderly. Through this study, the purpose of this study was to introduce food development Tech. and system preparation to improve eating disorders of the elderly B. Kim, H. Jang, M. Lee, Research Group of Food Processing, Korea Food Research Inst., Wanju-gun, Jeollabuk-do J. Hong, Research Group of Food Processing, Korea Food Reserach Inst., Wanju-gun, Jeollabuk-do bkkim@kfri.re.kr

AGFD 254 CONTROL ID: 3409578

Red cabbage microgreens modulation of the gut microbiota is associated with attenuation of high fat diet- induced risk factors in a diet-induced obesity mouse model Microgreens are young vegetable plants harvested 7-14 days after the cotyledon leaves appear. Cruciferous vegetable microgreens, such as red cabbage microgreen (RMG), are of special interest due to the well documented health promoting effects of their mature counterparts. However, little is known of the biological effects of microgreens. Dietary modulation of the gut microbiota has been implicated as a key contributing factor to human health. We hypothesize that consumption of microgreen may alter the gut microbiota. Accordingly, the present study used a rodent diet-induced obesity model to investigate the effect of RMG on the gut microbiota. High-fat diet (HF) is purported to cause alterations of gut microbiota that is characterized by loss of microbial community and increased abundance of specific bacteria, resulting in increased risk for chronic diseases and inflammation. We found consumption of RMG exerted profound impacts on microbial composition in mice. Specifically, the species diversity of mice on both low fat (LF) and HF diet were significantly increased from consuming RMG. In comparison to LF control group, the intake of RMG increased the gut Firmicutes/Bacteroidetes (F/B) ratio. Furthermore, an unidentified species of the Clostridiales order, increased by RMG, was found to be negatively correlated with the hepatic cholesterol ester level in mice ($r = -0.621$, $p = 0.0004$). In addition, RMG significantly inhibited HF diet-induced elevation of the genus AF12, of which the abundance was positively correlated with body weight gain ($r = 0.514$, $p = 0.004$) and the amount of low-density lipoprotein in mice ($r = 0.506$, $p = 0.007$). Overall, our results demonstrated that RMG can alter the gut microbiota and may prevent HF diet-induced body weight gain and altered cholesterol metabolism through regulation of the gut microbiota R. Li, Animal Parasitic Diseases Laboratory, USDA-ARS, Beltsville, Maryland, H. Huang, X. Jiang, Univ. of Maryland, College park, Maryland, Q. Pham, T.T. Wang, Diet, Genomics, and Immunology Laboratory, USDA-ARS, Beltsville, Maryland, Y. wu, J. Wang, School of Food and Health, Beijing Tech. & Business Univ., Beijing, China W.H. Yokoyama, USDA Ars Western Reg Rsrch Lab, Berkeley, California, L. Yu, Nutrition and Food Sci., Univ. of Maryland, College Park Q. He, Sichuan Univ., Chengdu, China Y. Luo, USDA-ARS, Beltsville, Maryland, yanbeiwu@btbu.edu.cn robert.li@usda.gov

AGFD 255 CONTROL ID: 3430550

Dietary quercetin and cognitive function Modification of lifestyle including dietary changes is suggested to prevent cognitive impairment and dementia. Recently, Nakagawa et al. showed that quercetin, which is the major flavonoid contained in onions and other vegetables, fruits and tea, delayed deterioration in Alzheimer disease model mice and enhanced memory recall in aged mice, probably by improvement of integrated stress response, involving eukaryotic translation initiation factor 2α (eIF2α) phosphorylation and activating transcription factor 4 (ATF4) expression. ATF4 binds cAMP responsive element binding protein (CREB) associated with learning and memory, and works as a memory-suppressor gene. Nishihira et

al. showed that the result of a randomized, double-blind, placebo-controlled study in elderly subject suggested that ingestion of quercetin rich onion improved cognitive function. Quercetin consumed in diet may contribute to maintain or improvement of cognitive function in elderly people. To elucidate the molecular mechanism of dietary quercetin on improvement of cognitive function, we fed aged mice with a control AIN93M diet, a high fat, high sucrose and high cholesterol Western style diet or the Western style diet supplemented with 0.05% quercetin for 36 weeks. The results indicated that quercetin improved in learning and memory and increased the expression of the antioxidant enzymes superoxide dismutase 1 (Sod1), glutathione peroxidase 1 (Gpx1), and catalase (Cat) significantly in the cerebral cortex in aged mice fed a Western diet. Transcriptome analysis of hippocampus of the aged mice showed that the Western diet was predicted to inhibit CREB1 associated with memory. Quercetin was predicted to be activated the neurotrophic factor CNTF and HTT. Comprehensive molecular mechanism of action of dietary quercetin on cognitive function in aged mice fed a Western diet is under investigation. M. Kobori, Food Research Inst., National Agriculture and Food Research Organization, Tsukuba, Japan kobori@affrc.go.jp

AGFD 256 WITHDRAWN

AGFD 257 CONTROL ID: 3431476

Lifespan extension through autophagy-inducing chestnut flowers extract The aging process is constant change in cells and organs throughout the life span, and includes loss of function such as disease resistance, homeostasis and metabolism. Among the cellular process that related with aging, autophagy is getting the most attention. We investigated the hypothesis that chestnut flowers extract (CFE) can improve autophagy activity and life extension. CFE increased autophagy activity and showed extending survival rate in C. elegans together with high feeding behavior and exercise capacity compare to untreated control. In addition, CFE administration enhanced survival rate in C57BL6 mice through improved autophagy activity and mitochondrial function. These results suggests that autophagy-inducing CFE extend lifespan. H. Seo, S. Park, E. Lee, C. Jung, Research Group of Natural Material and Metabolism, Korea Food Research Inst., Wanju-gun, Jeollabuk-do , hyo-deok.seo@kfri.re.kr

AGFD 258 CONTROL ID: 3411155

Utilization of nanocellulose from cotton agricultural residues: Materials and applications Nanocellulose in the form of cellulose nanocrystals (CNC) or cellulose nanofibers (CNF) are a renewable biopolymer that can be extracted from over thirty plant species including cotton, tunicate, sugarcane, soy, and various wood sources. Nanocellulose dimensions from these processed feedstocks range from a few nanometers in width to lengths of several microns, depending on the source material, method of isolation, and ultimate product (CNC or CNF). Increasingly, the focus has been on using agroindustrial by-products as cellulose sources to produce nanocellulose, both as a means of conserving cost and reducing waste. In this regard, cotton gin motes and cotton gin waste were shown to be an effective cellulose source for the production of CNCs with or without chemical pretreatments. CNCs and CNFs may be subsequently chemically modified for specific uses or tailored for applications as rheology modifiers, polymer reinforcements, and nanocomposites. Thus, observed effects are dependent upon not only the nanocellulose morphology, but also their chemical composition and physical properties. A comparison is then drawn between cellulose source (wood vs cotton), type (CNC vs CNF), and functionality (carboxylate vs sulfate). J.H. Jordan, M. Easson, H.N. Cheng, B. Condon, Southern Regional Research Center, USDA - ARS , Destrehan, Louisiana jacobshjordan@gmail.com

AGFD 259 CONTROL ID: 3411771

Preparation of cellulose-based soft materials using ionic liquids Cellulose is the most abundant organic resource on the earth and currently used in various practical applications as fibrous materials. Due to its highly crystalline structure, however, cellulose shows poor solubility and processability, leading to difficulty in applications as soft materials. On the other hand, ionic liquids are identified as good solvents for cellulose since an ionic liquid, 1-butyl-3-methylimidazolium chloride (BMIMCl), has been found to dissolve cellulose. This presentation reports the preparation of cellulose-based soft materials through the dissolution/gelation with BMIMCl. When a solution of cotton cellulose in BMIMCl (5 wt%) soaked in water at room temperature, the gelation smoothly progressed. The resulting ion gel was then dried at 60C 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 150C, suggesting the occurrence of phase transition at the temperature. Accordingly, the film showed thermal processability above the temperature, indicating its thermoplastic property. The cellulose hydrogels were also obtained from solutions with BMIMCl in different concentrations under adapted conditions. Lyophilization of the hydrogels efficiently gave the regenerated celluloses. Analytical results suggested their amorphous structure and porous morphology, respectively. Furthermore, pore sizes of the regenerated celluloses were depending on the concentrations of the initially prepared solutions with BMIMCl, which also affected mechanical property under tensile mode. When the porous celluloses were immersed in water, re-swelling was observed to reform hydrogels. By soaking the cellulose solution with BMIMCl in different organic liquids, the corresponding organogels and solutions were formed depending on their polarities J. Kadokawa, Grad Schl of SCI Engineering, Kagoshima Univ., Kagoshima, Japan kadokawa@eng.kagoshima-u.ac.jp

AGFD 260 CONTROL ID: 3412901

High-value utilization of low value xylans via novel enzymes Bio-manufacturing is the best choice to achieve sustainable development, which is also a major strategic need for all over the world. Many co-products are produced during the agricultural harvest and processing, such as xylans. Xylan is rich in xylooligosaccharides, xylose, ferulic acid and other high value-added active ingredients. However, its effective utilization is really difficult due to its complex structure, which is also becoming a major industry problem. In order to realize the high-value utilization of xylan, our team proposed a stepwise enzymatic hydrolysis and transformation strategy, and targeted mining of new enzymes. 1. Screened a thermostable endoxylanase CoXynA, which can hydrolyze xylan to xylosaccharide under high temperature; 2. A rare, small molecule, and bifunctional acetyl ester-xyloside hydrolase (CLH10) was obtained by genetic mining. CLH10 is capable of synergistically hydrolyzing both the β-1,4-xylosidic bond-linked main chain and the ester bond-linked acetylated side chain of xylan, which can hydrolyze xylooligosaccharides into xylose and ferulic acid at the same time; 3. Using ferulic acid as a substrate, bioactive ingredients such as vanillin and curcumin are further synthesized by cascade enzymatic method. After clarifying the regulatory mechanism of the above key enzymes, a method for co-production of xylooligosaccharides, xylose, ferulic acid, vanillin and curcumin using xylan as substrate was established, and successfully produced vanillin with wheat bran as substrate. Our research provides a perspective for the screen, application and directed evolution of new enzymes, and also lays a theoretical foundation for the development of functional foods and the green high value utilization of xylan. H. Cao, L. Sun, B. WEN, F. Xin, Inst. of Food Sci. and Tech., Chinese Academy of Agricultural Sciences, Beijing caohao@mail.buct.edu.cn

AGFD 261 CONTROL ID: 3414207
Development of biobased lubricant additives from vegetable oils Fully biobased lubricants comprise both biobased base oils and biobased additives. Currently available biobased oils range from highly purified vegetable oils to biorefined products from vegetable oils and their derivatives. There are also some commercial biobased additives, based on vegetable oils and fats, that adequately perform some additive functions. Still, formulators need to continue using petroleum based additives to cover all of their additive needs. Thus, there is a need to continue developing biobased additives in order to extend their application range, improve their performance, and ensure they are cost competitive. One approach to achieving this goal is by developing efficient processes for modification of vegetable oils into multi-functional biobased additives. In this presentation, we discuss results of efforts at developing such processes as well as the characterization of the biobased multi-functional additives obtained from application of such processes. G. Biresaw, G.B. Bantchev, R.E. Harry-O'kuru, NCAUR, USDA-ARS, Peoria, Illinois, girma.biresaw@ars.usda.gov

AGFD 262 CONTROL ID: 3419367
Lignin depolymerization via solvent liquefaction: Effects of pretreatments, process conditions and catalysts Finding high value uses for lignin by-products is critical to the economic viability of biorefineries producing advanced bio-fuels and other renewable chemicals and materials. Currently, 50 million tons of lignin are produced worldwide, and most of this is used in low value applications such as combustion for process heat. In this presentation we will discuss the application of various solvents, conditions and catalysts for the solvent liquefaction of lignin. One area to be compared will be use of high boiling solvents versus low boiling solvents. High boiling solvents offer the advantage of reducing the overall pressure requirement but are more difficult to separate from the lignin products for reuse. We will also present the results for when various pretreatments are employed including pre- reaction fractionation or chemical modification (e.g. methylation). Key results will include liquid yields and their characterization in terms of aromatic monomer concentration and overall molecular weight. Detailed characterization of any higher molecular weight portions of lignin depolymerization products will also be accomplished via fractionation and/or analysis via GPC and diffusion orientated NMR spectroscopy. Further conversion of oligomeric fractions of the liquefaction products will also be discussed. C.A. Mullen, A.A. Boateng, USDA-ARS, Wyndmoor, Pennsylvania charles.mullen@ars.usda.gov

AGFD 263 CONTROL ID: 3422123
Molecules and polysaccharides from agri-biomass modified via high-pressure homogenization to form nanoparticles and potential nanocarriers There is an increasing drive to find agri-based biopolymers that can be transformed into nanoparticles with the potential of being nanocarriers of bioactive molecules. We have explored nanoparticle formation with three agri- based biopolymers that have distinctive properties for different types of nanocarrier applications. A water-soluble polysaccharide, a water-insoluble polysaccharide, and a feruloylated soybean oil were each individually put through high-pressure homogenization to form nanoparticles. The water-soluble polysaccharide was purified from the Vitis riparia Michx Frost grape vine found locally in Illinois. The water-insoluble polysaccharide alpha-glucan was produced from microbial enzymatic synthesis. The feruloylated soy glycerides were synthesized by chemically combining ethyl ferulate with soybean oil. The frost grape polysaccharide formed nanoparticles that were an average of 227 ± 18 nm in diameter, had an average surface potential of -26 ± 1 mV and were stable for more than 21 days. The alpha-glucans formed nanoparticles with a diameter average of 131 ± 24 nm, had a surface potential average of -3.7 ± 4.2 mV and were stable for more than 225 days. The feruloylated soy glycerides formed nanoparticles with an average of diameter of 168 ± 43 nm, an average surface potential of -26.6 ± 3.3 mV and stability over more than 90 days. These materials from renewable biomass show great potential to be developed into highly stable, biodegradable nanocarriers. K. Evans, D.L. Compton, N.P. Price, C.D. Skory, S.F. Vaughn, USDA, Chillicothe, Illinois, Kervin.Evans@ars.usda.gov

AGFD 264 CONTROL ID: 3426495
Polyhydroxyalkanoate (PHA) biosynthesis: An integrated biorefinery approach The continuous expansion of recalcitrant plastics into the biosphere has generated immense concern recently due to their environmental persistence. Unfortunately, the adoption of more benign polymers in large-scale applications has been hindered due to cost concerns. Polyhydroxyalkanoates (PHAs) are well-known bacterial bioplastics that have been well-documented to degrade to CO2 and water in microbially-active terrestrial and aquatic environments. In an effort to reduce the production costs of these potentially valuable, carbon-neutral biopolymers, many low-value feedstocks have been assessed as fermentation substrates. Two of the more intriguing substrates for PHA biosynthesis have been crude glycerol and lignocellulosic biomass. Crude glycerol is produced as a byproduct (approx. 10%) of the transesterification reaction used in biodiesel production while lignocellulosic biomass (LCB) is the most abundant raw material on earth and is typically composed of both 5- and 6-carbon sugars and lignin. LCB is an attractive feedstock for biorefining processes due to its low-cost, abundance and wide-spread availability. This presentation will focus on the use of integrated biorefinery approaches to more economically transform both crude glycerol and lignocellulosic biomass (specifically corn stover) into PHA biopolymers such that these valuable polymers are more commercially appealing for wide-spread application. R. Ashby, SBCP, USDA/ARS/ERRC, Wyndmoor, Pennsylvania, G. Strahan, A. Nunez, CORE, USDA/ARS/ERRC, Wyndmoor, Pennsylvania, rick.ashby@ars.usda.gov

AGFD 265 CONTROL ID: 3427806
Carbohydrate polymers based value-added co-products from sorghum bran, bagasse and biomass Three different types of sorghum are currently being developed by plant breeders, grain sorghum (bred for high yield of kernels), sweet sorghum (bred for high yields of sugar in the stems) and forage/biomass sorghum (bred for high yield of total biomass). The alkali soluble arabinoxylans (Hemicellulose B) and insoluble fibrous cellulose rich fractions from sorghum bran, sorghum bagasse and biomass sorghum were isolated by alkaline treatment, characterized and their functionalities were studied. The monosaccharide composition of the Hemi. B fraction from sorghum bran showed a highly branched structure but the Hemi. B fractions from sorghum bagasse and biomass sorghum were less branched. The Hemi. B from all these three sorghum sources appear to have useful properties as emulsifiers and soluble dietary fibers. Like corn fiber gum, these polysaccharides are unique in their ability to make low viscosity solutions, even at high concentrations and they show shear thinning behavior. Cellulose rich fractions prepared from the residues remaining after Hemi. B isolation were also characterized and their water holding capacity was determined. The cellulose rich fractions from all these sorghum sources have high water holding capacity (22.76 to 35.27 g water/g cellulose rich fraction). The new insoluble fibers from these sorghum sources are expected to have unique applications as non-caloric food bulking agents and may be useful in replacing fat with healthy fiber and water without changing taste. The new insoluble fibers may also improve mouth feel of foods such as bakery products, dairy products, meats, dressings, mac and cheese etc. Understanding the functional properties of Hemi. B and cellulose rich fraction will be beneficial for

their commercialization and for identifying new applications in food industries. M.P. Yadav, M. Sarker, SBCP, USDA, ARS, ERRC, Wyndmoor, Pennsylvania, madhav.yadav@ars.usda.gov

AGFD 266 CONTROL ID: 3432012
Correlating the flocculation performance of modified bovine hemoglobin with their molecular structures and physicochemical properties Flocculants are often used in wastewater treatment, agricultural irrigation or food and beverage processing to improve precipitation of small particulates. While most commercially used flocculants are synthetic polymers, a new generation of bio-based flocculants is gaining attention due to their eco-friendliness and low cost. Our previous work demonstrated that bovine hemoglobin (Hb) recovered from slaughterhouse blood is an effective flocculant for kaolin suspensions. We further showed that the flocculation activity of Hb was significantly improved by methylation of the carboxylic acid side-chain groups of Glu and Asp residues, thus eliminating negative charges. In this work, the heme prosthetic group of Hb was removed to produce apo-hemoglobin (apo-Hb), with and without subsequent methylation. The effects of the derivatizations on the charges, molecular structure, physicochemical properties, and flocculation performance, were examined. Apo-Hbs were prepared via three established methods. The flocculation properties of the apo-Hb did not improve considerably compared to that of the native Hb (pI 6.8), although the removal of the heme increased the pI of the apo- Hb to 8. Methylated apo-Hb (apo-MeHb) significantly improved the flocculation performance by lowering the effective dose and broadening the pH tolerance range to 4.5 - 9. Because of the high pI values of the apo-MeHbs, charge neutralization was initially assumed to be the primary mechanism for the flocculation. However, zeta-potential measurements indicated that the addition of apo-MeHbs only partially neutralized the negative charges of kaolin suspension. Therefore, electrostatic patches and bridging effect of apo-MeHbs may be attributable to the flocculation behavior in kaolin suspension. Changes in the molecular structures were investigated by FTIR, Trp intrinsic fluorescence, and Circular Dichroism (CD) spectroscopic techniques. Significant structural variations were identified among the three apo-Hbs than their methylated counterparts. Finally, modified Hbs were examined by HPSEC-light scattering techniques to correlate their observed flocculation properties with the physicochemical characteristics. C. Liang, R.A. Garcia, P.X. Qi, C. Lee, Dairy and Functional Foods, USDA-ARS-ERRC, Wyndmoor, Pennsylvania, qwfylc@gmail.com

AGFD 267 CONTROL ID: 3429155
Nitrate ion-selective microresonator sensor Abstract Compact, field-deployable nitrate sensors with high sensitivity and selectivity are highly desired for a broad range of areas such as soil science, precision agriculture, and real-time environmental monitoring. However, no current nitrate sensing techniques can enable real-time and accurate quantitative determination of nitrate concentration without compromising on cost and miniaturization. In our work, we demonstrate a novel nitrate sensing platform based on chip-scale micro-ring resonator photonic sensors. To achieve high sensitivity and selectivity for nitrate, the devices are functionalized by nitrate ion-selective membranes (ISMs). Unlike the ISM-functionalized potentiometric sensing techniques such as ion-selective electrodes (ISEs) and ion-selective field-effect transistors (ISFETs), our optical approach does not need a reference electrode, which usually suffers severely from drifting issues, so this technique is more favorable for real-time and field-deployed nitrate determination. Compared with other optical methods such as UV-vis, fluorimetric and FTIR, our refractometric sensors are compact, low-cost, and can be easily functionalized to achieve high sensitivity and specificity for targeted chemicals. Using nanofabricated micro-ring resonators integrated with nitrate selective ISMs that undergo small but detectable changes in refractive index upon absorbing nitrate ions, we show that the photonic sensor can detect nitrate concentrations in the relevant range of 1-100 ppm with good specificity against Cl- and NO- These sensing capabilities appropriately meet the needs of nitrate sensors for 2 agriculture and soil science. Z. Zhang, S. Guha, The Univ. of Chicago, Illinois, Z. Zhang, S. Guha, X. Zhang, Argonne National Laboratory, Lemont, Illinois, zxz202@case.edu

AGFD 268 CONTROL ID: 3431713
Towards inexpensive high performing gas measurements – method and instrumentation for sensor system optimization Metal oxide semiconductor (MOS) gas sensors are very sensitive to a broad range of organic gases and could be utilized in many food and agriculture applications, e.g. in the detection gaseous indicators of food spoilage or crop disease. However, many of these applications require a selective detection of one or more substances in a complex gas matrix, which can increase the limit of detection by orders of magnitude. The compensation of these matrix effects is the major issue for most application. Gas analytics usually starts with separation of compounds mostly by using dedicated sampling methods and gas chromatography. Sensor systems, however, have to minimize the costs and therefore the complexity of the system to a minimum. For many applications, dynamic operation of the sensor e.g. with temperature-cycled operation followed by signal processing is sufficient for selective detection, in other case separation methods are necessary. Recently, we have developed models for the description of sensor under temperature variation in constant and pulsed gas applications. Here, we present a comprehensive method and instrumentation for the design optimization of inexpensive sensor systems. The instrumentation is based on a synchronized combination of a MOS-sensor module with a GC-MS system, which allows simulating the sensor performance for different system configuration. For predictable and quantitative results, we present an analytical description of the system including column, split, the following restriction columns and the detectors, by means of pressures, flow rates and split ratio and preliminary characterization measurements. Using a special technique, the differential surface reduction, the reaction rate of each compounds can be measured explicitly, which allows the prediction of a sensor system even under temperature-cycled operation. Therefore, the methods is a new pathway for effective system optimization. T. Sauerwald, Fraunhofer Inst. for Process Engineering and Packaging IVV, Freising, Germany J. Joppich, T. Baur, O. Brieger, A. Schütze, Lab for Measurement Tech., Saarland Univ., Saarbrücken, Germany tilman.sauerwald@ivv.fraunhofer.de

AGFD 269 CONTROL ID 3392673
Tackling emerging plant diseases with in-field sensors Crop diseases caused by pathogenic microorganisms pose severe threats to the global food supply. Effective diagnostic tools for timely determination of plant diseases become essential to the assurance of agricultural sustainability and global food security. Nucleic acid- and antibody-based molecular assays are gold-standard methodologies for the diagnosis of plant diseases. However, conventional analyzing procedures are complex and laborious. Recently, cost-effective and field-portable diagnostic tools are emerging. Miniaturized molecular diagnostic assays combined with portable sensor devices (e.g., smartphones) have paved the way for fast and on-site diagnosis of plant diseases and long-term monitoring of plant health conditions, especially in resource-poor settings. This talk will highlight our recent effort in creating low-cost in-field plant sensors for early detection of emerging plant diseases. Q. Wei, Dept. of Chemical and Biomolecular Engineering, North Carolina State Univ., Raleigh qwei3@ncsu.edu

AGFD 270 CONTROL ID: 3430392
Engineered bacteriophage-based electrochemical biosensor via hierarchical conductive nanofibers for rapid bacterial detection in food Foodborne illnesses resulting from bacterial pathogens pose an increasing threat to human health worldwide. The ability to more rapidly and sensitively detect bacteria in food samples is critical to ensure food safety and minimize the risk of human exposure to potential hazards. Herein, a highly sensitive and selective electrochemical biosensor platform was assembled through a revolutionary combination between hierarchical PEDOT nanofibrous- modified-chip and genetically engineered bacteriophage T7 for the detection of Escherichia coli without the need for culturing or nucleic acid extraction. This biosensor platform is based on engineered bacteriophage mediated specific lysis of target bacteria and release of alkaline phosphatase which was detected electrochemically after bacteriophage lysis. The employment of conductive nanofibrous membranes as a sensor matrix multiplied the electroactive surface area 3 times. The integration of the phage, nanofiber, and electrochemical technologies demonstrated successful detection of 1 CFU/mL of E. coli BL21 in spinach leaves within 3 hours. Additionally, the specificity of the assay was demonstrated with negative control bacteria. A. El-Moghazy, N. Wisuthiphaet, G. Sun, N. Nitin, Univ. of California Davis, aelmoghazy@ucdavis.edu

AGFD 271 CONTROL ID: 3430280
Growing structural proteins in advanced materials for food security and food safety Applications of robotics and sensing technologies, big data analysis and bioTech. in farming, plant and Food Sci. are highly sought to guarantee global food security while mitigating the environmental impact of agriculture. In this scenario, the potential benefit of applying materials science principles to enhance food security remains underexplored when compared to material- based research efforts in biomedicine, energy and optoelectronics. In this seminar, we highlight recent development in the design of structural proteins using AI principles and in the nanomanufacturing of structural proteins to engineer a new generation of advanced materials that can be interfaced with food and plants. We will present a new AI algorithm designed to accelerate de novo protein design and newly developed techniques to direct the assembly of structural proteins into nanostructured materials that can serve as: edible coatings to prolong the shelf-life of perishable food, and injectors to sample food fluids and detect foodborne pathogens. These examples will provide an opportunity to discuss how the establishment of a successful interface between biomaterials and foods requires the development of a basic scientific knowledge on: mechanics of disorder to order transitions in proteinaceous materials during condensation phenomena, fluid mechanics and transport phenomena in structural biopolymers, and swelling of porous materials exposed to food fluids. B. Marelli, Civil and Environmental Engineering, Massachusetts Inst. of Tech., Cambridge, bmarelli@mit.edu

AGFD 272 CONTROL ID: 3428831
Graph convolution neural network in environmental carcinogenicity prediction Evaluation of chemical toxicity and human health risk of compounds are important. Thousands of industrial chemicals used worldwide require safety testing each year, however, animal testing is very costly and would require the use of extra 10-20 million animal experiments which is contrary to spirits to reduce the use of animals in science. Traditionally, structural features using QSAR for chemical toxicity predictions are very commonly done. However, the improvements of the machine learning and deep learning add great value to this field. This work use the state of the art graph convolution neural network (GCN) for carcinogen prediction. The training data was retrieved from ECHA substance information through the OECD eChemPortal(https://www.echemportal.org/) query service with endpoint “carcinogenicity”. There are total 1105 samples with 675 positive samples and 430 negative samples. Graph convolution neural network was used, and the applicability domain of the model was evaluated based on distance method. Predictions are expected to be reliable when the calculated distance between the prediction point and its k- nearest neighbor is small than an AD threshold. The AD threshold was determined by selecting 1% of training data as outliers. GCN also provides an extra value as explainable deep learning for carcinogen predictions instead of the traditional black box machine learning. B. Su, Y. Tseng, Computer Sci Info Eng, National Taiwan Univ., Taipei |H. Liu, Y. Tien, T. Cho, Y. Tseng, Graduate Inst. of Biomedical Engineering and Bioinformatics, National Taiwan Univ., Taipei Y. Tseng, Drug Research Center, School of Pharmacy, National Taiwan Univ., Taipei, r08945028@ntu.edu.tw

AGFD 273 CONTROL ID: 3426940
Use of machine learning to increase access to nutritional information With the ever-increasing levels of obesity in the world, it is important for consumers to be aware of the nutritional content of the food they eat in order to promote healthy habits. We present a deep sequential model based on convolutional neural network (CNN) to identify images of food and deliver nutritional information. We constructed a dataset of five types of foods served by Sodexo, one of the world's largest food service corporations which serves over 100 million people in many schools, colleges, and other public cafeterias, with an average of 300 images per food. We then trained our model on a training set of around 1500 images and tuned with kfold cross validation. The model parameters are optimized with the number of convolutional model layers, kfold, and batch size. For a test set of 276 images, accuracy of 0.996 and loss of 0.025 was achieved using three convolutional model layers. The purpose of this work is to give consumers, especially high school and college students, greater access to nutritional information for their food, and thereby promote healthy eating habits. J. Gao, Illinois Mathematics and Science Academy, Makanda M. Xiao, Mathematics, Southern Illinois Univ., Carbondale jgao@imsa.edu

AGFD 274 CONTROL ID: 3431559
Quantum chemical and quantitative structure activity relationship (QSAR) assessment of the antifungal properties of phenolic compounds Components of essential oils and other phenolic compounds are of recent interest as antifungal compounds to reduce molds, commodity spoilage, and exposure to mycotoxins. A series of Quantitative Structure-Activity Relationship (QSAR) studies have been carried out on the antifungal bioactivity of phenolic compounds against certain mycotoxin producing Aspergillus, Fusarium, and Penicillium species. Quantum chemical properties investigated using B3LYP/6-311+G** density functional theory calculations indicate phenolic compounds with lower electrophilicity index possess greater antifungal activities. QSAR models developed using genetic function approximation and machine learning techniques provided two descriptor models associated with topological and electrostatic properties. The best validated models for predicting antifungal activities possessed correlation coefficients between 0.85-0.93. The QSAR models are economical tools to calculate antifungal properties. M. Appell, D.L. Compton, K. Evans, L.C. Wang, USDA-ARS, Dunlap, Illinois, Y. Tu, Insilico Taiwan Inc, Taipei, Taiwan michael.appell@gmail.com

AGFD 275 CONTROL ID: 3409378
Multiple analysis system for specific IgE using a microarray allergen biochip with a small amount of blood at clinics Microarray Tech. is a powerful tool for parallel analysis. In addition to nucleic acid-based arrays, various types of microarray systems have been developed. Among these systems, antigen, allergen, and autoantigen

microarrays have been reported by several researchers. However, it was difficult to immobilize some molecules. To overcome the problem, we have developed a new immobilization method using photoirradiation. Beacuse the photoimmobilization method requires no limitation of functional groups due to a radical reaction, it is possible to immobilize any organic molecules on any organic substrate through covalent bonds. In addition, as a result of no requirement of functional groups, the orientation of the photoimmobilized macromolecules is random, leaving various sites exposed for interaction with polyclonal antibodies. Here, we developed a photoimmobilized allergen microarray for an allergen-specific IgE assay. First, an aqueous solution of a photoreactive poly(ethylene glycol)-based polymer was spin-coated on a plate, and an aqueous solution of each allergen was microspotted on the coated plate and allowed to dry in air. Finally, the plate was irradiated with an ultraviolet lamp for covalent immobilization. An automated machine using these plates was also developed for the assay. After a patient's blood from the finger was added to the microarray plate, the adsorbed IgE was detected by an enzyme-conjugated anti-IgE-antibody through the chemical luminescence intensity. The results were highly correlated with those by the conventional method. 41 different allergen-specific IgEs were assayed using 20 microlitter of whole blood from the finger within 30 minutes. The system is now commercially available from Nippon Chemiphar with approvement of Japanese medical insurance. Y. Ito, Nano Medical Engineering Laboratory, RIKEN Cluster for Pioneering Research, Wako-shi, Saitame, Japan Y. Ito, Emeergent Bioengineering Materials Rearch Team, RIKEN Cener for Emergent Matter Science, Wako-shi, Saitama, Japan Y. Ito, R-NanoBio Co. Ltd., Wako-shi, Saitama, Japan y-ito@riken.jp

AGFD 276 WITHDRAWN

AGFD 277 CONTROL ID: 3431365
Population level association analysis of Korean gut microbiome with intrinsic and extrinsic host factors Human gut microbiome plays crucial roles in harvesting energy from the diet, stimulating the proliferation of the intestinal epithelium, developing the immune system, and regulating fat storage in the host. Numerous diseases including type 1 & 2 diabetes (T1 & T2D), inflammatory bowel disease (IBD), gastric and colonic cancers, and even CNS-related disorders and aging have been shown to be linked to dysbiosis of gut microbial communities. Recent advances in microbiological analysis methods and application of systems biology in data interpretations allow us to understand the close association of the gut microbiota with human health and critical illnesses. And the human gut microbial information could be applied to prepare future disease prevention strategies, personalized health care guides, and novel therapeutic interventions. The composition of gut microbiome and its functions are affected by various intrinsic and extrinsic factors including host's lifestyle, diet, ethnicity and geographic location, etc. However, the understanding of the gut microbiome of Asian population, whose lifestyle, dietary patterns, and genetic backgrounds differ from those of Western individuals, is still limited. Y. Nam, Korea Food Research Inst., Wanju-gun, Jeollabuk-do , Korea(The Republic of) youngdo98@kfri.re.kr

AGFD 278 CONTROL ID: 3431199
Tribological approach using extended stribeck curves to understand oral processing for the elderly Besides nutrition, functionality, and mastication, swallowing is one of major attributes to be fine-tuned in senior-friendly foods due to the risk of aspiration. Triobology is an emerging technique to mimic oral processing between tongue-palate and/or tongue-food by monitoring friction behavior of food fluids between ball and pins. In this study, extended stribeck curves were established with yogurt products varying in viscosity (77-1025 mPas). In the extended stribeck curve, a shift from static to kinetic state of motion (i.e., breakaway point) was detected in response to elastic deformation of the system. The friction coefficient and sliding velocity at the breakaway point displayed a negative correlation (R*2= 0.998 and 0.997, respectively) with viscosity (at 50/s shear rate). This relationship was also true for the first highest peak in the extended stribeck curve, but lesser extent exhibited (R*2 = 0.976 and 0.942, respectively). Yogurt samples varying in non-fat milk solids (8.5% 10%, 12%, w/v) were subjected to sensory evaluation. Results were assessed by rolling correlation with extended stribeck curves, and rheological parameters including viscosity (at 50/s shear rate) , G' and G" (at 1 and 10 rad/s). The results showed that viscosity, G' and G" values were associated with a low range of sliding speed (~4.94E-06 mm/s) including breakaway point, which correlated with cohesiveness in the mouth, coated and residual feelings after swallow. Apparent viscosity and stickiness were associated with the latter stage of hydrodynamic friction (0.63-1.0 mm/s), while smoothness when swallowing was highly associated with the early stage of hydrodynamic friction (0.013-0.199 mm/s), which finally impacted on the textural acceptance. Overall results indicate that correlation amongst rheological and tribological results and sensory assessment is an effective tool to predict specific food structure and formulation ideal for target consumers. J. Hong, Y. Choi, Research Group of Food Processing, Korea Food Research Inst., Wanju-gun, Jeollabuk-do , B. Kim, Research Group of Food Processing, Korea Food Research Inst., Wanju-gun, Jeollabuk-do jungsunhong@kfri.re.kr

AGFD 279 CONTROL ID: 3431291
Simultaneous determination of vitamin D and K: vitamin nano-encapsulation and fortification for the elderly A novel analytical method was developed for the determination of vitamin D2, D3, K1 and K2 from vitamins- fortified emulsion by using dispersive liquid-liquid microextraction or QuEChERS (quick, easy, cheap, effective, rugged, and safe) methods followed by liquid chromatography–atmospheric-pressure chemical ionization tandem mass spectrometry (LC-APCI-MS/MS). The extraction methods were evaluated using response surface methodology (RSM). Validation of the optimized methods showed good linearity (R*2 > 0.9999), accuracy accuracy (≥98.47%), intra- (≤4.50%) and interday (≤6.43%), limit of detection (0.03-0.96 μg/L), and limit of quantification (0.1-5.79 μg/L). The relative recoveries were 90.7–106.3% in vitamin-fortified samples. H. Jang, T. Kim, G. Yoo, M. Lee, B. Kim, Korea Food Research Inst., Wanju-gun, Korea(The Republic of) okay0730@gmail.com

AGFD 280 CONTROL ID: 3431102
Physical stability and in vitro digestion of vitamin K loaded lipid nanocarriers for application to food for elderly Vitamin K is essential nutraceuticals for human health such as the activation of specific proteins involved in blood clotting (e.g., prothrombin) and bone mineralization (e.g., esteocalcin). However, incorporating vitamin K into commercial foods, beverages, and pharmaceutical products has been difficult, due to its chemical instability, poor water solubility, and low bioavailability and absorption rate. Lipid nanocarrier, including emulsion, nanostructured lipid carrier (NLC), and solid lipid nanoparticle (SLN), is one of the simplest systems for lipophilic nutrient delivery. Incorporating or encapsulating nutrients into lipid carrier has many advantages, such as high incorporation efficiency, high bioavailability, and free organic solvents during processing. Therefore, in this study, vitamin K was encapsulated into lipid nanocarriers using different cooking oils including soybean oil, coconut oil, and palm oil and surfactants including tween 80 and soybean lecithin. The mean diameter of lipid nanocarriers were approximately 100–140 nm, and PdI and zeta-potential were lower than 0.3 and -40 mV, respectively, which means a stable dispersion system. The physical stability of lipid nanocarriers with different

carrier oils was investigated after imposing environmental stress that included heat, freezing, and ionic strength. The heat stability was higher in the lipid nanocarrier emulsified with 1:1 ratio of tween 80 and soybean lecithin than the lipid nanocarriers emulsified with tween 80. Moreover, poor salt stability was exhibited in the lipid nanocarrier emulsified with soybean lecithin without tween 80 due to electrostatic screening effect. The destabilization of the dispersion by creaming was observed by turbidimetric measurements, which revealed that the nanocarrier prepared with coconut oil showed higher stability than others. In addition, nanocarriers with coconut oil were digested faster than others in a simulated small intestinal phase, due to their lower unsaturation degree and shorter hydrocarbon chain length compared to soybean oil and palm oil. M. Lee, Food Processing, Korea Food Research Inst., Wanju-gun, Jeollabuk-do , Korea(The Republic of) leemh0514@gmail.com

AGFD 281 WITHDRAWN

AGFD 282 CONTROL ID: 3432253
Biomass lignin-based stimulus responsive polymers This presentation discusses lignin-based self-healing polymers and shape-memory polymers. The lignin- based self-healing polymer is lignin-graft-poly(5-acetylaminopentyl acrylate) (lignin-graft-PAA), which has been prepared by the covalent linkage of chemically modified lignin with PAA, which is an end-group functionalized polymer. The key synthetic step is a copper-catalyzed azide−alkyne cycloaddition or “click” reaction to join together the lignin and PAA. The PAA was prepared via reversible addition−fragmentation chain transfer (RAFT) polymerization of monomers containing multiple hydrogen-bonding sites on their pendants in the form of acetylamino functional groups. The lignin-graft-PAA shows autonomic self-healing properties (93% of original maximum stress recovery) due to the high concentration of hydrogen-bonding sites from acetylamino group. The second lignin-based smart polymer is a crosslinked lignin-polycaprolactone (lignin-PCL) which has a shape memory function. The new lignin-based polymer is prepared by two steps: lignin modification/PCL preparation and crosslinking via thiol-ene reaction. Lignin’s hydroxyl groups was modified to have alkenes via carbodiimide-mediated esterification with 4- pentenoic acid. Separately, PCL was prepared by stannous octoate catalyzed ring-opening polymerization. The synthesized alcohol-terminal four-arm PCL was further modified to have thiol terminals via esterification with 3- mercaptopropionic acid. The prepared lignin–alkene and PCL–SH were crosslinked by a photoredox thiol-ene reaction in the presence of Ru(bpy)3Cl2 catalysts and p-toluidiene. The crosslinked lignin–PCL demonstrates a thermal responsive shape memory function at 80C (flexible above transition temperature for deformation) and 10C (solidified below cool temperature for temporary shape). H. Chung, S. Kim, H. Liu, Florida State Univ., Tallahassee, hchung@fsu.edu

AGFD 283 CONTROL ID: 3432205
Application of crown ether functionalized lignin-based biosorbent for the selective removal of Pb(II) A novel 1-Aza-18-crown-6 functionalized lignin-based adsorbent (AFL) is facilely prepared through Mannich reaction in a one-step process. Structure characterization by Fourier transform infrared spectroscopy, nuclear magnetic resonance spectroscopy, elemental analysis and X-ray photoelectron spectroscopy confirmed the successful fabrication of AFL AFL was observed to display enhanced adsorption capacity (Qmax = 91.4 mg/g) and superior selectivity toward Pb(II) ions, due to a display of crown ether units and their interaction with metal ions. The adsorption equilibrium results from a kinetic study indicated that the Pb(II) adsorption by AFL is a chemisorption process. Additionally, the obtained thermodynamic parameters showed the adsorption mechanism to be an exothermic and spontaneous process at room temperature. The AFL could be regenerated by desorption of Pb(II) ions and remained at over 80% adsorption efficiency after four adsorption-desorption cycles. Therefore, the AFL displays acceptable adsorption performance and can serve as a bioresource-based and recyclable adsorbent material, portending a new expectation in the application for water purification engineering Z. Liu, NCAUR, ARS/USDA, Peoria, Illinois, J. Can, G. Liu, G. Wu, S. Huo, Z. Kong, Inst. of Chemical Industry of Forest Products, CAF, Nanjing, Jiagnsu, China envis@163.com

AGFD 284 CONTROL ID: 3432604
Nanocellulose composites enhanced with zinc oxide and lignin for functional properties There is a growing interest to develop bio-based multi-functional packaging materials which extend shelf-life of various food products. In this study, nanocellulose-based composite films in combination with ZnO/lignin were fabricated and evaluated their antimicrobial, antioxidant, and UV-shielding properties. The composite films with TEMPO-oxidized nanocellulose (TOC) derived from sugarcane bagasse are prepared by solution casting, with/without incorporating lignin (.001%) and blended with ZnO at different concentrations (0.05%, 0.1%, and 0.2%). Antimicrobial activities of composite films against S. aureus and E. coli were measured by agar diffusion method. The antioxidant properties of the composite films were determined by DPPH assay. All TOC/ZnO and TOC/ZnO/lignin films were effective to inhibit both testing organisms, minimum inhibitory concentration of ZnO was 15 mg/L and 30 mg/L for S. aureus and E. coli, respectively. All the composite films were transparent and able to absorb UV-light. The results showed that the lignin incorporated films were capable to reduce DPPH concentration more than 80% within 6hrs. This study is beneficial for developing multi-functional bio composite packaging materials. N. Shahi, Integrative Biosciences , Tuskegee Univ., Tuskegee, Alabama, B. Min, Food and Nutritional Sciences, Tuskegee Univ., Tuskegee, Alabama nshahi1164@tuskegee.edu

AGFD 285 CONTROL ID: 3428807
Antimicrobial activity of medium chain fatty acid amides and their potential application as food preservatives Fatty acids are derived from renewable natural products and they are known to exhibit various biological activities including antimicrobial activity. Taking advantage of the double bond and the carboxylic acid functional groups present in fatty acids, chemical modification is commonly carried out to enhance or explore new biological activity. In our research group the carboxylic acid functional group of medium chain fatty acids was modified with heterocyclic amines to form different fatty acid amide derivatives. The fatty acid derivatives were evaluated for their effectiveness against gram-positive and gram-negative bacteria with emphasis on food-borne pathogens. Some of the compounds exhibited excellent activity against both gram-positive and gram-negative bacteria. The low inhibitory concentration, which is in the range of millimolar concentration, against the food-born pathogen is very promising and the potential application of the active fatty acid derivatives as food preservatives has been investigated. The synthesis of the modified fatty acids and their effectiveness as antimicrobial agents against different bacterial strains will be presented. H. Yosief, S. Hussain, M. Sarker, USDA, Hatfield, Pennsylvania Hailemichael.Yosief@usda.gov

AGFD 286 CONTROL ID: 3432319
Cover crop derived regenerated cellulose enhancing the physio-chemical and functional properties of PVA- based films Regenerated celluloses (RC) from plant sources are known to enhance the mechanical and functional properties of composite materials. Biomass from cover crops, which is an abundant source from agricultural fields, could be a potential source of biopolymer. Poly (vinyl) alcohol, biocompatible and biodegradable material, is a

highly used biopolymer in the packaging industry. However, the functionality of PVA is susceptible to wet conditions due to hydrophilic and hygroscopic nature, which can be improved by the blending of PVA with RC. In this study, PVA films impregnated with RCs which is derived from black oat were prepared at different concentrations (1, 3, and 5%) by solution casting method. It is also investigated the effectiveness of RCs on the physicochemical, thermal, and mechanical properties in PVA films. The films incorporated with RC showed lower water solubility and reduced water vapor permeability than PVA films alone. Interestingly, the films with 3% RC exhibited a significant reduction in swelling and water vapor transmission rate compared to the control PVA films ($p<0.05$). In mechanical properties, Young's modulus of films was increased by around 13%, 40%, and 42% with 1%, 3%, and 5% RC loadings, respectively. In thermal properties, the increase of onset decomposition temperature of PVA films was proportional to RC concentration. The results indicate that the addition of RC at 3% significantly enhanced the water barrier and mechanical properties of PVA films. Hence, cover crops might be potential sources of cellulosic biomaterials to enhance film properties. G.K. Joshi, B. Min, Food and Nutritional Sciences, Tuskegee Univ., Tuskegee Inst., Alabama, N. Shahi, Integrative Biosciences , Tuskegee Univ., Tuskegee, Alabama gkjoshi1990@gmail.com

AGFD 287 WITHDRAWN

AGFD 288 CONTROL ID: 3433269
Optimization of the in situ transesterification of DDGS Modifications were made to the protocol used to convert the acylglycerides in distiller's dried grains and solubles (DDGS) from sorghum post-fermentation stillage to fatty acid methyl esters (FAMEs) using an in-situ transesterification (IST) method. Moisture was removed from the DDGs at either 60 degrees C or 110 degrees C. Subsequently, transesterification reactions were conducted at 40 degrees C or 65 degrees C in the presence of various volumes of NaOMe dissolved in various volumes of MeOH, MeOH/MTBE or EtOH. The experimental results suggest that reducing the moisture to less than 0.5 percent (w/w) within the feedstock was necessary for the reaction to proceed. All of the reactions were monitored by HPLC and reaction yield, using the modified protocol, improved from 32.2 percent to greater than 90 percent. V.T. Wyatt, R. Cook, K. Jones, Sustainable Biofuels and Co-products, US Dept. of Agriculture, Drexel Hill, Pennsylvania, D.B. Johnston, USDA ARS, Wyndmoor, Pennsylvania, vtwyatt@yahoo.com

AGFD 289 WITHDRAWN

AGFD 290 CONTROL ID: 3405572
Synthesis of nano-coacervates from chitosan and pectin with improved stability and biocompatibility for anthocyanins delivery: An in vitro and in vivo study Anthocyanins, the natural pigments with variety of biological activities, are unstable and prone to degradation. In order to improve their stability, this study developed a facile method to encapsulate anthocyanins in coacervates via electrostatic self-assembly of chitosan and pectin. The anthocyanin-loaded coacervates were well dispersed spheres and showed an improved stability regardless of whether it was under dark or light conditions for up to 70 days. In vitro digestion results revealed that the coacervates are stable under gastric conditions and can deliver anthocyanins to the small intestine with not significant release during gastric digestion. The encapsulated ANCs showed good protection effect for NRK cells against in vitro acrylamide-induced damage. The Caenorhabditis elegans treated with anthocyanin-loaded coacervates exhibited a significant longer lifetime, improved reproductive capability and locomotion behavior. Moreover, the anthocyanin-loaded coacervates showed effective protection effects against the damage induced by acrylamide, hydrogen peroxide, heat shock, and UV radiation. M. Tan, X. Zhao, Food Sci. and Tech. Dalian Polytechnic Univ., Davis, California, M. Tan, Dept. of Food Sci. and Tech., Univ. of California-Davis mqtan@dlpu.edu.cn

AGFD 291 WITHDRAWN

AGFD 292 CONTROL ID: 3414469
Characterizing plant-based gums with DWS microrheology In recent years, plant gums are becoming increasingly popular in formulation development for the food industry as texture modifiers, gelling agents, stabilizers, encapsulants, and many other functions. The diversity in their structural composition and functionality and ease of modification has led to new, growing research efforts, and new plant-based gums are being investigated to meet rising global demand. In particular, the microstructural properties of gums are of high interest.
In this scope, DWS Microrheology provides a unique possibility to characterize these novels systems with screenings spanning a full range of frequencies (from 0.01 rad/s to 10^6rad/s) in only a few minutes. This technique has several other advantages including high sensitivity, small sample volumes, short acquisition times, sealed cuvettes with no evaporation, and access to local rheology.
We present applications of DWS Microrheology on a sample of Kappa Carrageenan. In particular, we demonstrate the ability to record a gel transition as the system is subject to a decreasing temperature ramp. We show how the onset of this transition and the appearance of a microstructure can be detected with an outstanding sensitivity not available with other methods. C. Bretz, A. Vaccaro, D. Leumann, LS Instruments, Fribourg, Fribourg, Switzerland coline.bretz@lsinstruments.ch

AGFD 293 CONTROL ID: 3418255
Improvement of drug delivery capacity of dry bean proteins by enzymatic hydrolysis There has been a great interest in utilization of plant protein as biomaterial for delivery of oral drugs. Dry beans(Phaseolus vulgaris L.), the seeds of dicotyledonous plants belonging to the Leguminosae family, are reported to contain 20%-25% proteins with a relatively balanced amino acid composition. Their protein fractions may show great potential to be used as cost-effective source to replace animal proteins, and thereby fabricate drug delivery systems. The functional properties of bean proteins may be further improved by controlled enzymatic hydrolysis. However, the selection of an adequate enzyme with optimized degree of hydrolysis (DH) is important when aiming to use these hydrolysates as delivery materials. Therefore, in this study, the effect of enzymatic hydrolysis on the drug delivery capacity of proteins from two dry beans including great northern and navy beans was studied and the causes of functionality improvements were comprehensively investigated. Hydrolyzed protein isolates were prepared by alcalase and papain at different enzyme-to-substrate ratios, and showed improved interfacial and emulsifying properties. The potential of using bean protein hydrolysates with DH ranging from 1%-13% to encapsulate curcumin, a model drug molecule, has been studied. The complex nanoparticles were self-assembled with size ranging from 244.7-344.7 nm. Great northern bean protein hydrolysate with 5% DH showed the highest curcumin loading capacity value (9.97 μg/mg). The binding ability of protein hydrolysates with curcumin was also investigated by fluorescence quenching method. And compared with nonhydrolyzed protein, the binding affinity was increased by low DH but decreased when the DH reached 7% or higher. It is concluded that proteins from dry beans and their hydrolysates are promising alternative biomaterials for bioactive delivery. The findings in this study are useful for fabricating, optimizing and selecting dry bean protein-based delivery systems. Y. Zhang, Food Sci. and BioTech., Zhejiang Gongshang Univ., Hangzhou, China yue.zhang@unl.edu

AGFD 294 WITHDRAWN

AGFD 295 CONTROL ID: 3430501
Evaluating the structure-function relationship of radiofrequency processed egg white powder Egg white powder (EWP) is a low moisture product which is extensively used in various food matrices. However, it has a low thermal conductivity making the process of pasteurization energy extensive. When radiofrequency treatment (RF) is applied to EWP, it substantially reduces the come-up time due to volumetric heating and enhances the functional properties such as gel firmness. Since changes in functionality is associated with structure, hence the effect of treatment with time, temperature, pH and their interactions were investigated. EWP with neutral pH (6.4) and alkaline pH (9.9) were subjected to RF treatment and traditional hot room (HR) treatment at 70C and 80C for 20 days. The critical points of analysis (Least square means from ANOVA) were identified from the treatment conditions resulting in maximal change in gel firmness, solubility which could parallelly be energy efficient. The structural and conformational changes were investigated using Raman spectroscopy, differential scanning calorimetry (DSC), size exclusion chromatography, gel electrophoresis and surface hydrophobicity. Statistical analysis was done by 2-way ANOVA at 5% level of significance using SAS. The gel firmness significantly increased on the 10^{th} day at alkaline pH (70C) and 0th day neutral pH (80C) with RF. The soluble protein content and insoluble content were affected only by treatment time and pH, but not treatment type. DSC analysis revealed no significant changes due to treatment type. Subtle changes were observed which could be attributed to treatment time. Raman spectroscopy detected changes in the intensity of the bands at 400-450 cm-1, 840-870 cm-1, 1000 cm-1 and 1770 cm-1 however, no significant changes in the Raman shift has been observed. Size exclusion chromatography also corroborated with the findings from Raman spectroscopy. The intensity differences were observed across samples however, no significant change in the total protein profile was detected. Even though, RF escalated the gel firmness in EWP, it did not substantially affect the structural and conformational attributes, thereby making the whole process not just energy efficient but also a major cost saving alternative for the industry A. Kar, K. Majumder, Food Sci. and Tech., Univ. of Nebraska Lincoln J. Subbiah, Food Sci. and Tech., Univ. of Arkansas, Fayetteville, kar.alisha@huskers.unl.edu

AGFD 296 CONTROL ID: 3431220
Excipient emulsion and black pepper synergistically enhanced oral bioavailability of carotenoid in humans Background: Carotenoids are important beneficial compounds found in various fruits and vegetables, but the human utilization of carotenoids was limited due to their poor oral bioavailability. Dietary lipid and black pepper have been shown to increase carotenoid bioavailability by different mechanisms. However, their combined effects on carotenoid bioavailability remained unknown. Objective: This study aimed to develop an innovative excipient system that utilized the combination of dietary lipid- based emulsion and black pepper to synergistically enhance oral bioavailability of carotenoid. Design: In a randomized crossover design, healthy young adults (8 males and 8 females) consumed (1) a raw, mixed vegetable salad rich in carotenoids (control), (2) the salad with canola oil emulsion (COE, 8 gram of oil), (3) the salad with 0.5 gram of black pepper (BP), (4) the salad with canola oil emulsion (8 gram of oil) and 0.5 gram of black pepper (COE + BP). The newly absorbed carotenoids were quantified in the blood by HPLC. Results: COE + BP led to higher AUC 0-10h of total carotenoids than the control (6.2-fold, $P < 0.0001$), BP (3.1-fold, $P < 0.0001$), and COE (2.0-fold, $P = 0.0003$). COE + BP increased AUC 0-10h of lutein, α-carotene, β-carotene, and lycopene by 5-fold, 13-fold, 7-fold, and 5-fold, respectively ($P < 0.0001$) compared to the control. COE + BP produced a significant synergy in increasing both Cmax ($p = 0.015$) and AUC 0-10h $p = 0.007$) of total carotenoids. COE + BP produced stronger enhancement in females on Cmax (11.5 vs. 3.9-fold) and AUC 0-10h (10.1 vs. 4.8-fold) of total carotenoids compared to the control than in males, respectively. Conclusion: Excipient system consisting of emulsion and black pepper synergistically enhanced carotenoid bioavailability in humans. H. Luo, Food Sci., Univ. of Massachusetts Amherst, hluo@foodsci.umass.edu

AGFD 297 CONTROL ID: 3433524
Investigation of biochemical and structural mechanisms for the release of phytochemicals from cell-based carriers Delivery of bioactives using cell based carriers provides an alternative to engineered micro-carriers for both the food and pharmaceutical industries. This study was focused on understanding the role of intracellular compositions and structure in modulating the release and bio-accessibility of encapsulated phytochemicals during simulated gastrointestinal digestion of cell-based carriers. Conventionally, changes in the structure of the micro- carriers during digestion is correlated with the release of encapsulated bioactives, however the cell based carriers are significantly complex and has diverse biochemical composition that can modulate the release of encapsulated bioactives. Yeast was selected as a model cell-based carrier and trans-resveratrol (trans-Res) as a model encapsulated phytochemical. The release of encapsulated trans-Res was evaluated during the simulated gastric, intestinal (at low and high bile salt concentration), and sequential (gastric followed by intestinal) conditions. A combination of vibrational spectroscopy (FTIR) and principal component analysis (PCA) were used for characterizing biochemical changes in cellular composition during gastric and sequential digestions. Transmission electron microscopy (TEM) was used for characterizing structural changes in the cells. The results illustrate the role of gastric treatment in influencing the intracellular protein secondary structures and aggregation and the significant role of these biochemical changes in accelerating the release of encapsulated phytochemical during gastric as well as during sequential digestions. In contrast, limited changes in structural properties of cells were observed using TEM. Bile salts solubilizes the intracellular lipids and improve partitioning of phytochemical to the intestinal fluid during sequential digestions. The gastrointestinal treatments have no significant effect on the intracellular nucleic acid confirmations. Overall, the results highlight significant role of the gastric treatment and bile salts in the release and bio-accessibility of encapsulated phytochemicals from cell based carriers based on biochemical changes while limited effect was observed on structural properties of these carriers during gastro-intestinal digestion. R. Rai, Food Sci. and Tech., Univ. of California Davis, N. Nitin, Univ. of California, Davis rewarai.iitd@gmail.com

AGFD 298 CONTROL ID: 3410479
Endocrine disrupting chemicals in food contact materials Thousands of substances are known to be present in and potentially migrating from food contact materials (FCMs) into food. Some of these substances are endocrine disrupting chemicals (EDCs) and thus a hazard to human health and the environment. However, there is little awareness of FCMs as a source of human exposure to EDCs. As a consequence, FCMs are not being managed in a way that sufficiently protects public health. To raise awareness, here we present an inventory of recognized and suspected EDCs that may be intentionally used in FCMs. First, we developed a food contact chemicals database (FCCdb) containing nearly 12,000 food contact chemicals (FCCs) identified across 67 regulatory and industry sources. We then searched the FCCdb for the EDCs listed within widely recognized regulatory classifications and non-regulatory assessments by academia and civil society groups. We found that 20 FCCs are classified as substances of very high concern (SVHC)

under the REACH legislation in the European Union (EU) specifically for their endocrine disrupting properties. An additional 30 FCCs are identified as EDCs in the overview report published by the United Nations Environment Programme in 2018 [Overview Report I: Worldwide initiatives to identify endocrine disrupting chemicals (EDCs) and potential EDCs]. Finally, 366 of the FCCs in the FCCdb are included on The Endocrine Disruption Exchange (TEDX) list, indicating that each has at least one published study demonstrating endocrine disrupting properties.
While this investigation covered only intentionally used FCCs, many more chemicals could be present in FCMs as non-intentionally added substances (NIAS), which may include impurities, reaction by-products, or degradation products. Importantly, for many FCM types, most of the chemicals migrating are NIAS. Many NIAS are currently unknown and their potential endocrine disrupting properties remain unassessed. Therefore, more research is urgently needed to address the endocrine disruption-related hazards and risks posed by NIAS in FCMs, including when they migrate as chemical mixtures into food. The results of this work contribute to our ongoing research seeking to better understand human health risks associated with exposure to FCCs. J. Boucher, ETH Zurich, Zurich, Switerland J. Boucher, K.J. Groh, B. Geueke, J. Muncke, Food Packaging Forum Foundation, Zurich, Switzerland justin.boucher@chem.ethz.ch

AGFD 299 CONTROL ID 3388335
In vivo, in vitro, and in silico evaluation of the toxicity and potential estrogenic activity of natural antioxidant and antimicrobial isomers: carvacrol and thymol in low concentrations Thymol and carvacrol are used in food industry as flavoring ingredients and preservatives. Both are phenolic isomers that lead to the concerns of developmental toxicity and potential endocrine disruptions (ED) at low concentrations.However, few reports estimated the toxicity and ED below concentrations of 10exp-6 M (150µg /L). We thus conducted this study to assess their potential estrogenic activity (EA) at 10exp-12 to 10 exp-7 M by MCF-7 cell proliferation assay, determine the developmental toxicity and potential ED of thymol or carvacrol at 500 ng/g and 50 ng/g using chicken embryonic assay, mutagenicity by Ames test at 10exp-12 to 10exp-6 M, and an in silico molecular docking for potential ED including EA. Carvacrol showed adverse effects on embryonic growth at 50 ng/g and weak EA at 10exp -8M while thymol did not. Both showed risks of gene mutagenicity from 10exp-11 M to 10exp-8 M. Carvacrol showed similar but kind higher binding affinity to several types of hormone-related receptors (like androgen and estrogen receptors) than thymol. Carvacrol and thymol showed different toxicities due to the locations of one phenolic hydroxyl group. X. Zhang, Animal and Food Sci., Univ. of Delaware, Newark C. Wu, Animal and Food Sci.s, Univ. of Delaware, Newark wenzhang@udel.edu

AGFD 300 CONTROL ID: 3433329
Emerging public health concerns of food packaging: phthalates and reproductive/developmental health Food packaging constitutes the majority of modern-day plastic production, which is increasing amidst rising indicators of declining reproductive function (i.e., lower sperm count and quality) and increasing rates of reproductive illnesses (i.e., testicular cancer and infertility) since the mid-20th century. Consequently, there are about 40,000 chemicals registered for use in the United States, many of which are commonly used as plasticizers or inputs to plastic production in products like food packaging as well as flooring/building materials, shower curtains, medical equipment, beauty products, and even children's toys. Phthalates are anti-androgenic plasticizers used in myriad food contact materials, including plastic food packaging, food production equipment (i.e., industrial polyvinyl chloride tubing), and food handling/preparation gloves. We will present our research on food packaging as a source of cumulative phthalates exposure in the U.S. population. We found children, teenagers, and adults who dine out at restaurants, cafeterias, and fast food outlets have 35–55% higher levels of multiple endocrine disrupting phthalates in their bodies compared to those who eat at home. These findings indicate food is a significant modifiable source of human exposure to phthalates, which are unintentional contaminants that enter the food supply through contact with industrial processing equipment and food packaging materials. Ultimately these findings may help pave the way for removing phthalates from the food supply and finding safer alternatives. T. Woodruff, J. Varshavsky, Obstetrics, Gynecology & Reproductive Sciences, Univ. of California, San Francisco, T. Woodruff, J. Varshavsky, Program on Reproductive Health and the Environment, Univ. of California, San Francisco tracey.woodruff@ucsf.edu

AGFD 301 CONTROL ID: 3436519
Endocrine disruptors and risk assessment of food contact materials Food contact materials (FCM) and mainly polymers, contain a series of small molecules that can be transferred to the food in contact with them. This process, named as "migration" poses a risk for consumers, as many of such molecules are toxic for human health. It is known that even some substances of very high concern (SVHC) are present in FCM. Some of them are intentionally added (IAS) but FCM also contain non intentionally added substances (NIAS), coming from impurities of raw materials, interaction between ingredients, decomposition of additives during their manufacture and so on. Among them, endocrine disruptors have been often identified and quantified in migration simulants and in food. Phthalates, some surfactants or some oligomers which demonstrated to be toxic for reproduction were identified in some FCM. A selection of studies dealing with the subject will be shown and discussed. C. Nerin, I3A, Campus Rio Ebro, Edificio Torres Quevedo, Univ. of Zaragoza, pain cnerin@unizar.es

AGFD 302 CONTROL ID: 3436520
Methoxy groups reduced the estrogenic activity of lignin- derivable replacements relative to bisphenol A and bisphenol F as studied through two in vitro assays Bisguaiacols are promising lignin-derivable alternatives to bisphenol A (BPA), but limited bioassay data are available on their estrogenic activity (EA). Herein, we investigated the estrogen receptor alpha (ERa)-mediated EA of six newly synthesized bisguaiacols, which differed in the number and location of methoxy substituents, through in vitro assays: MCF-7 cell proliferation and VM7Luc4E2 transactivation. The six bisguaiacols had undetectable EA at concentrations less than 10*-7 M, most importantly, with significantly lower EA than BPA over an environmentally relevant range of 10*-10 M to 10*-7 M. Adding a single methoxy group led to significant reduction in EA in all cases, relative to BPA and one petroleum-derived BPA analogue (bisphenol F, BPF), and the incorporation of more methoxy groups had subtler, but pronounced, impacts on either ERa binding or MCF-7 cell proliferation. In short, the six lignin- inspired bisguaiacols presented herein are viewed as promising sustainable alternatives to BPA and BPF. Y. Peng, Animal and Food Sci., Univ. of Delaware, Secane, Pennsylvania, K. Reno, Chemical and Biomolecular Engineering, Univ. of Delaware, Newark, T.H. Epps, Chemical Engineering, Univ. of Delaware, Newark, C. Wu, Animal and Food Sci. Univ. of Delaware, Newark, pengying@udel.edu

AGFD 303 CONTROL ID: 3432448
Determination of select anionic herbicides, fungicides, and disinfection byproducts in homogenized food samples using ion chromatography coupled with electrospray ionization-mass spectrometry (IC-ESI-MS) Residual contaminations in food are increasingly a public and a regulatory concern. Contamination from disinfection processes and perchlorate from contaminated soil and

water are well known. More recently, ionic herbicides (glyphosate, glufosinate) and fungicides (methylbromide, fosetyl-Al), under the category of polar pesticides, have also become a concern. Ion chromatography (IC) with suppressed conductivity detection is designed for the determination of ionic compounds in a variety of samples, including food, and therefore is better suited for separating these compounds than other chromatography techniques. Additionally, IC is a direct determination method unlike GC which requires labor intensive and costly analyte derivatization. IC with suppressed conductivity detection combined with serial detection by electrospray ionization single quadrupole mass spectrometry (ESI-MS) provides additional selectivity with mass confirmation needed with these critical ions. Here we combine the determinations of select polar pesticides, and disinfection byproducts in homogenized pear and green bean samples into one method. All analytes (2.5 µL) are separated by IC on a 2 x 250 mm anion-exchange column within a 14 min run using an electrolytically generated hydroxide gradient from 10 to 75 mM at 40C and 0.35 mL/min. The ions were detected serially by suppressed conductivity and ESI-MS in full scan from 50-350 m/z and in selected ion monitoring (SIM) modes. The method with MS detection had good reproducibility (RSDs < 3) and accuracy (80-120% recoveries). With calibration ranges from 5 µg/L to 10 mg/L, most of the ions exhibited responses fitting a quadratic equation. Sensitivity using a 2.5 µL injection ranged from 5 to 100 µg/L. T.T. Christison, Ion Chromatography Products, Thermo Fisher Scientific, San Jose, California, J. Rohrer, Thermo Fisher Scientific, Sunnyvale, California terri_christison@yahoo.com

AGFD 304 CONTROL ID: 3434772
Developing next-generation antibiotic alternatives for animals
With declining antibiotic growth promoter (AGP) usage and increasing consumers' concerns about superbugs, the quest for novel alternate replacements to mitigate antibiotic use in animal agriculture will grow significantly in the coming years. For the agricultural industry, there is an urgent need to develop alternatives to antibiotics (ATA) for food-producing animals but also for crops and fruits. Furthermore, a significant increase in scientific papers in the recent literature on antibiotic alternatives and feed additives to promote gut health in food animals indicate the timely need to develop sustainable strategy. The classes of ATA that are available to increase animal productivity and help poultry perform to their genetic potential under existing commercial conditions include probiotics, prebiotics, synbiotics, organic acids, enzymes, phytochemicals, antimicrobial peptides, hyperimmune egg antibodies, bacteriophages, clay and metals. In this session, I will review the classes of phytochemicals and scientific evidence to support their role in improving animal health. Future challenges are to know the mechanism of action, efficacy, and advantages and disadvantages of their applications in the field. Scientists from industry and academia and government research Inst.s need to work together in developing and applying potential ATA phytochemicals commercially to develop a sustainable animal production system in the absence of antibiotics. H.S. Lillehoj, Agricultural Research Service, USDA, Beltsville, Maryland, Hyun.Lillehoj@usda.gov

AGFD 305 CONTROL ID: 3425573
Alternatives to antibiotics in aquaculture: Integrating genetic resistance and vaccination Infectious diseases cause substantial economic loss in aquaculture and are the primary reason for application of medicated feed. In order to reduce loss and antibiotic application, selective breeding is being increasingly utilized to produce aquatic animals with superior innate resistance against specific disease. Selective breeding is easier to implement in fish compared to terrestrial animals due to high animal fecundity and the ability to synchronize development by water temperature manipulation. These life-cycle characteristics facilitate high-throughput evaluation and allow more precise identification of animals with high genetic merit. At the NCCCWA, we have bred a line of rainbow trout, with increased resistance against Flavobacterium psychrophilum, the etiologic agent of bacterial cold water disease. The line, ARS-Fp-R (resistant), exhibits higher survival as compared to reference lines ARS-Fp-C (control) and ARS-Fp-S (susceptible) following standardized laboratory challenge with F. psychrophilum strain CSF259-93. Here, we investigate whether genetic resistance has strain specificity and whether modulation of the adaptive immune system by vaccination is additive with genetic resistance. The three genetic lines were challenged with 16 strains of F. psychrophilum and relative survival measured. Analysis of survival following standardized exposure indicates that the resistant line exhibits a minor component of broad-based resistance as well as strain-specific resistance, that in part, correlates with bacterial o-polysaccharide type. We demonstrate that vaccination with formalin-killed strains having different o-polysaccharide type than the CSF259-93 strain induces specific antibody and correlates with both augmented and broadened resistance. These studies suggest that integration of both the innate and adaptive arms of the immune response can be combined to generate broad-based resistance against pathogens exhibiting genetic diversity. G. Wiens, T.D. Leeds, NCCCWA, USDA-Agricultural Research Service, Kearnesyville, West Virginia, greg.wiens@usda.gov

AGFD 306 CONTROL ID: 3403036
Redox-active natural products for fungal pathogen control
Control of fungal pathogens, such as causative agents for human invasive aspergillosis, candidiasis, cryptococcosis or species producing toxic secondary metabolites, is a difficult task since effective antifungal agents are often very limited. Moreover, the expansion of fungal resistance to commercial drugs or fungicides is a global human health or food safety/security concern. Therefore, there is persistent need to discover new antifungal drugs or fungicides. Natural compounds that pose no significant medical or environmental side effects are potential leads of new antifungal agents. Many natural phenolics are redox-active compounds (namely possessing both antioxidant and prooxidant potential), which are abundantly available in plants. These compounds serve as potent redox-cyclers in fungal pathogens, thus can function as effective antifungal agents by disrupting redox homeostasis and/or redox-sensitive structures in the cell. Our study indicated many natural compounds can disrupt fungal defense systems including the antioxidant or cell wall integrity. To improve the susceptibility of fungal pathogens to natural compounds, we also investigated the model yeast Saccharomyces cerevisiae or fungal mutants as screening tools for identifying fungal targets of natural compounds. This approach also led to the discovery of new utility of known natural compounds as sensitizing agents (viz., chemosensitizers) to enhance the efficacy of conventional antifungal drugs or fungicides. We also investigated natural compound-based chemosensitization as a method to enhance the efficiency of compound repurposing process, where combined application of a natural chemosensitizer with already marketed non-antifungal drugs resulted in the exertion of antifungal activity of certain non-antifungal drugs. In conclusion, our strategy can lead to the natural compound-based new antifungal development which enhances the susceptibility of pathogens to the compounds, and thus, abates drug or fungicide resistance. J.H. Kim, K.L. Chan, L. Cheng, Foodborne Toxin Detection and Prevention Research Unit, Western Regional Research Center, USDA-ARS, Albany, California, jongheon.kim@usda.gov

AGFD 307 CONTROL ID: 3428120
Alternatives to antibiotics in plants: A case study in Galactomyces of apples Antibiotic applications are often the

primary means of disease management in bacterial pathosystems, where epiphytic populations are the source of primary inoculum. Fire blight of apple and pear caused by the bacterium Erwinia amylovora is one such system. This pathosystem has been managed with aminoglycoside antibiotics (e.g. streptomycin) for more than 70 years. Antibiotic resistance has emerged in pome fruit production regions in the United States on several occasions, waxing and waning with eradication and resistance management practices. In Erwinia amylovora, the genetic determinants of resistance are often present on plasmids or transposable elements, which leads to concern of horizontal gene transfer to medical pathosystems. Biopesticides are becoming an attractive alternative to antibiotics, especially for certain markets where antibiotics are prohibited, such as organic production. Considerable advances have been made in the formulation and efficacy biopesticides in recent years. Diverse modes of action are available and include competitive inhibition, antimicrobial metabolite production, and induced defenses. When used in the context of proper production practice, sustainable management of fire blight can be achieved with biopesticides. The promise and progress of biopesticides and growth regulators for the management of fire blight be will presented and discussed. K. Cox, A. Wallis, M. Choi, Plant Pathology and Plant Microbe Biology, Cornell Univ., Geneva, New York kdc33@cornell.edu

AGFD 308 CONTROL ID: 3429096
Self-assembled antimicrobials to reduce ecological toxicity and antimicrobial resistance Broad spectrum, fast acting antimicrobial agents are foundational to our food and medical systems. Yet many of these chemicals cause ecological toxicity, are environmentally persistent and spread antimicrobial resistance. Using the tools of self-assembly, we developed reversible antimicrobial agents that rapidly eliminate pathogens from surfaces, are compatible with commercial formulations and show efficacy against mold, yeast and bacteria. After use, these substances dissociate abiotically as they are diluted in wastewater, limiting ecotoxicity, subinhibitory exposure and the potential for antimicrobial resistance. W. Hart-Cooper, J. McManus, J. Cunniffe, D. Marsh, A. Thompson, N. Vlahakis, J. Situ, W. Orts, BRU, USDA-ARS, Albany, California, K. Johnson, Method/People Against Dirty, San Francisco, California, hartcoop@gmail.com

AGFD 309 CONTROL ID: 3408437
Porcine mycobiome as potential antibiotic alternative during weaning transition Weaning is a time of significant stress, dietary changes, microbial alterations, and predisposition to infection in piglets. The loss of animal growth makes potential microbial interventions of interest to industry. The fungal populations (mycobiome) are a critical, but often ignored, component of the microbiome. Despite few studies, interactions between bacteria and fungi in the gut have been shown to be a crucial component of host health by altering host nutrition, pathogenicity of infection, and host development. In this study we characterized the development of the fecal bacteriome and mycobiome in healthy piglets from birth through the weaning transition (d1- 35). Fresh feces were collected from individual piglets (n=23) from 3 litters on days 1, 3, 7, 14, 21, 24, 28, and 35. The V4 and ITS2 region of the 16S rRNA and ITS gene regions were used to analyze the bacteriome and mycobiome, respectively. Strong temporal trends were seen in beta diversity in both the bacteriome and mycobiome particularly between pre- (d1-21) and post-wean (d24-35) time points. Alpha diversity in the bacteriome increased over the experimental timeline, transitioning from an Enterobacteriaceae and Bacteroidaceae dominated population pre-wean to fiber-degrading and short chain acid producing families Prevotellaceae and Ruminococcaceae post-wean. In comparison, fungal alpha diversity peaked during the weaning transition (d21-24) and decreased by day 35. The development of the mycobiome was characterized by an increased presence of Debaryomycetaceae or Saccharomycetaceae at days 24-35. Based on mycobiome profiles of environmental sources, high abundances of Saccharomycetaceae were found in sow feces, while high abundances of Debaryomycetaceae were present in nursery feed, suggesting adult feces and food as potential sources of fungal origin in piglets. Fecal co-occurrence networks at days 1, 21, and 35 showed an increased network complexity between bacterial and fungal genera as piglets developed. At day 35, Aspergillus showed several negative associations with bacteria, including butyrate- producing Subdoligranulum. Overall, the mycobiome showed greater taxonomic variation and diversity than the bacteriome during piglet development, suggesting a more transient and malleable role in the gastrointestinal tract, and making the mycobiome a potential target for probiotic and alternative-antibiotic intervention. A.M. Arfken, J.F. Frey, K.L. Summers, ABBL, USDA, Beltsville, Maryland, A.M. Arfken, ORISE, Beltsville, Maryland ann.arfken@usda.gov

AGFD 310 CONTROL ID: 3431198
Natural compounds from plants and fungi as antimicrobials The increase in drug and multi-drug resistant pathogenic strains of bacteria, fungi, and protozoa is a global public health issue. We explored the potential use of plant and fungal extracts in addition to their bioactive molecules to inhibit the growth of various pathogenic organisms such as protozoan parasites (Trichomonads), fungi (Candida, Aspergillus, Neosartorya, Penicillium spp.), bacteria (Bacillus, Escherichia, Listeria, Salmonella, Staphylococcus spp.) and commensals (Lactobacillus spp.). We have found that the tomato glycoalkaloid a-tomatine is highly effective in inhibiting three different 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-solanine and Russet potato peel powders were also highly effective against the three trichomonad strains and the potato phenolic compounds were mildly inhibitory. Preliminary studies with cherry tomato and eggplant extracts show that they are also active against these parasites. We have also explored the potential antimicrobial properties of medicinal mushrooms against these parasites, fungal pathogens, and bacteria. Initial results indicate with these medicinal mushroom extracts are promising against several members of each group. These studies with natural plant and fungal extracts and biologically active natural compounds may lead to the development of novel and effective broad-spectrum natural antimicrobials against pathogenic bacteria, fungi, and protozoa that contaminate human food, animal feed, and infect animals and humans. C.C. Tam, L. Cheng, Foodborne Toxin Detection and Prevention Research Unit, Western Research Regional Center, Agricultural Research Services, USDA, Albany, California, M. Friedman, Healthy Processed Foods Research, Western Regional Research Center, Agricultural Research Service, USDA, Moraga, California, K.M. Land, Biological Sciences, Univ. of the Pacific, Stockton, California, J.H. Kim, USDA-ARS, Albany, California, christina.tam@usda.gov

AGFD 311 CONTROL ID: 3411383
Development of a campylobacter phage product to decontaminate poultry meat in Kenya Campylobacter is the leading bacterial cause of diarrhea worldwide, and it is particularly detrimental to children under age two in developing countries. Globally, Kenya has the highest case fatality rate for campylobacteriosis, with children there being 88-fold more likely to die than infected children in the US. In addition, studies have shown that frequent diarrheal episodes in children have long-term impacts on physical growth rates, cognitive development, and school performance years later. A primary source of Campylobacter is contaminated poultry meat, with studies showing that up to 77% of retail meat samples in Kenya were contaminated with the bacteria.

Antibiotics are frequently used in poultry feed, but these undoubtedly contribute to the reported Campylobacter drug resistance rates of >70% in Kenya. Thus, alternatives to antibiotics are urgently needed to combat this public health problem. We are therefore developing a phage product to decontaminate poultry meat in Kenya. Phages are inexpensive, naturally occurring viruses that can kill antibiotic-resistant bacteria, and the FDA and USDA have approved phage products targeting other bacteria (e.g., Listeria, Salmonella and E. coli) for food decontamination. However, there is no phage product available for Campylobacter. We have previously demonstrated that feeding phages to chickens 24-48 hours before slaughter can reduce Campylobacter levels enough to decrease human infections by an estimated 30- fold, without affecting farm productivity. To date we have isolated 17 phages from chicken droppings and rectal swabs from poultry farms in Kenya. TEM analyses indicate that these phages are typical Myoviridae phage. DNA sequencing is ongoing, and host range analysis is being conducted against a panel of 70 Campylobacter strains isolated in Kenya. Based on these data we will select a subset of phages for further product development. Given the lack of a reliable cold chain in Kenya, we also aim to develop a product that will be stable under long-term, high-temperature storage conditions. Thus, we have developed a preliminary dry powder formulation for Campylobacter phages. In parallel, we have also conducted 51 focus discussion groups with a total of 377 Kenyan poultry farmers, with the goal of informing these stakeholders about the potential benefits of phages and also gaining input regarding how best to deliver a phage product in Kenya such that it will be socially accepted and utilized. T.E. Nagel, Phages for Global Health, Oakland, California, S. Kariuki, P. Muturi, A. Nyambura, G. Nganga, G.A. Odityo, J.K. Ngumo, R. Onsare, Kenya Medical Research Inst., Nairobi, Kenya N. Carrigy, R. Vehring, Univ. of Alberta, Edmonton, Canada L. Liang, P. Connerton, I. Connerton, Univ. of Nottingham, Nottingham, UK
tobi@phagesforglobalhealth.org

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